The role of sustainable urban design principles in delivering high density mixed use schemes in Jordan: Using Amman as a case study

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Abstract

This research is about the role of sustainable urban design principles in delivering high density mixed use schemes in Amman. It builds on previous work developed in the 2010 Amman Master Plan to propose, a first for the city, sustainable high density mixed use (HDMU) development in three distinct geographical areas in the city. High density mixed use developments conceived as part of the master plan is a new approach for the city of Amman and for Jordan.

The need to undertake this kind of research in Amman is amplified by the fact that Amman remains a little studied city in spite of a growing body of work on Arab urbanism. The city was named the capital of Jordan in 1921 and has in recent years witnessed exponential growth, especially since early 1990s. It has doubled its population in the space of a few years as a result of the influx of nationals from neighbouring states following the 1991 Iraqi invasion of Kuwait and the subsequent war, the 2003 second Gulf War, and more recently as a result of the civil war in Syria. This rapid growth has evidently led to a set of problems which affected the urban form for the city and its ability to deliver services effectively to its growing residents. Transportation infrastructure, access to power and water access suffered as a result. Urban sprawl, a well-established phenomenon, was allowed to take hold even more. As a result, it has therefore become necessary to propose and implement a master plan that addresses the issues arising while taking advantage of the opportunity to integrate sustainable development solutions to guide future growth and development.

At the commencement of this research, it was not known how HDMU mechanisms would be implemented in the Amman context or what prerequisites were needed to enable this to happen. Accordingly, there was a need to research and propose an implementation framework. This thesis therefore took this work forward by

exploring the components that can constitute a successful and effective implementation framework for the HDMU schemes in the allocated areas in the master plan drawing broader lessons from elsewhere and reflecting on these where needed. The output framework was achieved through defining the main components which represent suitable indicators, constraints, solutions and planning strategies that can constitute a thorough implementation framework for the HDMU schemes in the Amman master plan .

The thesis uses two approaches to achieve the main objectives, the testing-out and exploratory approaches, adopting a mixed method approach (qualitative and quantitative method) by using comparative case study areas, interviews and a questionnaire survey with expert professionals working in the city. Context-derived data and statistics analysed together were used to explore the components of the implementation framework. The interviews and questionnaire were also used to evaluate core findings of the research and formulate the main components of this framework. The thesis's contribution lies in devising an implementation framework which consists of a series of practical recommendations for implementing HDMU schemes and to inform the future development of the Amman master plan. The framework developed here can be developed further in order to inform wider work that is being undertaken in the cities in the Middle Eastern.

I declare that the research contained in this thesis, unless otherwise formally indicated within the text, is the original work of the author. The thesis has not been previously submitted to this or any other university for a degree, and does not incorporate any material already submitted for a degree.

Signed:

Rami Al-Shawabkeh

Dated

22/12/2015

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List of Acronyms

GAM: Greater Amman Municipality
HDMU: High Density Mixed Use
SCRSC: sustainability Checklist for Regional Shopping Centres
IUSIL: International Urban Sustainability Indicators List
UN, CSD: United Nations-Commission on Sustainable Development
BREEAM: Building Research Establishment Environmental Assessment Method
LEED: Leadership in Energy and Environmental Design
SAM: Sustainable Architecture Matrix
BEQUEST: Building Environmental Quality Evaluation for Sustainable through Time
GBC: Green Building Challenge
EU, SDS: European Union-Sustainable development strategy
DETR: Department of the Environment, Transport and the Regions
WCED: World Commission on Environment and Development
UNCED: Conference of United Nations for Environment and Development
UNEP: United Nations Environment Program
EUEGUE: European Union Expert Group on the Urban Environment
UNGA: United Nations General Assembly
IISD: International institute for sustainable development
AGSC: Alliance for Global Sustainability Conference
UN MEA: United Nation, Millennium Ecosystem Assessment

Chapter 1

Introduction

1.1 Introduction

Sustainable urban design, based on an environment-friendly practice, is a prevalent concept in architectural and urban thinking. As early as the late 1920s, the historical roots of urban design began to appear in the relationship between 'urban architecture' and 'urbanism' (Mumford, 2009). Gosling (2002, p.7) had already defined urban design as the "disciplinary solution for the real gap between architecture and planning through the 1960s". It is no wonder then, that urban design has come to be seen as an interdisciplinary field of study, practised by those with professional training in both architecture and planning (Lang, 1994; Moudon, 2003). Marshall and Caliskan (2011, p.4) went even further and argued that "urban design is sometimes seen as a specialised side discipline or sub-discipline of planning, or an extension of architecture".

Miller (2002) argued that understanding sustainable urban design requires an examination of the relationship between urban design and sustainability. Sustainable urban design focuses on the relationship between buildings and the environment considering the importance of meeting present needs without losing sight of the right of future generations. In addition, sustainable urban design also requires that buildings are designed, built and managed in a manner that is not harmful to the environment.

This thesis, in discussing and exploring key aspects related to sustainable urban design principles, challenges, constraints and solutions, proposes a set of practical recommendations that can constitute a framework for providing the guidelines for implementing HDMU schemes in a rapidly growing city.

This chapter introduces the key ideas, concepts and thinking behind this thesis and the issues it aims to address. It introduces the context of the study and defines the scope of the work undertaken.

1.2 Context

Sustainability focuses on improving the quality of life for citizens without indefinitely increasing the use of natural resources beyond the capacity of the environment to sustain them. Additionally, it is about putting in place appropriate governance arrangements to promote wellbeing (Tratalos *et al.*, 2007; Gaston and Spicer, 2004; Jenks and Jones, 2010; Warren *et al*., 2006). On the road towards sustainability, it is important that key aspects related to sustainable urban design, such as principles, challenges, constraints and solutions are considered over a medium to long term, and that information and actions at different levels of responsibility are integrated to give a full picture, which in turn delivers full benefits.

Berke and Manta (1999) argue that improving the management of the urban environment implies targeting resources in order to regenerate areas suffering from economic and social decline, and investing in skills and innovative capacity. Additionally, good governance arrangements mean giving local authorities a strategic role in managing the whole urban environment, with powers to ensure that other property owners maintain their land and premises to an acceptable standard. Strategies for creating designated urban priority areas require the application of special regeneration measures, a streamlined planning process with accelerated compulsory purchase powers and fiscal incentives (Blowers, 1997).

The master plan plays an important role for delivering sustainable communities through providing the means which address the multi-faceted issues for making places successful (ACT, 2013; Abdulgader and Aina, 2005; EUEGUE, 2004). The

Commission for Architecture and the Built Environment (CABE) (2012) defined a master plan as a comprehensive long-term plan whose aims are to guide development and growth of a region or community. It sets out proposals, analysis and recommendations for buildings, land uses, movement, spaces, community facilities and other infrastructural elements in three dimensions (social, environmental and economic) and matches these aspirations with an implementation strategy. Therefore, this study uses the Amman master plan to examine the issues related to sustainable urban design practices for making sustainable communities.

1.3 The rationale for the selection of case study areas

This thesis selected the city of Amman to apply sustainable urban design principles, using urban sustainability indicators. The researcher is an academic from a Jordanian university and Amman is a city in which he has lived and worked and with which he is, therefore, quite familiar.

There is a clear need to undertake this kind of research in Amman which remains, in academic literature, a little studied city (Hanania, 2014). In 1921, the city was named the capital of Jordan. It is a bustling and growing city that has tended to blend its rich natural and cultural heritage with modern urban development (Potter *et al.,* 2009; Abu-Dayyeh, 2004b; Al Rawashdeh and Saleh, 2006). In recent years, and especially since the early 1990s, the city has witnessed exponential growth doubling in size as a result of influxes of nationals from neighbouring states following the 1991 Iraqi invasion of Kuwait and the subsequent war, the 2003 second Gulf War, and more recently as a result of the war in Syria.

The consequences of these geopolitical upsets are, amongst others, challenges to the urban form for the city. These include pressures on the transport infrastructure, access to power and water, access to natural gas, and sprawl driven by socio-economic pressures. It became necessary at the start of the 21st century to propose and implement a master plan that addresses these issues while taking advantage of the opportunity to integrate sustainable development solutions to guide future growth and development. The vision that was put together proposed densification of areas in the city which conforms to sustainable urban design principles. The principles were used to integrate ecologically sensitive urban design guidelines, culture and heritage promotion, green city principles, effective governance and service delivery, and public spaces and social inclusion (GAM, 2010; Potter *et al.,* 2009).

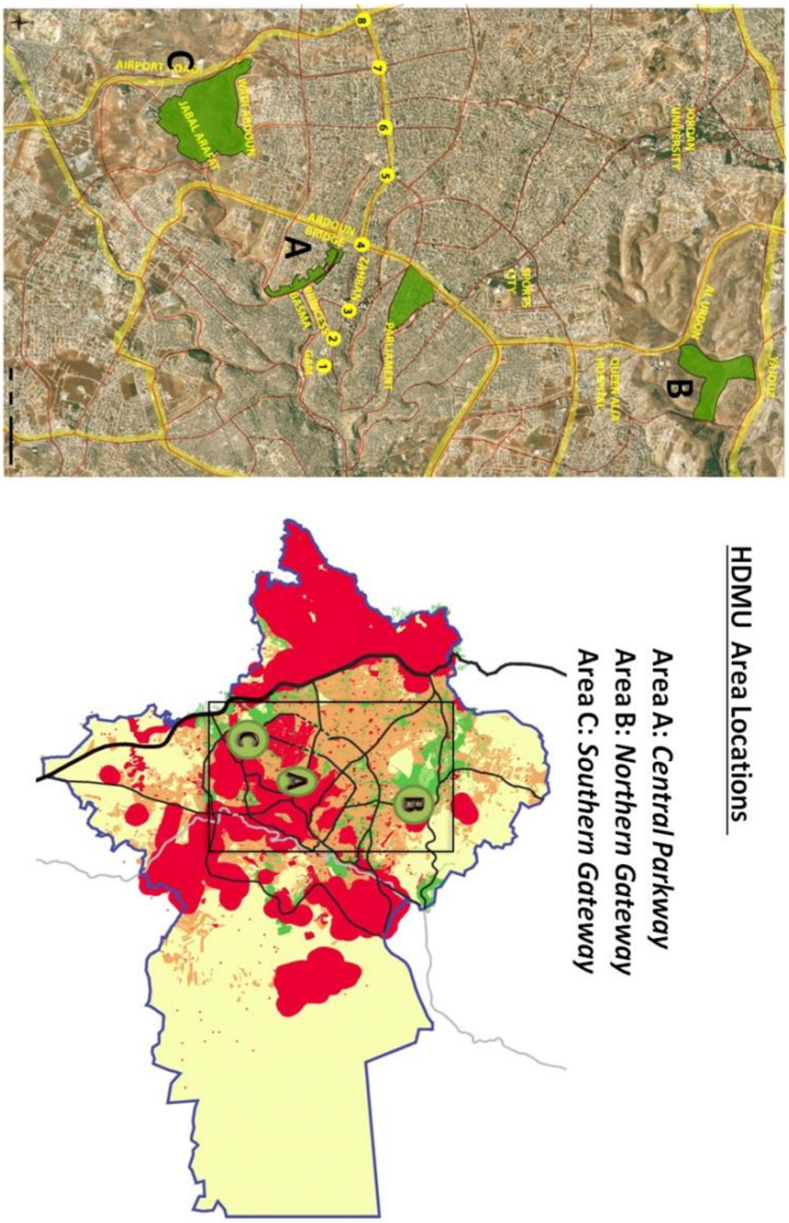

Figure 1.1: HDMU area locations, (Sources: GAM, 2007). Modified by the researcher

Figure 1.1 shows a schematic plan of the city of Amman which indicates the geographical case study areas in Amman used for the purposes of this research as A, B and C. These areas, proposed as densification corridors in the city's 2010 Master Plan, provide an opportunity to apply and test urban sustainability indicators as part of the research undertaken for this doctoral study.

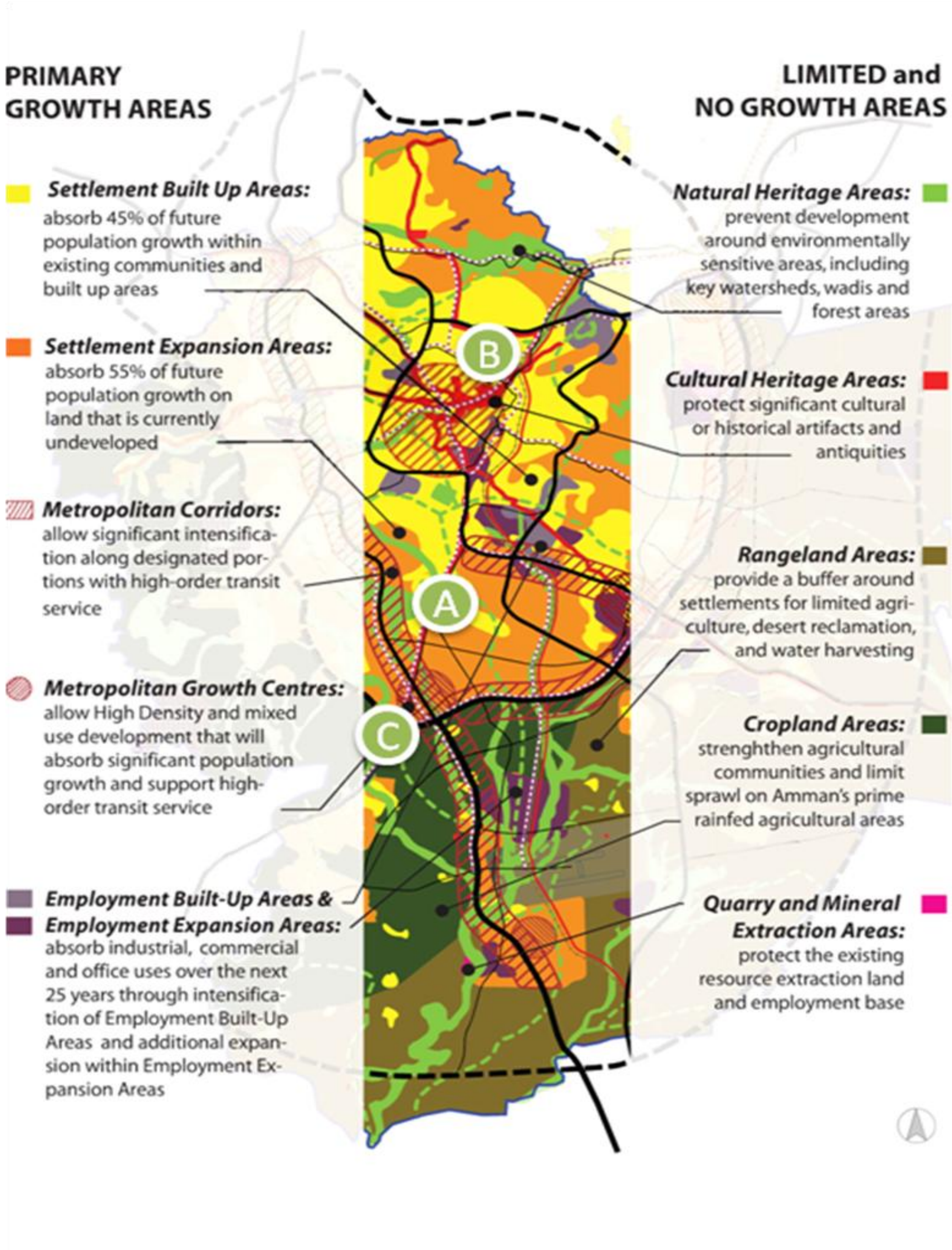

Figure 1.2: Metropolitan growth plan 2025; Area distributions, (Sources: GAM, 2007). Modified by the researcher

Figure 1.2 shows the rationale behind selecting the three case study areas outlined above. The 2010 Amman Master Plan designated these three areas as Primary Growth Areas where good 'sustainable' planning and development principles can co-exist in harmony with sustainable high-density urban design (GAM, 2010).

For the purpose of this thesis and research into high density mixed use, the primary reasons for selecting the three areas are outlined here. Area A in the centre was chosen because it offers the scope for significant intensification (new projects) and densification (of existing areas) close to areas that have seen recent growth and expansion. Area B was selected because it could accommodate high density mixed use without impacting on heritage areas in the older parts of the city. Area C was selected because it proposes high density projects in new growth areas in the southern part of the city along the airport corridor. All three therefore, in addition to being selected by the city as growth areas (GAM, 2007), suit the research objectives set out in this thesis.

To commence the thesis, sustainable urban design solutions adopted elsewhere were explored. For example, Curitiba in Brazil which is similar to Amman in terms of area, geography, climate, population growth, population density and temperature. In Curitiba, the sustainable urban design principles using high density mixed use schemes (HDMU) was also recently applied (Campbell, 2012).

1.4 Recent studies

This research builds on previous work for the development of the 2010 Amman Master Plan proposing, a first for the city, sustainable high density mixed use (HDMU) development in three distinct geographical areas in the city. High density mixed use developments conceived as part of master planned areas in a new one area of activity for Amman and for Jordan.

At the commencement of this research, it was not known how HDMU mechanisms would be implemented in the Amman context or what prerequisites were needed to enable this to happen. Accordingly, there was a need to research and identify an implementation framework. Flaspohler et al. (2008) described implementation framework as major steps related to promoting implementation. It focuses on details in the specific procedures, strategies and practices that shape the implementation process to ensure quality implementation (Duncan *et al*., 2012). This gives an opportunity to avoid mistakes that may occur by providing practical guidance. This thesis took this work forward by exploring the components that can constitute a successful and effective implementation framework for the HDMU schemes using the allocated areas in the master plan as case studies. This work draws on broader lessons from elsewhere and reflecting on these where needed. The output framework was achieved through defining the main components which represent suitable indicators, constraints, solutions and planning strategies that can constitute a thorough implementation framework.

The underpinning literature review comprised, amongst others, works by Pearce (2000), Pearce and Barbier (2000), DEA (2010,2006,2005,1998), Ndeke (2011), Lehman (2010) and Al Waer et al*.* (2014) found plenty of frameworks for assessing urban sustainability. In particular, Al Waer et al*.* (2014, p. 8) noted how sustainable communities need to be developed within an ''inclusive framework''. The idea of 'inclusivity' as a feature of any framework is a key part underlying the thinking around devising a framework for Amman.

From the literature, it was found that the components of this framework could include all or any of the following: (1) providing a broad variety of indicators using their measurements; (2) identifying the consequences of actions such as constraints and solutions, and; (3) identifying pathways through a planning strategy for managing the process path to a 'desired future' (Pearce and Barbier, 2000; DEA, 2010,2006,2005,1998; Ndeke, 2011; Al Waer *et al.,* 2014 and Lehmann, 2010). This study identified the components constituting the implementation framework to providing the guidelines which can be used effectively in the context of Amman. Starting from here, the study raises the key question of how the sustainable urban design principles can be implemented using HDMU schemes within the context of Amman, Jordan. This is shown in Figure 1.3.

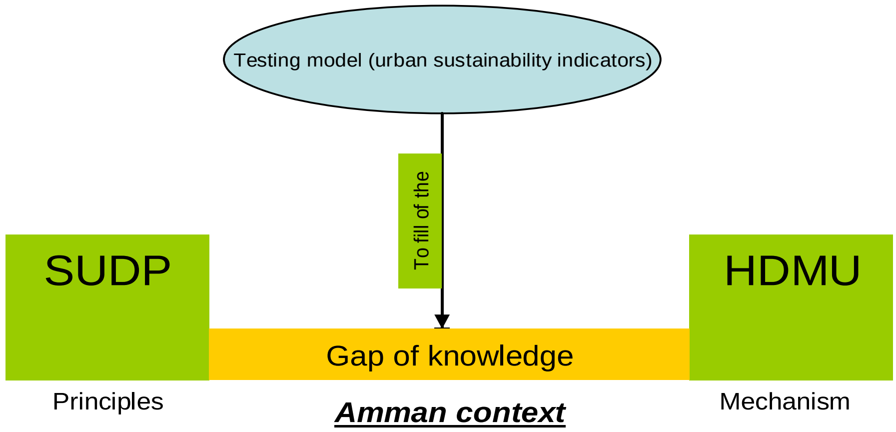

Figure 1.3: The gap of Knowledge, (Sources: The researcher).

Figure 1.3 shows the gap of knowledge represented in the lake of a framework for the implementation of sustainable urban design principles using HDMU schemes as shown in the next section. The thesis identified the main research aim to facilitate the implementation of sustainable urban design principles using HDMU as shown in the next section.

1.5 Research aim and objectives

The research aims to propose a framework, consisting of a set of recommendations providing guidelines for the implementation of sustainable urban design principles using HDMU schemes using Amman as a case study. The additional output is to inform the future development of the city's master plan. This was achieved in the thesis through exploring the three main components of the framework outlined in Figure 1.3. The contention here is that the three main components themselves represent a set of gaps that need to be addressed to fill the main gap in knowledge. In order to begin to understand these better, this thesis has attempted to: (1) identify a range of suitable indicators for the city of Amman; (2) identify the key constraints and solutions to overcome the challenges facing the implementation of sustainable urban design principles using HDMU schemes, and; (3) identify the planning strategy within which the schemes can be implemented and managed.

In order to operationalize the research ideas around these gaps, the aims and objectives were devised around them and are as follows:

1. To identify and review urban sustainability indicators and measurements through a detailed literature review.
2. To identify a set of suitable indicators and constraints for the sustainable delivery of High Density Mixed Used Schemes through testing the indicators identified from the literature review. A suitable methodology was devised in order to achieve this.
3. To formulate the solutions and the planning strategy for the implementation of sustainable urban design principles using HDMU.
4. To propose the implementation framework through evaluating its components including the suitable indicators, constraints, solutions and planning strategy

Accordingly, the contribution to knowledge of this thesis lies in a series of multi-faceted recommendations constituting an implementation framework providing guidelines for implementing HDMU schemes, in order to inform the future development of the master plan. In addition to the contribution to knowledge, it is anticipated that the outputs will also address the planning and implementation gaps for the Amman master plan.

1.6 Structure of the thesis

Chapter one of this thesis introduces the subject matter of the work enabling the reader to understand the background and context.

Chapter two presents a review of the literature on the conceptual and theoretical content of the thesis relating to debates in the literature over sustainable urban design framework.

Chapter three provides a review of the literature on the theoretical basis of urban sustainability indicators and planning strategy as part of the main components of the framework.

Chapter four presents the content of the case study areas and high density mixed use in the Amman master plan. It also presents findings from a desk study on the city of Curitiba to highlight lessons learnt which can then be read in the context of the Amman study.

Chapter five provides a discussion of the rationale for the methodological framework used in the study. Flick (2006) emphasised that in qualitative research, validity is underpinned from the trustworthiness, credibility and authenticity of the data and this was achieved by the researcher using appropriate research methods, clearly outlined criteria, accepted procedures, systematic analysis adequate discussion and a clear distinction between data and interpretation. The researcher being a native of Jordan, was able to facilitate participant involvement in the research.

Chapter six presents and discusses the findings from testing the urban sustainability indicators within case study areas in Amman based on objective 2 of the thesis.

Chapter seven presents and discusses the findings from a questionnaire survey of 100 sampled professionals (planners and architects) and interviews with professionals based on objective 3 and 4. The validity of the findings was generated through sound and robust data collection.

Chapter eight draws conclusions and recommendations from the research. It also highlights the contribution to knowledge from this study.

1.7 Chapter Summary

This chapter set out to familiarise the reader with the broader context within which the research presented here is set. It also outlined the key aim and objectives, and the overall structure of the thesis. In Chapter 2, 3 and 4, the thesis presents the literature review undertaken as part of the desk research in order to better understand the concepts of ‘sustainable urban design principles’, 'high density mixed use scheme' and ‘implementation framework'. This gives an opportunity to better understand the main research question, aim and objectives.

Chapter 2

Sustainable urban design concepts and framework

2.1 Introduction

The thesis is predicated on the role that urban design principles play in delivering sustainable high density mixed use through making an implementation framework. Two key concepts relevant to this research are therefore examined in this chapter. The first is that of sustainable urban design principles and the second is that of the implementation framework.

In the late 1920s, the historical roots of urban design began to appear in the relationship between 'urban architecture' and 'urbanism' (Mumford, 2009). Gosling (2002, p.7) had already defined urban design as the "disciplinary solution for the real gap between architecture and planning through the 1960s". It is no wonder, then, that urban design has come to be seen as an interdisciplinary field of study, practised by those with professional training in both architecture and planning (Lang, 1994; Moudon, 2003). Marshall and Caliskan, (2011, p.4) went even further and argued that "urban design is sometimes seen as a specialised side discipline or sub-discipline of planning, or an extension of architecture". Rouge (2009), on the other hand, suggested that urban design was a separate discipline from planning and architecture focusing on the design of the public realm created by both public spaces and the buildings.

In the UK, the now abolished Department of the Environment, Transport and the Regions (DETR), in the superseded 1998 Planning Policy Guidance Note 1, (PPG1) stated that urban design focuses on the examination of the relationship between buildings and the squares, streets, parks, waterways and other spaces, which constitute the public realm (DETR, 2000; RTPI, 2010). Around the same time, authors such as Susan and Peter-Calvert (2002) were advocating the need for increasing the awareness around sustainability and resource efficiency. Much earlier than that, the World Commission on Environment and Development had previously stated in 1987 what many had already believed: that the depletion of non-renewable resources was no longer sustainable (WCED, 1987). These trends pushed a number of researchers to advocate an alternative model for sustainable development. Velibeyoglu (1999, p.3) noted that "new attention to the qualities of the built environment has been given after 1980s in response to global competition of cities and their parts. This made the role of urban design more significant in the production of the built environment". Even more important, development was beginning to focus on the delivery of a 'new' and 'sustainable' built environment with a diversity of land uses, well-designed streetscapes and buildings, clear destinations for the pedestrian and proximity to transit (Aurbach , 2005).

2.2 Defining sustainability

The word 'sustainability' is derived from the Latin ''sustinere'' (tenere, to hold; sus, up). Dictionaries provide more than ten meanings for sustain, the main ones being to "maintain", "support", or "endure" (Charles, 1964).

The concept of sustainability has in recent times been introduced to combine the concern for the welfare of the planet with continued growth and human development. It is a widely-used term meaning all things to all people with the most prevalent definition put forward by the World Commission on Environment and Development (the Brundtland Commission of the United Nations) in 1987. This defined sustainability development as ''development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (McDonough and Partners, 2000, p. 4). In order to further embrace the idea of a global ecology with intrinsic value, the definition was expanded to include the reconciliation of environment, social equity and economic demands - the so called 'three pillars' of sustainability (UNGA, 2005). This concept of sustainable development drove a programme of development presented by the

United Nations Environment Programme UNEP in the seventies alongside the concept of eco-development(UNCED, 1992). Global interest reached its peak with the adoption of the environmental concept of sustainable development on a global scale at the Earth Summit that was held in Rio de Janeiro in 1992. The World Conference for Social Development followed in 1995 adopting the concepts of sustainability and sustainable development. These were followed by the World Conference on Sustainable Development in 2002. Later on, the World Summit in 2005 sought to investigate the sustainability dimensions as represented in environmental, social and economic demands.

Planning for sustainability requires all of this as well as a more comprehensive approach with the integration of a wide range of actors and stakeholders representing different societal sectors, providing the knowledge base for sustainable development processes and enabling decision-makers in cities to make better-informed decisions (Baker, 2006). The relationship between urban design and sustainability is examined later on in this chapter.

2.3 Defining urban design

Webber (2008, p. 1) defines urban design as "the process of moulding the form of the city through time". Previously, Tirikatene (2007, p. 6) defined "urban design as the multi-discipline of designing and organizing all the physical elements that constitute cities to create harmonious and successful places for communities". Urban design can be said, therefore, to include the design, organization and arrangement of buildings, surrounding environment, transport systems and effective infrastructure. In addition, it is a framework that organizes a set of the key elements into a network of squares and streets (Childs, 2010). Lawson (2006) stated that urban design is about shaping the form of the physical urban fabric, by organizing urban structure, manipulating relationships between elements, creating coherent ensembles of buildings and spaces. Therefore, urban design in the specific sense, grew out of an effort to combine art and science in the three-dimensional planning of urban environments (Mumford, 2009). Wall and Waterman (2009, p. 17) argue that "urban design is a place making process which consists of three dimensions for the urban forms and surrounding spaces." Moreover, urban design can operate on a variety of scales, although it tends to be most associated with the scale greater than, or equal to, architecture (buildings) and less than equal to that of town planning (settlements) (Marshall and Caliskan, 2011).In discussing and exploring key aspects related to sustainable urban design, such as; principles, indicators, challenges and solutions, there should be the examination of the relationship between urban design and sustainability.

2.4 The relationship between urban design and sustainability

Purayil (2004, P.20) argues that urban design for sustainability supports the concept of combining economic development with environmental progress. Mougthin and Shirley (2005) have also strongly argued that sustainable development and urban design are indeed linked. Abdulgader and Aina (2005) too state that urban design gives the opportunity to guide city development towards sustainability. Miller (2002) previously noted that most city areas use urban design and design coding to determine present and future use of each parcel of land in the area. A clear thread in the literature supports this position starting with Kostof (1991) who argues that the relationship between sustainability and urban design was important.

Boyko *et al.* (2005, p.1) note that "examination of this relationship highlights the need to understand those who are the decision makers and what influences their decisions". Others have called for a clear awareness of the role that decision-makers play in the local and national governance order to stress the importance of sustainability in urban design (Kagiolou, *et al*., 1998). On another level, there is a need for local and national governments to continue to stimulate the key decision makers and stakeholders to become more responsible about understanding how the urban design process works (Boyko, *et al.,* 2005). This gives those involved in the urban design process more information to create urban environments and to contribute to the design and operation of sustainable urban environments. Tirikatene (2007, p.9) stresses the importance of this saying that "sustainability is an over-arching concept incorporating economic prosperity, resilient communities, civic and social leadership, environmental stewardship, social cohesion and cultural diversity, now and into the future".

It is necessary to examine the relationship between urban design and sustainability in order to further appreciate and understand sustainable urban design (Miller, 2002). This will be effectively achieved in this thesis through the discussion of the key aspects, related to sustainable urban design, such as: principles, indicators, challenges and solutions. This is in order to formulate strategies for the application of the principles of sustainable urban design within cities (European Union Experts Group on the Urban Environment (EUEGUE), 2004; 1995).

2.5 Defining sustainable urban design

Thomas and Fordham (2003, p. 3) describe sustainable urban design as "the sustainability in the physical aspects of an urban environment that include the buildings and their engineering systems, transport systems, green and open spaces, energy, water and waste systems". It can also incorporate architecture, urban planning, landscape architecture, and civil engineering (Neuman, 2005). Farr (2007) defines sustainable urban design as walk able and transit-served urbanism integrated with high performance of both buildings and infrastructure.

Sustainable urban design has also been described as the act of unifying architecture, city planning, and environmental design for progressing towards a better life (Adhya *et al.*, 2010).

McGeough *et al.* (2004, p. 5) define sustainable urban design as "the state a metropolitan community reaches once it is able to meet the needs of the present generation without compromising the ability of future generations to meet their own needs". This definition first appeared in 1987 when the United Nation's World Commission on Environment and Development published the common future report (WCED, 1987). McGeough *et al.* (2004) emphasise that sustainable urban design does not exclude the economic growth, environmental preservation and social development objectives but that it fundamentally supports these objectives (EUEGUE, 2004).

2.6 Dimensions of sustainable development

The concept of sustainable development encompasses three main axes: the social (human), the economic and the environmental (Crilly, 2000). Jonathan (2000) argues that sustainable development seeks to reconcile environmental, economic and social development through combining these three axes; effectiveness of economic terms, justice of social terms, possibilities from an environmental perspective. Additionally, sustainable development takes into account natural resources, ecosystems and economic soundness without omitting the social objective to fight against poverty, unemployment and inequality, and to seek justice. Birkmann and Gleisenstein (2002) argue that sustainable development is a three-dimensional interconnected and interrelated development characterised by a rationalization of resources (see also Ghneam and Abu Zanat, 2006). Tinder (2004) notes the three dimensions (environmental, social, economic) and adds governance (the point of decision-making) arguing that these are essential to measuring the range of the application and implementation of sustainable development in a given society. Others, including Pearce *et al.* (1989), Tratalos *et al.* (2007), Bramley and Power (2005) and Jenks and Jones (2010), have all outlined different dimensions of sustainable development. These are reviewed in the following sections:

2.6.1 The social dimension

Jonathan (2000) argues that social sustainability is the core element of sustainability. Economic and environmental factors are important, but they are both means to an end, rather than ends in themselves. Therefore, by working towards economic and environmental sustainability, they are already working towards social sustainability. However, the social element of sustainability has some distinct criteria that address social challenges such as: poverty, exploitation, ill health (mental and physical), lack of essential services, civil unrest, crime, depression (Ndeke, 2011; Jacobs and Slaus, 2010; Colantonio, 2007; Allen, 2002; Roseland, 2000).

Holmberg (1992) states that a socially sustainable system has to achieve distributional equity, adequate provision of social services including health and education, gender equity, and political accountability and participation. Jenks and Jones (2010) state that the socially sustainable system must include five characteristics: protecting the mental wellbeing of all stakeholders, protecting the physical health of all stakeholders, encouraging community, treating all stakeholders fairly and providing all stakeholders with essential services. These characteristics provide the requirements to achieve sustainable development for all stakeholders.

In essence, this means the right of people to practise all activities and live in a healthy environment. This requires providing a fair share of natural resources and social and environmental services, to meet basic needs (food, shelter, clothing, and air), as well as complementary needs (business, entertainment and fuel), without affecting future generations. This is consistent with the goals of sustainable development.

2.6.2 The environmental dimension

Holling (1994, p. 84) states that sustainability is "essential to stop the continual degradation of the natural environment". However, as previously noted, Jonathan (2000) claims that to achieve sustainability it is necessary to accept that human beings are dependent on the natural environment for their own survival and wellbeing. Without a healthy natural environment, it is impossible to have a healthy society or economy. The poor state of the natural environment as a result of mankind's mistreatment has resulted in serious consequences that pose a direct threat to society and the economy. Consequences include global warming, resource depletion and waste disposal implications (Jonathan, 2000).

The latter is to a great extent due to product design. Datschefski (2001) defined sustainable products as being those which are: cyclic, solar, safe and efficient. Other consequences that need urgent attention also include: acidification, air pollution, global warming, land degradation, ozone depletion, reduced biodiversity, solid waste, and water pollution.

Ecosystems play a vital life-support function and should be protected. Ecological sustainability considers how humans interact with the biosphere (Allen, 2002; Ndeke, 2011). Zarsky (1990) defined four levels of ecological sustainability. Firstly, biodiversity such that all species of flora and fauna and their habitats are conserved to maintain the natural potential for species to evolve. Secondly, ecosystem conservation in that the natural stock of ecological resources (such as soil, ground and surface water, land biomass) has regeneration limits. Thirdly, interconnectedness insofar as improvement in environmental quality in one country should not be achieved at the expense of another. Fourthly, aversion to risk in that since the future is unpredictable it is best to be cautious and to make decisions based on avoidance of potentially bad consequences, even if this means that returns are not maximized in the short term.

The environmental dimension gives attention to the management of natural resources to achieve sustainable development in community. Generally, sustainable development focuses the quantity and quality of natural resources available for communities. Therefore, achieving sustainable development requires an understanding of the scientific management of natural resources in order to stop the continual degradation of the natural environment.

2.6.3 The economic dimension

Holmberg (1992) states that an economically sustainable system must be able to produce continually good services, to minimize external debt and to avoid damage in industrial or agricultural production. Howarth and Norgaard (1993) note that to achieve intergenerational equity, it is supposed that a low discount rate regarding resource use and environmental impacts should be imposed. Additionally, Jacobs and Slaus (2010) point out that the economically sustainable system is the improvement of human economic welfare in personal disposable income, employment, equality in income distribution, energy efficiency education and net household savings.

Jonathan (2000, p.10) states that "sustainability is essential for two reasons: firstly, the majority of businesses will not pursue sustainability unless they see it as offering them financial benefits. Secondly, financial wealth is an important criterion for quality of life". However, and contrary to traditional belief, the goal of financial profit must not be in conflict with the goals of social and environmental profit. Carefully designed products within businesses and social and environmental systems can yield many solutions that have long-term financial viability, and consistently generate financial profit and wealth. All of this can be achieved without damage to society or the environment. Financial issues include: liabilities, finite resources, customer loyalty, waste (“muda”), inconsistent revenues, declining customer value, rising costs and competition (Jonathan, 2000).

Therefore, the environment is an integrated economic entity as a base for sustainable development, and the depletion of resources eventually leads to the weakening of the future development opportunities for future generations. The economic perspective should be considered in the long-term to solve the problems facing the communities, in order to save money, resources and time.

2.6.4 The governance dimension

This dimension relates to the institutions of the state, which manage and regulate the social, economic and environmental development policies (Turner *et al*., 1994; Crilly, 2000; Rowan, 2002; CSD, UN, 2007). The state provides services and benefits to its citizens, raises the level and quality of life of individuals, secures their human rights, and provides a good framework for the commitment of their duties towards society (European Commission, Eurostat, 2009a; Colantonio, 2007; Allen, 2002; Roseland, 2000). Deeb and Mhana (2009) argue that the effective application of the dimensions of sustainable development and programmes needs capable governments. These governments should provide services and requirements for the population, and the population should adhere to their duties towards their governments (Rowan, 2002; Ndeke, 2011; CSD, UN, 2007). This will help the effective advancement towards a sustainable community.

The measurement and the application of the dimensions of sustainable development in the community require the implementation of appropriate sustainability principles and indicators (Deeb and Mhana, 2009). For the purposes of the research in this thesis, there should be an understanding of what the sustainable urban design principles are that can be used to form an essential nucleus to achieve sustainable urban design goals using HDMU schemes in urban areas . These principles are discussed in the following section.

2.7 Principles for sustainable urban design

The principles of sustainable urban design include the improvement of quality of life in cities without leaving any additional burdens for future generations or the depletion of key resources (Rogers and Gumuchdjian, 1997; Blowers, 1997). Additionally, Deeb and Mhana (2009) argue that there cannot be global ecological sustainability without urban ecological sustainability, and there cannot be a sustainable city in the 21st century without social justice and political participation, as well as economic vitality and ecological regeneration (see also Goodwin, 2003). Carmona (2009) stated that the goal of sustainable communities is access to the principles that achieve a balance between energy and resources, and between financial inputs and outputs which play a key role in future decisions about sustainable urban design. The sustainable city of the present and future is one that embraces cultural and functional overlapping, cultural diversity, education, careful resource management, energy efficiency and regional communication (Daseking *et al.*, 2010). The emphasis is, therefore, on in-city development and an understanding of the principles of urban sustainability to deliver it.

For the purpose of this research, these principles are defined as principles that can achieve sustainable urban design goals on three levels: spatial, content and procedures covering a range of social, environmental, economic and governance issues (McGeough *et al.,* 2004; CSD, UN, 2007; Lehmann, 2010;2006; Daseking *et al.*, 2010). The Freiburg Charter for Sustainable Urbanism (2010) classified 12 principles of sustainable urban design as follows (Daseking *et al.*, 2010):

2.7.1 Spatial principles

The spatial principles are as follows:

1. City of Diversity, Safety and Tolerance

The construction of varied dwellings and work facilities for all parts of the population, the creation of manageable units and open spaces, provision of public and private infrastructure, specifically for all generations, as well as care, leisure and educational services.

2. City of Neighbourhoods

The promotion of decentralized developments for the city to provide support for social and care infrastructure, education and culture, leisure and recreation, interconnected green areas and sustainable resource management. In addition, the preservation of a specific urban spatial identity as a precondition for viable urban development.

3. City of Short Distances

Being able to access all essential services on foot helps to minimize the use of personal means of transport and improve the immediate living environment. Therefore, footpaths and cycle routes must be given priority over personal motor cars. Additionally, personal means of transport should be transferred over to electrical.

4. Urban Development along Public Transportation Lines

Public transport should be given priority over personal means of transport. The objective is to carefully and consistently increase urban density along public transport routes and to locate services around the stops of tram lines.

2.7.2 Content Principles

The content principles are as follows:

1. Education, Science and Culture

Universities and research institutes, as well as schools and cultural venues notably contribute to making a city attractive and valuable. They have a marked influence on public life and on planning culture. Therefore, the developments of new technical, economic and social models for urban living are needed.

2. Commerce, Economy and Employment

The aim must be to fully exploit the maximum potential. Therefore, the essential task of urban development will be to maintain and modernize existing developments to attract pioneering, innovative companies. This requires an appropriate organizational structure to control such developments.

3. Nature and Environment

This includes preserving biological diversity, conserving resources for future generations and maintaining a healthy environment and climate worth living in informs the central objectives of urban sustainability. Therefore, the habitats for animal and plant life, the natural quality of soil, water, air and climate, and cultural landscapes should be preserved and developed, to avoid negative consequences. Furthermore, this model must be supplemented by consistently making existing buildings more energy-efficient, building more new buildings which produce energy, introducing a more efficient switch to renewable energy, and sources as part of an overall urban energy concept.

4. Quality of Design

Planning decisions impact the face of a city for generations to come. These decisions should create the unique character of a city and develop it further whilst adhering to the highest design quality standards. Public spaces play an important role with the buildings that surround them and that together make up the face of a city. Therefore, ownership and control of public spaces must remain with the local community.

2.7.3 Principles of procedure

The procedure principles are as follows:

1. Long-term Vision

This principle requires that there is far-sighted urban sustainability incorporating awareness the city's individual past, which may reach several decades into the future. This implies a preservation of the old whilst embracing the new. This is the only way to develop, maintain and intensify a city's unique quality and character.

2. Communication and Participation

The development of the city requires a collective vision of the city. This vision should be reflected in the design of the city structure. It should contain common visions as a consequence of the communication between all players within and outside the administration, and the results of citizen participation. This vision should be integrated into a new urban design process to create transparency for political decisions.

3. Reliability, Obligation and Fairness

All parties involved in urban sustainability need to create a framework that allows the local government to take fundamental decisions. This makes the city a reliable partner for its citizens and private investors, giving each of them equal rights and duties. In addition, there should be a relationship of trust between the administration and those people tasked with providing the scope for the necessary stimuli and innovations.

4. Cooperation, Participation and Partnership

The tasks of sustainable urban design require the taking into account of many different parties. The city is dependent on collaboration between private and public participants who all have their own ideas. The citizens in each neighbourhood should be taken into account as an indispensable part of integrative sustainable urban design.

Up to now, this section of the literature review discussed the principles of urban sustainability, which should be pursued in a manner that maximizes the efficient utilization of energy resources, and minimizes or eliminates local and global environmental degradation. Sustainable cities should, therefore, be developed and managed in a fashion that preserves the natural environment.

The review identified that cities should be designed and developed to emulate nature, and create opportunities for increased social and economic interaction and diversity within our communities. Therefore, urban sustainability is not possible without the commitment and collective action of the individual neighbourhood communities, which comprise a metropolitan region to manage both natural and human resources. These systems offer all residents access to affordable housing, social services, and employment and economic development opportunities.

After understanding how the dimensions and principles of sustainable urban design form an essential nucleus to achieve sustainable urban design practices in urban areas, it was found that a framework for the implementation of these principles for HDMU schemes was needed as clarified in section 1.5. The next section outlines this framework and its components, and the criteria combinations to be implemented effectively.

2.8 An implementation Framework

At the commencement of the research undertaken in this thesis, it was not known how the HDMU mechanism could be implemented in the Amman context. At present, there are no clear guidelines for the implementation of SUDP using HDMU schemes. In this context, there are several frameworks for sustainable development in other countries, but there is not specific framework for the implementation of HDMU schemes. There is therefore an identifiable need to propose such an implementation framework. Flaspohler et al. (2008) describes an 'implementation framework' as a major step related to promoting and enabling implementation. It should focus on details in the specific procedures, strategies and practices that shape the implementation process to ensure quality implementation (Duncan *et al*., 2012). This gives an opportunity for researchers and practitioners to avoid mistakes that could occur by providing practical guidance.

Therefore, the thesis proposes an implementation framework which consists of a set of practical recommendations as guidelines for the implementation of HDMU schemes. These guidelines have been identified by exploring the components that affect the successful and effective framework of sustainable urban design principles using HDMU schemes in the allocated areas in the Amman master plan.

Several authors including Pearce (2000), Pearce and Barbier (2000), DEA (2010,2006,2005,1998), Ndeke (2011), Lehman (2010) and Al Waer *et al.* (2014)have proposed frameworks for assessing urban sustainability. In particular, Al Waer *et al.* (2014, p. 8) pointed out that sustainable communities need to be developed within an ''inclusive framework''. This framework needs a set of criteria in order to be more informative (Andy *et al.*, 2002; Vincenzo *et al.,* 2002; Jorge and Alberto, 200*7;* Deakin *et al*., 2002; Curwell *et al.,* 2005; Boyko *et al., 2005)*.

Building Environmental Quality Evaluation for Sustainability through Time (BEQUEST) is one of the sustainable urban development frameworks (Andy et al., 2002; Vincenzo *et al*., 2002; Jorge and Alberto, 2007). BEQUEST is a Pan-European research initiative and was funded by the European Commission since its beginnings in the late 1990s (Kohler, 2002). According to BEQUEST, a sustainable urban design framework is composed of a set of criteria combinations framed within the BEQUEST framework and represented in (1) activities, (2) dimensions/issues, (3) spatial levels and (4) time scales as shown in Figure 2.1 (Vincenzo *et al*., 2002; Jorge and Alberto, 2007*;* Deakin, *et al*., 2002; Deakin, 2009). Curwell et al*.* (2005) confirmed these criteria combinations through a sustainable-community assessment process framework as shown in Figure 2.2 (see also AlWaer *et al.,* 2014).

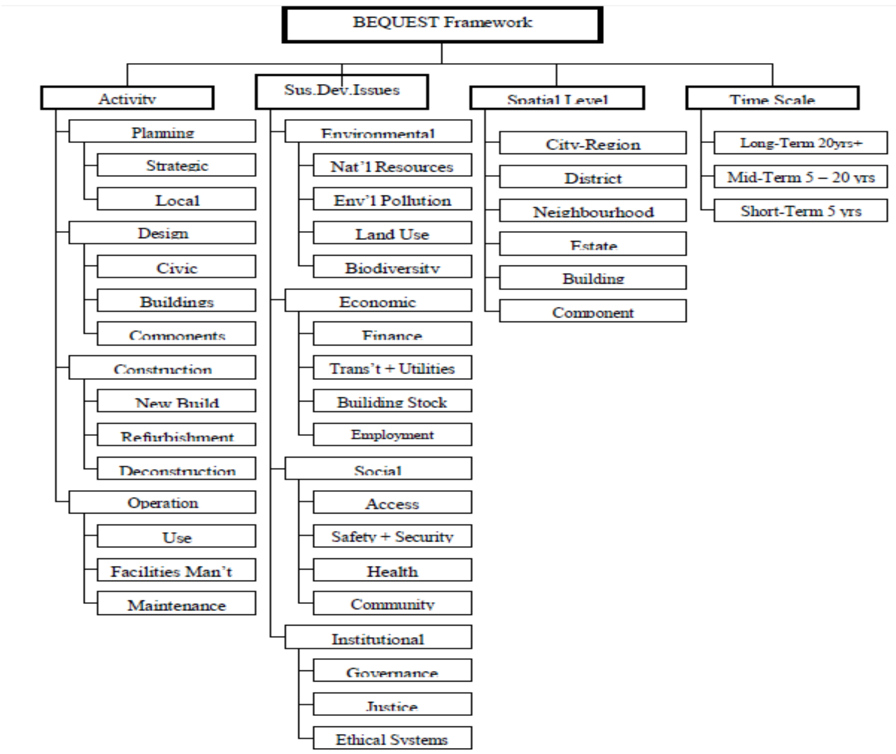

Figure 2.1: BEQUEST framework (from: Deakin *et al*., [2002: 176]; Jorge and Alberto, [2007:7]:)

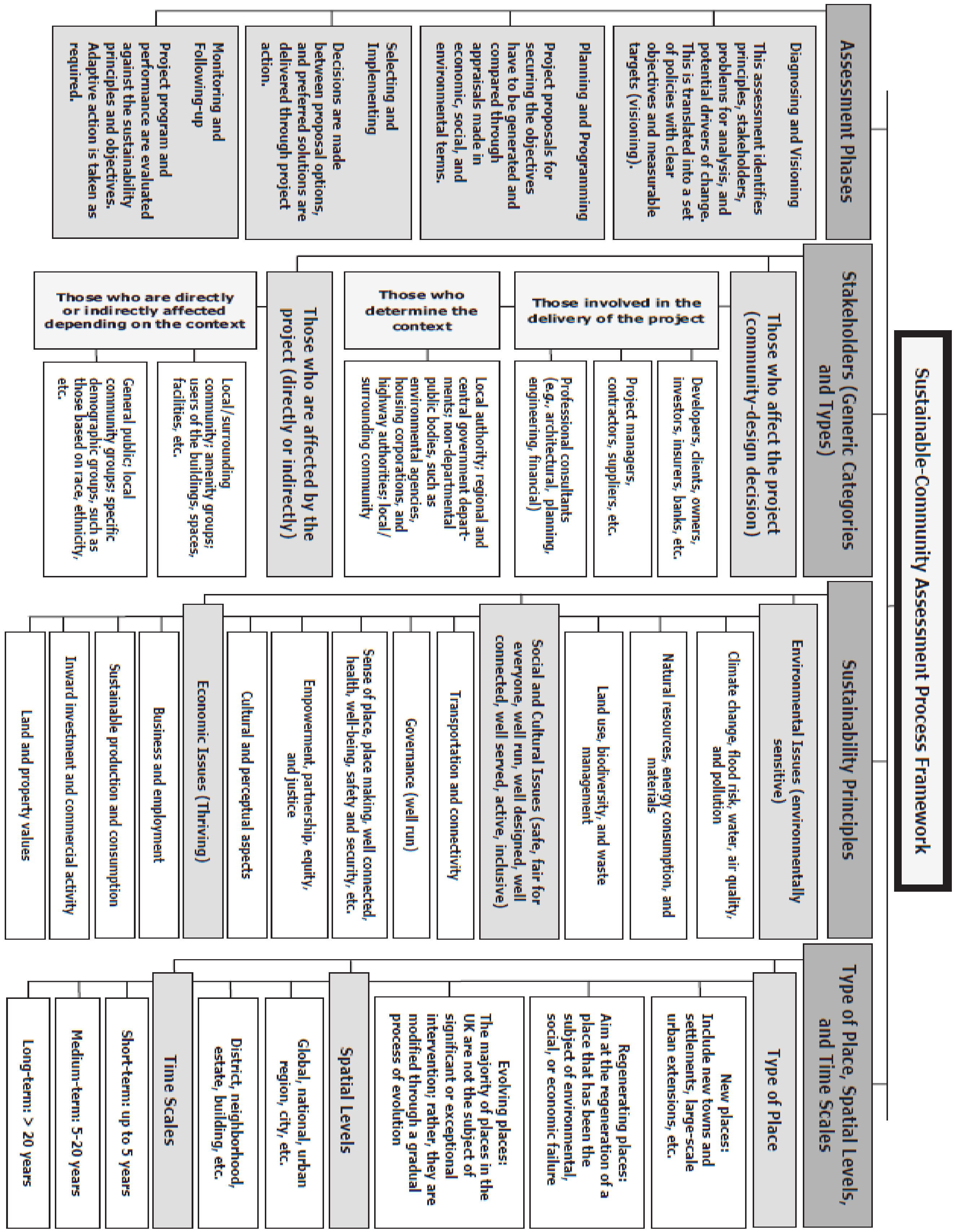

Figure 2.2: Sustainable-community assessment process framework (from: Curwell *et al.* [2005:34]; AlWaer et al., [2014:9]).

For the purposes of this research, the thesis identified these criteria combinations for the effective implementation framework of sustainable urban design principles using HDMU schemes in the city of Amman. Accordingly, these criteria combinations can be as follows:

(1) planning and design activities;

(2) environmental, economic, social and governance dimensions;

(3) neighbourhood spatial level; and

(4) long time scale, of more than 20 years.

By considering these criteria it gives an opportunity for this framework to appear more effective and flexible for the city through providing a range of components affecting the successful and effective framework, which covers economic, social, environmental and governance issues (Vincenzo *et al*., 2002; Andy *et al*., 2002; Jorge and Alberto, 2007; Deakin *et al*., 2002).

From the literature, it is obvious that the components of this framework include all or any of the following: (1) providing a broad variety of indicators using their measurements; (2) identifying the consequences of actions such as constraints and solutions, and; (3) identifying pathways through a planning strategy for managing the process path to the desired future (Pearce and Barbier, 2000); DEA, 2010,2006,2005,1998; Ndeke, 2011; Al Waer *et al.,* 2014 and Lehmann, 2010). The research undertaken as part of this thesis will identify these components constituting the implementation framework to provide the guidelines which can be used effectively in the context of Amman.

Finally, this chapter draws an initial implementation framework including its components that will be further explored in the next chapter as shown in Figure 2.3 below.

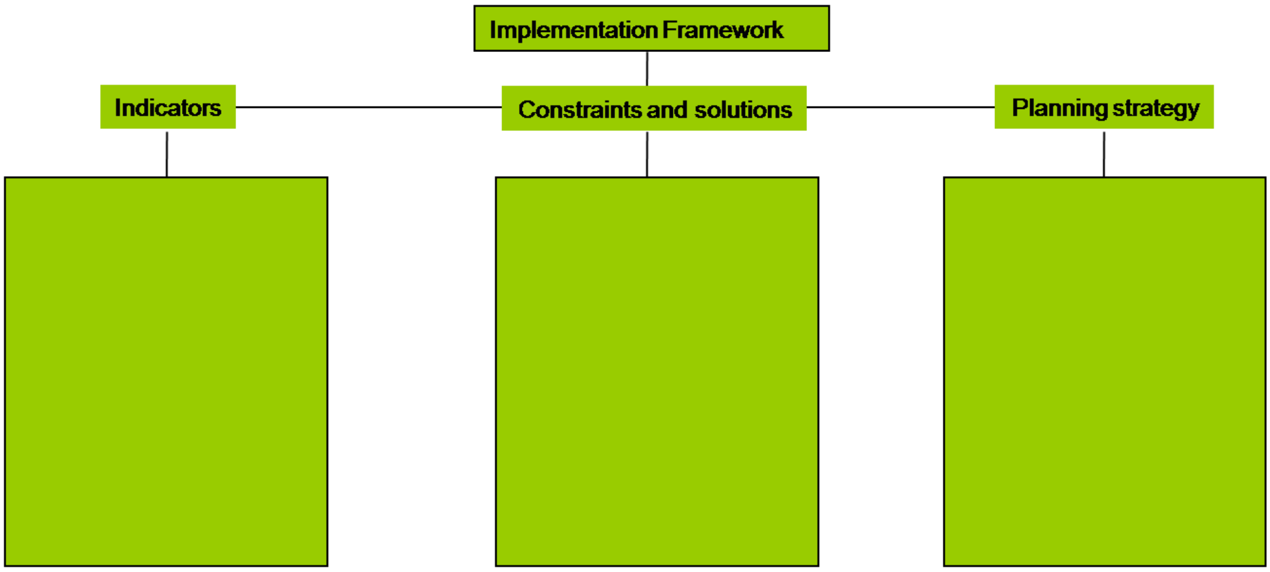

Figure 2.3: Implementation framework (Source: the Author)

2.9 Chapter Summary

This chapter examined the relationship between urban design and sustainability through the discussion of the various facets of sustainable urban design: principles, indicators, challenges and solutions. This was necessary in order to draw the framework for implementing sustainable urban design principles using HDMU schemes. It was found that such a framework needs a set of criteria to be more informed that is: (1) planning and design activities which include sustainable urban design activities; (2) environmental, economic, social and governance dimensions; (3) neighbourhood spatial level; and (4) long time scale, of more than 20 years.

In addition, this chapter found that this framework needs three key components to be used effectively: (1) provision of a broad variety of indicators using their measurements, (2) identification of the consequences of actions such as constraints and solutions, to overcome the challenges facing the implementation of sustainable urban design principles and (3) identification of process pathways through a planning strategy for managing the process path to the desired future. Therefore, the next stage of this thesis will examine these components to provide the guidelines which can be used effectively in the context of Amman. These components enable the opportunity to provide the requirements for a reflexive process of planning and development directed toward the vision of promoting a sustainable community, such that targets are clear, progress is monitored, and performance is made transparent.

Additionally, this chapter has drawn an initial implementation framework including its components which will be further explored to develop this framework in the next chapter.

Chapter 3

The main components of the implementation framework

3.1 Introduction

This thesis has identified that the implementation of sustainable urban design principles using HDMU schemes requires an implementation framework. It has also found that this framework requires three main components to be effective: (1) a set of indicators can be measured for the implementation of sustainable urban design principles in HDMU schemes; (2) a set of constraints and solutions facing the implementation of this process through testing these indicators, and; (3) a planning strategy for implementing and managing sustainable urban design principles using HDMU schemes. This chapter discusses these components constituting a framework for implementing SUDP using HDMU schemes in Amman.

The next section outlines the process by which a multitude of suitable urban sustainability indicators were reconciled before a final list was defined and used for the "testing purposes” of this thesis.

3.2 Urban sustainability indicators

Indicators are needed for target-setting and monitoring (Häkkinen, 2007a). Al Waer et al. (2014, p. 21) state that the purpose of sustainability assessment is “to offer decision-makers an evaluation of the global impacts on local changes to nature-society systems over long and short-term perspectives”. This helps according to identified actions which should, or should not, be taken in an attempt to make community or society sustainable (Kaatz et al., 2004). The use of sustainability indicators helps decision-makers to be better informed about the impact of future development in line with an understanding of past experiences (Rowan, 2002; Ndeke, 2011; Al Waer and Sibley, 2006). The use of indicators also presents an opportunity to improve the knowledge and practice of sustainability by providing a basis of analysis and decision-making (Cocca and Alberti, 2010;

Brandon and Lombardi, 2011; Lombardi, 2011; Baslas, 2004; Scipioni et al., 2009; Ndeke, 2011).

Therefore, measuring sustainability indicators provides environmental, social and economic information which can be seen as a significant tool for communicating information to decision-makers, and also to the public in a straight-forward and easy-to-follow manner (Haapio, 2012; Haapio, 2008; Haapio and Viitaniemi, 2007). This facilitates decision-making by "translating" collected data into manageable units of information (Häkkinen, 2007b;Haapio, 2010; Haapio and Viitaniemi, 2008; Moussiopoulos et al., 2010).This, therefore, supports phases of the decision-making process for progress towards sustainable communities (Alwaer, 2014). The most important benefit in measuring the sustainability of communities is the establishment of a single framework of indicators that harnesses all three dimensions. This gives an opportunity to communicate to a variety of different actors and disciplines to build sustainable community (D'Acci and Lombardi, 2010).

In broad terms, indicators can be used to evaluate the performance of projects, buildings, communities, and countries (Xing et al., 2006). What is more difficult, however, is the process of selecting a set of indicators when there is a lack of structured framework or consensus on what urban sustainability actually is (Cocca and Alberti, 2010; Brandon and Lombardi, 2011; Deakin, 2009; Deakin et al., 2011; Lombardi and Cooper, 2009; Al Waer et al., 2014).

Bell and Morse (2008) pointed out that identifying the main indicators depends on the stakeholder group and the dominant holistic viewpoint of that group. These indicators, therefore, reflect the holistic view that needs to be balanced in order for the system to be sustained (Malito, 2014), and it is the stakeholder groups that make these indicators fairly straight-forward. The groups might include (Bell and Morse, 2008):

- donors and their agents
- project managers
- agents for relevant ministries
- international non-governmental organizations
- local non-governmental organizations
- academics and other non-academic experts
- representatives of local rural populations (a diverse group who may well include a cross-section of the local hierarchy)
- representatives of local urban populations (ditto)
- representatives from local organizations of other types (such as industrialists)
- implementers
- beneficiaries

In order to achieve the stated aims of the thesis, the review of the literature on indicators highlights several international urban sustainability indicators CSD, UN, (2007a); Shen *et al.,* (2011), the Council of the European Union Sustainable Development Strategy (European Commission, Eurostat, 2009a), BREEAM Communities (2012), LEED ND (2009;2011), ESTIDAMA (2010), GORD/GSAS ND (2014) and Green Star (2012), SuBE Tool, sustainability Checklist for Regional Shopping Centres (SCRSC) (2006) and other scientific papers and authors like Serge Salat, (2012). A thorough review is presented in the revised thesis in the following sub-sections.

3.2.1 The United Nations Sustainable Development Indicators

The United Nations Commission on Sustainable Development (CSD) offers flexible criteria which countries can tailor or adapt to respond to national needs and circumstances. Depending on data availability, CSD indicators are available at the national level from a variety of institutions that collect and manage the data, such as ministries and government agencies. These indicators are shown in Appendix 1 (CSD, UN, 2007a; Shen *et al.*, 2011).

Table 3.1: The UN Sustainable Development Indicators (Sources: CSD, UN, 2007a; Shen *et al.*, 2011). Modified by the researcher

Table 3.1 shows the range of indicators as defined by the United Nations Commission on Sustainable Development (CSD, UN, 2007). These indicators include economic, social, environmental, and governance parameters and their measurement criteria.

3.2.2 Eurostat Sustainable Development Indicators

The Council of the European Union's Sustainable Development Strategy (2009) aimed to develop a tool giving local governments the opportunity to assess their progress towards sustainable development (European Commission, Eurostat, 2009a). These indicators were developed by Eurostat in collaboration with a wide ranging group of national experts taking on board existing models, such as the Sustainable Architecture Matrix (SAM) (Salem, 1990), BREEAM, Building Research Establishment Environmental Assessment Method (Birtles, 1997), Green Building Challenge GBC (Cole and Larsson, 1999), LEED Leadership in Energy and Environmental Design (Cole, 1999), and BEQUEST (Building Environmental Quality Evaluation for Sustainability through Time) in the EU. A first set of indicators was adopted by the Commission in 2005 and then updated in 2007 in order to adjust to the renewed SDS (European Commission, Eurostat, 2009b). As published, the indicators include a wide variety of the sustainable development measurements and are shown in Figure 3.2 below.

3.2.3 BREEAM Communities

BREEAM (Building Research Establishment's Environmental Assessment Method) is the first certification system to assess the environmental sustainability of the buildings (Rezaallah *et al*., 2014; BREEAM, 2011b; Ebert *et al*., 2011). The main focus of this system is in the UK although it is being used in different countries around the world. It was used to measure and describe a building's environmental performance (Cheshire, 2011; Ebert *et al*., 2011). This system was administrated and developed by BRE (Building Research Establishment) at the end of the 1980s and introduced to the market in 1990 (BREEAM, 2011a; BREEAM, 2008b). It was originally designed as a national system for office and residential buildings, but it is now used worldwide for a range of different building types (Ayyoob and Akito, 2014; Ebert *et al.,* 2011; BREEAM International, 2009).

This system includes ten main indicators and 76 criteria to be considered during the evaluation of credits in BREEAM 2011 sustainability assessment system, which was an updated version of BREEAM Offices 2008 (BREEAM, 2011a; BREEAM, 2011b). Each indicator has a set of different criteria related to it. These indicators are represented in energy, materials, innovation, waste, pollution, health and well being, water, transport, management and use and ecology (BREEAM International, 2009; BREEAM, 2011a; BREEAM, 2008a; 2008b). By 2014, it had over 250,000 buildings certified and over a million registered in the UK and in 50 countries around the world (Rezaallah *et al*., 2014; Sharifi and Murayama, 2014).

The type of building projects that can be assessed using BREEAM include whole new buildings, major refurbishments of existing buildings, new build extensions to existing buildings, a combination of new-build and existing building refurbishment, new build or refurbishments which are part of a larger mixed use building and existing building fit-out (BREEAM, 2008a; BREEAM, 2008c; BREEAM, 2011b).

BREEAM expanded from its original focus on individual new buildings to encompass the whole life cycle of buildings from refurbishment to in use and planning (BREEAM Communities, 2012; Ayyoob and Akito, 2013a; Rezaallah *et al.*, 2014). Its standard can be applied at these three other levels as follows: (1) BREEAM Refurbishment is an assessment method for sustainable housing refurbishment schemes; (2) BREEAM in-use is a scheme that helps to improve the environmental performance of existing buildings, and; (3) BREEAM Communities is a scheme that measures and improves the environmental, social and economic development conditions of large scale development projects as shown in Figure 3.1 (BREEAM Communities, 2012; Ayyoob and Akito, 2014; AlWaer and Kirk, 2015).

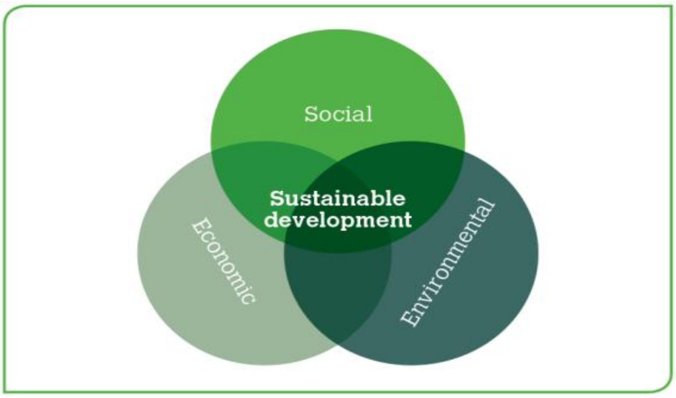

Figure 3.1: The sustainable development dimensions. (Source, BREEAM Communities, 2012).

BREEAM Communities includes indicators which can be used for sustainable communities development both in the UK and internationally as shown in Figure 3.2 below (BREEAM Communities, 2012; Ayyoob and Akito, 2013a; Sharifi and Murayama, 2013). The assessment criteria in BREEAM Communities considers the above-mentioned issues for BREEAM building level schemes issued at very early stages of design so credits achieved can be used to support and simplify a building level assessment (BREEAM Communities, 2012).

BREEAM community framework uses its indicators for creating sustainable communities in four steps(BREEAM Communities, 2012; Sharifi and Murayama, 2014). Firstly, the selection of a site for identifying the suitability and need for specific types of developments in an area as part of a planning application. Secondly, establishing the principle of development. During this step BREEAM assesses the degree to which the design team understand the opportunities to improve sustainability that necessitate a site-wide response such as community-scale energy generation, and transport and amenity requirements. Thirdly, determining the layout of the development in BREEAM Communities. This will include detailed plans for how people will move around and through the site, and where buildings and amenities will be located. Fourthly, designing the details which involves more detailed design of the development including: the design and specification of landscaping, sustainable drainage solutions, transport facilities and the built environment.

3.2.4 Leadership in Energy and Environmental Design for Neighbourhood Development (LEED-ND)

LEED is a certification programme developed by USGBC (U.S. Green Building Council) at the end of the 1990s (Reed *et al.*, 2011; LEED, 2009b; 2011). The motivation to create this system was the demand for an assessment tool that can measure and compare the sustainability of the buildings (Rezaallah *et al.*, 2014; Cheshire, 2011).

LEED was originally designed for the American market but is now in use worldwide (Ebert *et al.,* 2011; LEED, 2009b). In April 2010, 27,696 commercial and office buildings were registered for a LEED certification. 5,462 of these buildings have been certified (Rezaallah *et al.,* 2014; Reed *et al.*, 2011). The LEED for residential use was introduced to the market in 2007 and by April 2010, 24,939 residential buildings were registered for certification. 5,988 of these buildings have been certified (Ebert *et al.*, 2011).

The LEED sustainability assessment method includes 43 different criteria in LEED distributed on seven main indicators. These indicators are: energy and atmosphere, water efficiency, sustainable sites, materials and resources, indoor environment quality, innovation and design and regional priority (Rezaallah *et al*., 2014; LEED, 2009b; 2011).

The U.S. Green Building Council (USGBC), the Natural Resources Defence Council (NRDC) and the Congress for the New Urbanism (CNU) have jointly established a rating system for assessing and rewarding environmental neighbourhood planning and development practices within the framework of the LEED Green Building Rating System (LEED, 2009a). LEED-ND includes a set of principles for smart growth, New Urbanism, and green infrastructure and building (Ayyoob and Akito, 2013a). LEED-ND focuses the design, site selection and construction criteria that make buildings and infrastructure into a neighbourhood within its local and regional context (Ayyoob and Akito, 2013b; 2014).

The LEED rating systems include five environmental indicators, while LEED-ND has three basic indicators: smart location and linkage, neighbourhood pattern and design, and green infrastructure and buildings. It also includes two additional categories: innovation and design process and regional as shown in Figure 3.2 below (Reed *et al*., 2011; LEED, 2009a; Sharifi and Murayama, 2014). These indicators address environmental design and construction issues as well as some social issues without considering the most important economic, social and governance issues (LEED, 2009a; Ayyoob and Akito, 2013b).

The LEED-ND responds to environmental and land use considerations in the United States. It is not made to be a national standard that replaces zoning codes or comprehensive plans, nor has it been designed to certify sector plans or other policy tools (LEED, 2009a; Ayyoob and Akito, 2014). There were attempts to develop this for other countries, but they have not been implemented outside United States (LEED, 2009b; LEED, 2009a; Ayyoob and Akito, 2014). Local development patterns and performance levels vary greatly across the country because local government policies differ from one district to another. These differences largely affect land regulations which govern local development practices (Reed *et al.,* 2011; LEED, 2009a). This rating system can therefore not be considered as a one-size-fits-all government policies (LEED, 2009b; Sharifi and Murayama, 2014).

The LEED-ND process for applying its indicators and criteria is divided into three stages (Rezaallah *et al*., 2014; LEED, 2009a; 2011; Sharifi and Murayama, 2014): (1) providing conditional approval of a LEED-ND plan before the entitlement process begins; (2) completing a pre-certified plan can help projects secure financing, expedite permission or attract tenants; (3) completing certified neighbourhood development indicates that the project has achieved all the prerequisites and credits.

3.2.5 The Pearl Rating System for Estidama

Estidama is a building design methodology for designing, constructing and operating buildings more sustainably. It is a key aspect of the "Abu Dhabi Vision 2030" which aims to create more sustainable communities. It began in 2008 and is the first programme of its kind that is tailored to the Middle East region (Elgendy, 2011). These indicators were developed by Abu Dhabi Urban Planning Council in 2010 in collaboration with a wide ranging group of national experts taking on board existing models (Estidama, 2010a). This system is not considered a green building rating system like BREEAM or LEED, but rather a collection of ideals that are imposed in an elective building code type of format (Elgendy, 2011). It comprises three types of criteria: Pearl Community Rating System, Pearl Building Rating System and Pearl Villa Rating System (Estidama, 2010b).

This research discusses the Pearl community Rating System (PCRS) which is used to evaluate sustainable community development practices, because the others can only be applied to buildings. It aims to create a balance between design guidance and detailed requirements for a project’s potential performance in relation to the four pillars of Estidama: environmental, economic, cultural and social (Estidama, 2010a; Ayyoob and Akito, 2013b). This system includes a set of indicators and their measurements that are considered essential and fundamental to creating more sustainable communities. It addresses the Pearl Design Rating and the Pearl Construction Rating whilst the Pearl Operational Rating is currently under development (Estidama, 2010b; Elgendy, 2011).

The Pearl Community Rating System (PCRS)applies its indicators in seven steps: registering the development, appointing qualified professionals, conducting workshops, reviewing and updating, issuing the submission, reviewing by assessor and achieving the rating (Estidama, 2010a; Elgendy, 2011). It includes nine categories of indicators “integrated development process”, “natural systems”, “liveable communities”, “precious water”, “stewarding materials”, “resourceful energy”, '' innovating practice'' as shown in Figure 3.2 below (Estidama, 2010b).

3.2.6 Green Star is an internationally recognised sustainability rating system.

In order to create sustainable communities, launched by the Green Building Council of Australia (GBCA) in 2003, Green Star is Australia's only national rating that considers local conditions for sustainable community development (Lindub, 2010). By 2012, Green Star was developed by the Green Building Council of Australia (GBCA) in collaboration with a group of representatives from various organisations including private and public sector developers, product manufacturers, professional services providers and suppliers (Ann king, 2012). It also evaluates sustainability outcomes for the design and construction of all types of development projects. As with all Green Star rating tools it can be subject to further development in the future (Green Star Team, 2012). Green Star helps to improve environmental efficiency in buildings whilst creating jobs, boosting productivity and improving the wellbeing and health of communities (Green Star Team, 2012; Ann king, 2012; Lindub, 2010). It offers a framework of best practice indicators and benchmarks for sustainability.

The GREEN Star framework uses its indicators on four criteria (Green Star Team, 2012): (1) community which includes precinct planning and development; (2) design and as built which includes building design and construction; (3) interiors which involves fit-out design and construction; (4) performance which focuses on building operations and maintenance. This framework includes nine categories of indicators “management”, “transport”, “energy”, “water”, “materials”, “indoor environment quality”, “land use and ecology”, “emissions”, and '' innovation'' as shown in Figure 3.2 below (Ann king, 2012; Lindub, 2010).

3.2.7 Global Sustainability Assessment System (GSAS)

The Gulf Organisation for Research and Development institute (GORD) is comprised of various interconnected fields such as civil engineering, architecture, material science, behavioural science environmental psychology, electrical engineering and interior design (GORD, 2014). This institute aims to advance human knowledge and investigate new approaches to improve human well-being and achieve lower urbanization impacts on the environment (GORD, 2014). The Global Sustainability Assessment System (GSAS) was developed by GORD in collaboration with the School of Architecture at the Georgia Institute of Technology, and the Chan Centre at the University of Pennsylvania, United States (Ayyoob and Akito, 2013b). GSAS was developed by providing a set of practices adopted from 40 different global rating systems such as; BREEAM, LEED, GLOBES, CASBEE and SUBTool (GORD, 2014; Ayyoob and Akito, 2014). It aims to create a sustainable built environment that eliminates ecological impact, and addresses the cultural, social and environmental needs of the region without taking into account economic and governance issues (GORD, 2014). It was also formerly known as the Qatar Sustainability Assessment framework (QSAS) which provides a set of indicators including measurements.

The GSAS framework uses its indicators for ensuring an integrated project life-cycle approach via three stages(GORD, 2014; Ayyoob and Akito, 2014): (1) design including commercial and district schemes; (2) construction provides information on the assessment of the aspects of the construction process that has a lasting environmental impact and considers what impacts the project can mitigate; (3) operations provides information for the evaluation of the environmental impact of building operations. This framework includes eight categories of indicators that have been chosen on socio-economic, ecological or cultural grounds: “urban connectivity”, “site”, “energy”, “water”, “materials”, “indoor environment”, “cultural & economic value”, and “management and operations” as shown in Figure 3.2 below (GORD, 2014; Ayyoob and Akito, 2013b).

3.2.8 A new system of spatial indicators for assessing cities

This section presents the theoretical basis of a new system of spatial indicators for assessing cities. Salat et al. (2010b) propose new mathematical formulas for spatial and morphological sustainability indicators, which focus on the issues related to sustainable communities development. The development of this system into a set of performance indicators, which are essential to creating sustainable buildings and cities for neighbourhoods and cities is currently with the IISBE Urban Working Group chaired by the main author, and the CSTB (The French Centre for Building Science) has developed an original approach through its cross-disciplinary urban morphologies laboratory using a group of scientists, engineers, architects and urban planners (Salat *et al*., 2011a; 2010a).

The system framework applies its indicators to four scales: (1) the city scale permits comparisons with other cities in overall consumption per resident, in quantity of energy and resource consumption and in waste produced; (2) the district scale takes into account the structure, complexity and connectivity in particular of the street networks (for pedestrians, bikes, cars, public transport); (3) the neighbourhood scale measures proximity parameters: green spaces, public transport, public spaces and facilities; (4) the block scale focuses on morphological parameters and in urban configurations consisting of adjoining or homogenous buildings (Salat et al., 2012; 2011b; Bourdic and Salat, 2012). This system includes nine indicators that have been selected on the basis of socio-economic, ecological or energy aspects: “land use”, “mobility”, “water management”, “biodiversity”, “energy”, “equity”, “economy”, “wellbeing and culture”, and “waste and materials” as shown in Figure 3.2 below (Bourdic and Salat, 2012). This system can be used for an assessment of energy efficiency of the whole urban fabric including buildings and spaces, covering: intensity, diversity, proximity, complexity, urban form, connectivity and distribution (Salat et al., 2012; 2010b). This system has set these categories to highlight the very structural differences in the way these indicators are calculated (Salat et al., 2011b).

BREEAM Communities system	
Indicators	Measurements
Governance assessment issue	Consultation plan Consultation and engagement Design review Community management of facilities
Social and economic wellbeing (SE)	Economic impact Labour and skills Demographic needs and priorities Housing provision Delivery of services, facilities and amenities Public realm Utilities Green infrastructure Local parking Local vernacular Inclusive design Flood risk assessment Noise pollution Microclimate Adapting to climate change Flood risk management Light pollution
Resources and energy (RE)	Energy strategy Existing buildings and infrastructure Water strategy Sustainable buildings Low impact materials Resource efficiency Transport carbon emissions
Land use and ecology (LE)	Ecology strategy Land use Water pollution Enhancement of ecological value Landscape Rainwater harvesting
Transport and movement (TM)	Transport assessment Safe and appealing streets Cycling network Access to public transport Cycling facilities Public transport facilities
Innovation (Inn)	Innovation

GORD, GSAS system	
Indicators	Measurements
Energy	Energy Delivery Performance Fossil Fuel Conservation CO2 Emissions NOx, SOx, and Particulate Matter
Water	Water Consumption
outdoor Environment	Heat Island Effect Adverse Wind Conditions Air Flow Acoustic Quality
Cultural and Economics	Heritage & Cultural Identity Support of National Economy Housing Diversity
Site	Land Preservation Water Body Preservation Habitat Preservation Vegetation Walkability Bikeability Desertification Parking Footprint Mixed Use Crime Prevention Flood prevention Public Space GSAS Rated Typologies
Urban Connectivity	Transportation Load Proximity to Existing Districts Acoustic Conditions Solid Waste Load
Materials	Regional Materials Responsible Sourcing of Materials Materials Reuse Recycled Materials Life Cycle Assessment (LCA)
Management and Operations	Construction Plan Management Plan Wastewater Management Plan Organic Waste Management Plan Solid Waste Management Plan

LEED-ND system	
Indicators	Measurements
Smart Location and Linkage	preferred Locations Brown fields Redevelopment Locations with Reduced Automobile Dependence Bicycle Network and Storage Housing and Jobs Proximity Steep Slope Protection Site Design for Habitat or Wetland and Water Body Conservation Restoration of Habitat or Wetlands and Water Bodies Long-Term Conservation Management of Habitat or Wetlands and Water Bodies
Neighborhood Pattern and Design	Walk able Streets Compact Development Mixed-Use Neighborhood Centers Mixed-Income Diverse Communities Reduced Parking Footprint Street Network Transit Facilities Transportation Demand Management Access to Civic and Public Space Access to Recreation Facilities Visit ability and Universal Design Community Outreach and Involvement Local Food Production Tree-Lined and Shaded Streets Neighborhood Schools
Green Infrastructure and Buildings	Certified Green Buildings Building Energy Efficiency Building Water Efficiency Water-Efficient Landscaping Existing Building Reuse Historic Resource Preservation and Adaptive Use Minimized Site Disturbance in Design and Construction Stormwater Management Heat Island Reduction Solar Orientation On-Site Renewable Energy Sources District Heating and Cooling Infrastructure Energy Efficiency Wastewater Management Recycled Content in Infrastructure Solid Waste Management Infrastructure Light Pollution Reduction
Innovation and Design Process	Innovation and Exemplary Performance LEED Accredited Professional
Regional Priority	Regional Priority

Green Star system	
Indicators	Measurements
Management	Green Star Accredited Professional Commissioning and Tuning Fit out Information Commitment to Performance Metering and Monitoring Construction Environmental Management Operational Waste
Indoor environment quality	Indoor Air Quality Acoustic Comfort Lighting Comfort Visual Comfort Indoor Pollutants Thermal Comfort Quality of Amenities Ergonomics
Energy	Greenhouse Gas Emissions
Transport	Sustainable Transport
Water	Potable Water
Materials	Life Cycle Impacts Responsible Building Materials Sustainable Products Construction and Demolition Waste
Land use and Ecology	Sustainable Sites
Emissions	Light Pollution Microbial Control Refrigerant Impacts
Innovation	Innovation

The Pearl Community Rating System, Estidama	
Indicators	Measurements
Integrated Development Process	Life Cycle Costing Guest Worker Accommodation Construction Environmental Management Sustainability Awareness
Natural Systems	Reuse of Land Remediation of Contaminated Land Ecological Enhancement Habitat Creation and Restoration Food Systems Flood Systems
Livable Communities	Transit Supportive Practices Neighborhood Connectivity Open Space Network Accessible Community Facilities Housing Diversity Community Walkability Active Urban Environments Travel Plan Improved Outdoor Thermal Comfort Regionally Responsive Planning Pearl Rated Buildings Within Communities Safe and Secure Community
Precious Water	Community Water Use Reduction Stormwater management Water Efficient Buildings
Resourceful Energy	Community Strategies for Passive Cooling Energy Efficient Buildings Urban Heat Reduction Renewable Energy Efficient Infrastructure
Stewarding Materials	Regional Materials Recycled Materials Rapidly Renewable Materials Reused or Certified Timber Hazardous Waste Management Improved Operational Waste Management Improved construction Waste Management Organic Waste Management
Innovating Practice	Showcase of Cultural and Regional Practices Innovating Practice

spatial system for measuring cities	
Indicators	Measurements
Land use	Human density Building density Housing density Density of legal entities Job density Coefficient of land occupancy Subdivision intensity Diversity of subdivisions size Diversity of land use Diversity of subdivisions use
Mobility	Surface occupied by pedestrian and bicycle paths Surface occupied by the road network Proportion of the road network dedicated to public transport Connectivity of pedestrian/bicycle grid Connectivity of the car grid Cyclomatic complexity of the pedestrian/bicycle grid Average distance between intersections Proportion of the population more than 300 meters away from a public transport stop Number of public transport modes accessible within 300 meters Scale hierarchy of the street network
Water	Hydrological intensity Impermeability of land Intensity of water treatment Efficiency of water use Accessibility of drinking water
Biodiversity	Proportion of agricultural surfaces Proportion of green fabric Connectivity of green habitants Distribution of green spaces
Equity	Proportion of jobs in relation to housing Proportion of social housing Diversity of incomes Diversity of ages
Economy	Resources productivity Intensity of learning activities Job potential Structural diversity of jobs Structural diversity of uses
Waste	Proportion of recycled materials in the construction of new building Productivity of urban metabolism Intensity of GHG emissions per resident Intensity of emissions to produce wealth
Culture/well-being	Noise pollution Intensity of cultural activities Proximity of leisure facilities
Energy and bioclimatique	Energy intensity per resident Surface energy intensity Proportion of local production Rate of renewable energy used Rate of energy reuse Volumetric compactness Size factor Rate of passive volume Energy consumed for heating Energy consumed for air-conditioning

Eurostat Sustainable Development Indicators	
Indicators	Measurements
General Economic Background	Economic performance
Employment	Employment
Innovation and Research	Financial support for innovation and research
Economic Reform	GDP per capita
Indicators for the Social Inclusion Process	Financial, Poverty, Employment, Health, education
The Improvement of Living and Working Conditions	Health, employment, income deprivation, education, family, social participation, housing, environment, transport, safety, leisure, life satisfaction
Observatory for the Social Situation and Demography	Demography, social inclusion and income distribution, social capital (trust in society and its institutions, participation in formal and informal networks etc), and health status and living conditions
The Environmental Policy Review	Climate change and energy, nature and biodiversity, environment and health, natural resources and waste, environment and economy, and implementation
Environmental improvements in the quality and geographical coverage	Agriculture, air pollution, biodiversity, climate change, energy, fisheries, land management, transport, waste, and water
The Transport indicators	The environmental performance of the transport sector improving, the spatial and transport planning, existing transport infrastructure capacity, a fairer and more efficient pricing system, efficiency of vehicles used, management and monitoring tools being used to support policy- and decision-making
Energy and Environment Indicators	The use and production of energy decreases impact on the environment, energy use decreasing, energy efficiency increasing, a switch to less polluting fuels, renewable energy technologies implemented, environmental costs for pricing system
Agri-environmental indicators	Areas under agri-environment support (response), consumption of pesticides (driving force), emissions of methane and nitrous oxide (pressures and benefits), population trends of farmland birds (state), agricultural share of water use
Indicators of Fishing Capacity and Effort	Effectiveness of management measures in achieving objectives and decision-making (Rice and Rochet 2005), and aquatic or marine systems
The Biodiversity Indicators	Abundance and distribution of selected species, ecosystem coverage, invasive alien species, freshwater quality, and commercial fish stocks
Sustainable Consumption and Production	Efficiency and productivity in the use of natural resources, the environmental impacts from resource use, and reducing the ecological stress of resource use
Waste Framework Directive	The prevention and recycling of waste, waste management that encourages the prevention of waste
Indicators for Biofuel Criteria	The final energy consumed in all forms of transport, the contaminated and degraded land which is not being used for agriculture, and increasing biofuels production leads to rising food prices
Global partnership	Official development assistance as share of gross national income
Good governance	No headline indicator

Figure 3.2. Table mapping the indicators of the key sustainability systems (after: LEED, [2009a: 9]; Estidama, [2010b:10]; Ann King, [2012: 1]; GORD, GSAS, [2014:17]; Salat et al., [2012:7]) Modified by the researcher

Figure 3.2 shows the most important models which includes sustainability indicators. Through the comparison of these lists, the thesis identified a set of common urban sustainability indicators distributed on the four sustainability dimensions; social, environmental, economic and governance as shown Table 3.2.

Table 3.2: The common sustainability indicators list; (Sources: the Author)

The common sustainability indicators list	
Dimensions	**Indicators**
Social	Social and cultural wellbeing Indoor environment quality Innovation and Design Process
Environmental	Resources and energy Transport and movement Water Materials Land use and Ecology Emissions
Economic	Economic Reform Management and operational
Governance	Governance assessment issue Global partnership

From the thorough examination of sustainability indicators shown in Figure 3.2 above note that some of those indicators reviewed were excluded from the analysis undertaken as part of the research for this thesis. A subset of the indicators (including the United Nations Sustainable Development Indicators, Eurostat Sustainable Development Indicators, BREEAM Communities, the Estidama-Pearl Community Rating System (PCRS) and GORD-GSAS were excluded because of the emphasis they placed on broader aspects of sustainable communities at the expense of specific measures around sustainable urban design practices such as: proportion of population living below national poverty line, number of sworn police officers per 100,000 population and nutritional aspects of child health status and risks. Additionally, GSAS includes indicators to address social and environmental issues without taking into account the most important economic and governance issues related to sustainable urban design. The decision was taken to exclude the Green Star system because, as Australia's only national rating system, it placed undue emphasis on local conditions for sustainable buildings and sustainable community development in Australia. It cannot, therefore, be used by this research to test the indicators related to sustainable urban design specifically in Amman.

In addition, the LEED-ND system was also excluded because it considered environmental and land use conditions specifically in the United States. Attempts had been made to enable its use in and suitability for other countries but, as yet, it has not been implemented outside the United States. It can, therefore, not be considered a system that fits all local government policies because of existing differences between them across districts, which affect local development patterns. Moreover, this system includes indicators that address environmental design and construction issues, in addition to some social issues, without taking into account the most important economic, social and governance issues as related to sustainable urban design.

Accordingly, this thesis has not adopted these indicators but shifted its focus to those that are applicable to sustainable urban design at neighbourhood level. One such list is the sustainability Checklist for Regional Shopping Centres (SCRSC) which will be examined in the next section.

3.2.9 Sustainability Checklist for Regional Shopping Centres (SCRSC)

This section presents the Sustainability Checklist for Regional Shopping Centres (SCRSC) as shown in Table 3.3. This list was the forerunner to the Sustainable Built Environment Tool (SuBET), a unique framework for assessing the sustainability of urban landscapes at all scales (Hilson Moran, 2010). Hilson Moran is a multi-disciplinary engineering consultancy for the built environment.

Beginning with a doctoral thesis on applying a new kind of sustainability assessment to regional shopping centres in the UK, Husam AlWaer, an architect and academic at the University of Dundee (UK), investigated how current sustainability assessment tools could better address the social, environmental and economic dimensions (AlWaer *et al.* 2008b). This model was further developed by AlWaer and Clements-Croome (2010) during a stint at the University of Reading. In this second iteration, the authors further developed the model into a master planning tool in co-operation with Hilson Moran. In the first iteration, AlWaer examined how well each of the world's 23 most widely used sustainability assessment tools relate to truly integrated sustainability (AlWaer and Kirk, 2012). What they found was that the place specificity, urban scale and human element were largely neglected in the assessment tools surveyed. AlWaer (2011, p.1) stated that "of more than 650 sustainable building assessment systems, you can count the number that are applicable at the master planning scale on your hands". The assessment framework developed at the University of Reading was applicable to individual intelligent buildings while the original first iteration of the framework focussed on the sustainable regional shopping centres.

A series of workshops were run at the offices of Hilson Moran providing information on the outcomes of the ongoing projects at that time. At this point, Matt Kitson, Director of Sustainability at international engineering consultancy, Hilson Moran saw the potential to take the work further and the methodology that was developed, now called SuBET, was born (EPSRC, 2011). SuBET has been applied in a limited number of contexts including as a master-planning tool in Greenwich (UK), Riyadh (SAU), and Milan (ITA), and as a guideline in developing a proposal for an architectural competition in Riyadh, Saudi Arabia (Hilson Moran, 2010).

The identified need to address sustainability issues for master planning necessitated the development of the tool. SuBET assesses the sustainability of a development master plan at an early stage and can then be reapplied throughout the design cycle post implementation. SuBET incorporates over 80 indicators of cultural, social, environmental and economic impacts (AlWaer and Kirk, 2012; Hilson Moran, 2011; AlWaer and Clements-Croome 2010).

In addition, the SUBET focus ranges from the micro scale, right up to the global scale in order to tackle the impact on sustainability at national and international levels (EPSRC, 2011). As a consequence, SuBET is both internationally applicable and locally relevant.

For the purpose of this thesis, the Sustainability Checklist for Regional Shopping Centres (SCRSC) model, the forerunner to SuBET, as shown in Table 3.3 was adopted to be applied at the neighbourhood level using three case study areas previously identified in the City of Amman's 2010 Master Plan. The underlying rationale for this choice was that these areas in the master plan contain outline proposals for shopping centres within high density mixed use schemes where the regional nature of the shopping provision was the most dominant. Therefore, the regional shopping centres model is used instead of SuBET, because the SCRSC specifically contains the indicators focusing commercial issues. The creators of the SCRSC, Al Waer and Sibley, had already documented its flexibility for application at different phases of the life cycle of buildings. This can be used before, during or after the completion of the design of a project (AlWaer and Sibley, 2006). This flexibility in the SCRSC model was previously put to the test through three selected case studies Bluewater (London), Meadowhall (Sheffield), and Trafford Centre (Manchester) (EPSRC, 2011; AlWaer and Sibley, 2006).

Additionally, this model was selected because it includes a broad variety of indicators related to urban environment, architectural typology, community facilities and urban form linked to broader regional, global and national scales. This helped to address the relationship between sustainable urban design at the local level and high density mixed use centres by investigating their impacts on the social, environmental and economic conditions as outlined by AlWaer and Sibley (2006). SCRSC was also developed based on the economic, social, and environmental issues related to the buildings, which include land use, water, materials, energy, indoor environmental quality, solar availability and historical aspects of the local built environment (AlWaer and Sibley, 2006). It also addresses the issues related to the urban environment, which include resource consumption, emissions of pollutants from building materials, transportation contribution to global warming, flexibility, environmental management, economic performance and controllability (AlWaer and Sibley, 2006). This achieves a balance for the requirements of environmental, social and economic factors.

On the governance dimension, AlWaer et al. (2014) noted how the public authority, private sectors and local community are the key drivers for creating sustainable communities. In addition, Miller and Floricel (2000) pointed out that the governance dimension must take into account private partnership and public institutional frameworks that consider community consent. Therefore, this dimension administers executive institutions of the state, which constitute and carry out the social, economic and environmental development policies (Turner *et al.*, 1994; Crilly, 2000; Rowan, 2002; Goodwin, 2003; Ndeke, 2011). This means that the governance dimension must be taken into account at the heart of this process. The United Nation’s and the European Union supported the inclusion of this dimension through using a set of indicators which facilitate its role in creating sustainable communities (European Commission, Eurostat, 2009a; CSD, UN, 2007a; 2007b). Therefore, the research added a set of common governance indicators between the United Nation's and the European Union to the SCRSC model which considers the forerunner to SuBETool, as shown in Table 3.3.

Table 3.3 shows the part of the model which includes the urban sustainability indicators tested at the neighbourhood level. Furthermore, it also it shows the measurements for these indicators which are addressed in the next section.

Table 3.3: Sustainability Checklist for Regional Shopping Centres (SCRSC); (Sources: AlWaer and Sibley, 2006). Modified by the researcher

Dimensions	***Indicators***	***Measurements***
Social	Functionality, Usability and Aesthetic aspects	F1: Efficiency of open space utilization for local community F2: Efficiency of local community movement F3: High aesthetic aspects inside the building
	Indoor Environmental Quality/Health and Well being	I1: Maintain acceptable air temperature inside the building I2: Indoor noise and acoustic control within primary areas I3: Provision of indoor air quality monitoring. I4: Selecting of interior finish materials with minimal off – gazing
	Architectural considerations and cultural heritage	A1: Lot orientation to maximize compatibility of building design with local heritage value A2: Cultural heritage integration A3: Compatibility of urban design with local heritage value
	Local people facilities	L1: Facilities for local community L2: Provision of public transport for local area L3: Cyclist and pedestrian provision for the local area
	Customers facilities and trends	C1: Maximize Security inside the centre C2: Use/ Ignore the internet as a way of online shopping C3: Provision of food courts distribution inside the centre C4: Efficiency of cinema complex utilization C5 Provision of play area for children
Environmental	Energy and Natural Resources	E1: Use/ Waste solar energy E2: Use/ Waste of daylight in the primary area E3: Passive solar gain &cooling E4: high/ Low energy consumption E5: Use/ ignore natural ventilation
	Materials used, Durability and Waste	M1: Toxic/ Non- toxic material M2: Use locally produced materials

Dimensions	***Indicators***	***Measurements***
		M3: Use/ ignore recycled materials in the construction of the building M4: Use/ Ignore traditional or modern material M5: Material re- use/ recycling design for disassembly
	Sustainable Land use and Site selection	L1: Destroys/ Protects agriculture land (Site Criteria) L2: Proximity of site to public transportation L3: New/ Respect built environment surrounding the building L4: Enhance/ Ignore green areas & outdoor Environment L5: Collection & recycling of solid wastes
	Transport and Accessibility	T1: Consider/ Ignore Planning Regulation System PPG6/PPG13 T2: Encourage/ Discourage private car access T3: Provision of Pedestrian routes for population T4: Provision of cycle and cycle facilities T5: Public Transport Provision and facilities
	Water and water conservation (W)	W1: Stores/ Wastes rainwater in the centre for later reuse W2: Uses/ Ignore grey water recycling W3: Obtain the water locally W4: High / low water consumption W5: Design measures and management plans to limit use of potable water
Economic	Economic performance	EP1: Life cycle costs (Gross domestic product (GDP) per capita) EP2: Measure EP2: High/ Low quality of maintenance EP3: Minimization of operating and maintenance costs
	Local people employment	LE1: Job creation for locals (Employment-population ratio) LE2: Participation for local institutions in the building LE3: Ignore/ provide training for locals
	Management and Controllability	MC1: Provision of building management control system MC2: Provision for on-going monitoring and verification performance MC3: Minimize the consumption of energy resources and water
Governance	Public Participation	PP1: Participation of private sector, public institutions (Civic engagement) PP2: Participation of the local community (Citizens participation).
	Public Communication	PC1: The Connection with local community PC2: The Connection with private sector

3.3 The measurement of urban sustainability indicators

This section explains of how should sustainability indicators be measured. Sustainability measurement is a term that indicates the measurements used as the quantitative basis for the informed management of sustainability indicators (ACCA, 2008). The assessment of sustainable development indicators may be measured by way of an evaluation which can be either a conformance-based or a performance-based evaluation (Alexander, 2006). Conformance-based evaluations depend on a conformance methodology in the outcomes according to pre-established criteria and statistics. Performance-based evaluations depend on the quality of performance process and not simply the outcomes (Alexander, 2006). Deakin et al.(2007) stated that sustainable communities have to be evaluated at a higher scale. Conformance-based evaluation or performance-based evaluations have to take into account compliance requirements of the measurements, related to social, economic, and environmental indicators. The infrastructure and environment of the place have to be taken into account as well (Al waer *et al.,* 2014).

Gann *et al.* (2003) classify urban sustainability indicators and associated measurements into two types: quantitative (numerical) or qualitative (subjective).

3.3.1 Qualitative indicators

Unlike existing models, where until now most data applied in most models has been quantitative, this model SCRSC includes qualitative matters taking into account the difficulties of interpreting data. Take, for example, data on a good indoor environment and its functionality supporting internal activities, a characteristic that needs to consider the human response (Dewulf and Meel, 2004; AlWaer and Sibley, 2006). While some indicators of design can be measured objectively, others result in intangible assets depending, in part, on the subjective views, experiences and preferences of the people asked (Gann *et al.,* 2003;

AlWaer *et al.,* 2014; AlWaer and Sibley, 2006). In order to make these judgments as objective as possible, the qualitative issues should be converted into a quantitative value (AlWaer and Sibley, 2006).

3.3.2 Quantitative indicators

Quantitative indicators are implemented on the basis of facts, where an existing number for an indicator is measured at a negative or a positive level. According to AlWaer and Sibley (2006, p. 3), "An explicit indicator presents clearly the state of the indicator and supplies the methodology and units that should be used to decide the value of the indicator".

3.3.3 Mixed type indicators

These are based on quantitative and qualitative approaches such as, "architects' opinions on natural day-lighting use and its impact on the actual figure for energy consumption" (AlWaer and Sibley, 2006, P. 3).

In order to achieve an effective measurement for selected indicators, it is important for them to meet the following criteria (adapted from Brandon and Lombardi, 2005, p. 39):

- Be relevant to sustainable urban design
- Be based on available data
- Be relevant to a variety of spatial levels, building, local, regional, national and global scales
- Reflect changes over a period of time
- Give an opportunity to participants to compare and contrast different options
- Be quantifiable (quantitative criteria or qualitative converted to quantitative)"

Al Waer and Sibley (2006) pointed out that in defining a set of indicators and their measurements in relation to regional shopping centres, there is significant work to be carried out in order to make the process of calculation (score system) less complex, more flexible and easier to follow. Therefore, the study deferred to other score system adopted by the UN Committee of Sustainable Development, the committee responsible for sustainability in Jordan (CSD, UN, 2007b; Shen *et al.,* 2011). This system was applied in many cities such as: Melbourne, Hong Kong, Iskandar, Barcelona, Mexico City, Taipei, Singapore, Chandigarh and Pune (Shen *et al.,* 2011). In order to begin to apply these indicators at spatial level, there should be an understanding of what score system is used for them. The UN Commission on Sustainable Development (2007b) identified this and the outcomes are shown in Table 3.4 below.

Table 3.4: Measurement of sustainable development indicators, (Sources: CSD, UN, 2007b). Modified by the researcher

Number of Measurements	**More than one measurement**	**One measurement**
Minimum threshold of measurement	If number of measurements that meet the thresholds of sustainability were more than other measurements (higher than 50%, > 50%), it would be successful (Included), and if number of measurements that meet the thresholds of sustainability were less than other measurements (lower than 50%, < 50%), it would be unsuccessful (Not included). But if for the number of measurements were equal (=50%), the indicator is similar. (CSD UN, 2007; Shen *et al.,* 2011)	If it meets the thresholds of sustainability it will be successful (included), and if it does not meet the thresholds of sustainability it will be unsuccessful (Not included).

Table 3.4 shows the score system needed in order to analyse the urban sustainability indicators. These indicators were measured using the minimum threshold of measurement applied by the UN Commission on Sustainable Development. This Commission is responsible for sustainability in Jordan (CSD, UN, 2007b; Shen *et al.,* 2011). Therefore, urban sustainability indicators were analysed within selected areas for the master plan for the city of Amman using this scale of measurement.

Accordingly, these indicators were categorized into three types as shown in Table 3.4 (CSD, UN, 2007b; Shen *et al.,* 2011). Firstly, the included indicators (met threshold) whose number of achieved measurements is greater than the number of not achieved measurements. Secondly, the not included indicators (did not meet threshold)whose number of achieved measurements is less than the number of not achieved measurements. Thirdly, the similar indicators (equals threshold) whose number of achieved and not achieved measurements is equal. Thereafter, the research took the existing data from testing the indicators to be addressed in various figures, to be used in calculating the percentages of indicators for each category. Moreover, the research took the percentages for each indicator, according to its achieved measurements, in order to rank the indicators within a scoring system, and identify which ones are suitable for the city of Amman. This ranking depends on the categorization of indicators (included, similar and not included) and the scoring system.

This section examined different sets of indicators which can be tested in the context of Amman to identify the first and second component of the framework: a set of suitable indicators and constraints for Amman.

In exploring an implementation framework, the next section of the literature review highlighted that the third component of this framework includes identifying process pathways through a planning strategy for the effective implementation and management of the process path to the desired future.

3.4 Towards a planning strategy for urban sustainability

This section turns to a broader context to identify which sustainable urban design strategies can be effective for achieving a sustainable future vision for local communities. Abdulgader and Aina (2005) argue that this process entails a comprehensive community planning strategy that moves from strategic vision, goals and objectives through to good practice in city management for effective implementation.

A number of authors have written on the frameworks of integrating sustainability principles into urban design, to create a planning strategy of sustainable urban design, such as Frey (1999), Williams et al. (2000), Atkinson and Ting (2007), Carmona (2001; 2009), Abdulgader and Aina (2005), Sanderson and Lepkowsky (2014). A planning strategy of sustainable urban design requires that economic, social and environmental implications of development activities should be considered (Abdulgader and Aina, 2005; The European Union Expert Group on the Urban Environment (EUEGUE), 2004). Olsen (2012) states that the application of sustainable urban design practices requires providing an effective planning strategy that can implement and manage this process. Thus, this integrated strategy is considered as part of the main components of the framework for implementing sustainable urban design principles using HDMU schemes (Lehmann, 2010; Balanced Scorecard Institute, 2014; Richard, 2011).

The planning strategy necessitates a set of requirements and phases to be effectively implemented. (McGeough *et al.,* 2004; Habitat ll in Istanbul, UN, 1996; Ndeke, 2011; Sanderson and Lepkowsky, 2014). These requirements and phases identify the main elements and techniques needed for the effective implementation of HDMU schemes. The requirements are identified and defined as follows and further explained and explored at the questionnaire methods stage in section 7.6.3:

1. Competencies and skills (Leadership): This is a requirement for the election of a wide range of government officials that have established expertise in this field. These individuals should possess the skills and abilities necessary

to communicate the essential relevance of sustainability to the larger community (McGeough *et al.*, 2004; Ndeke, 2011; Habitat ll in Istanbul, UN, 1996). This stage is essential because the main project phases, including the study of project, preparation of plans, design of plans, implementation of project and monitoring of project require a set of skills and competencies for implementing the projects effectively (Olsen, 2012). These skills include consulting with the local community, the private sector, public institutions and experts from outside the country (Haines, 2004).

In this context, this study identified at the questionnaire phase, the extent to which each of these skills influence the effective implementation of SUDP using HDMU schemes in Amman. This led to the exploration of competencies and skills needed for each planning and implementation phase of the main HDMU project in the case study areas.

2. Participation: The effective participation of the local citizens, the private sector and public institutions are necessary to achieve the effective planning strategy for the implementation of community sustainability goals. These participatory groups can be involved in this strategy by using a set of methods such as; surveys, focus groups, and interviews (Olsen, 2012; Haines, 2004; Burkhart and Reuss, 1993). This research utilised the questionnaire survey to explore the extent to which each of these participations affect and influence the planning strategy. This led to further exploration of how the above mentioned methods can be used to provide the technical and administrative support to this participation for the effective implementation of SUDP using HDMU schemes in Amman.
3. Consensus: The broad aim of community participation in any planning strategy is ultimately to generate consensus (McGeough *et al.,* 2004; DEA, 2006). At the beginning, the generation of consensus for an effective strategic planning process should examine the main objectives that can be

achieved by the community (Henry and Brian, 1996; Richard, 2011). The consensus of views can be taken from a wide range of groups which represent local citizens, private sector and public institutions (Ndeke, 2011; Balanced Scorecard Institute, 2014). In this context, this research explored, at the questionnaire phase, to extent each of these groups affect the consensus of views for an effective planning strategy.

4. Investments: The urban infrastructure development patterns and alterations in land uses require both public and private investments, and large capital ex*penditu*re (McGeough *et al.,* 2004; DEA, 2005). Therefore, provisions that would make future public and private investments possible should be encouraged (Olsen, 2012; Allison and Kaye, 2005). In this context, this research identified, again at the questionnaire phase, how these investments affect the planning strategy for the effective implementation of SUDP using HDMU schemes in Amman.
5. Incentives: The sustainable future for communities requires compromises and tradeoffs (McGeough *et al.,* 2004). Therefore, both individual and organizational incentives, such as financial and convenience incentives should be taken into account (Haines, 2004; Richard, 2011). In this context, this research identified, at the questionnaire phase, to what extent each of the above mentioned incentives affect the planning strategy for the effective implementation of SUDP using HDMU schemes in Amman.

The research undertaken in this thesis identified through the questionnaire survey which of the above-mentioned planning strategy requirements can be used for the effective implementation of the SUDP using HDMU schemes in Amman. This led to thinking to what extent each of these requirements influence the effective implementation of the SUDP using HDMU schemes in Amman. This was further explored at the questionnaire phase.

For the strategy phases, each phase includes a set of outputs which helps to implement the HDMU schemes effectively as consolidated in Table 3.5 below (McGeough et al., 2004; Sanderson and Lepkowsky, 2014).

Table 3.5: The process phases and outputs for the effective planning strategy. Source: (McGeough *et al.*, 2004). Modified by researcher

Phases	Out puts
Strategic vision	Identification of stakeholders
	Creation of a community consensus on sustainability goals
Strategic assessment	Assessment of current energy consumption (economic state)
	Assessment of environmental quality control
	Assessment of transportation systems infrastructure
Strategic analysis	Identification of the desired future state
	Identification of the community's current condition
Tactical alternatives	Political tactics
	Economic tactics
	Social tactics
	Environmental system technologies tactics
Plan formulation	Creation of a wide range of policies
	Creation of a wide range of programmes
	Creation of a wide range of budgets
	Creation of a wide range of deployment schedules
Implementation and management	Identification of the specific performance measures
	Identification of the specific performance methodologies
	Identification of the reporting systems
	Identification of the progress adjustments

Table 3.5 shows the planning phases and outputs to sustainable urban design that offer a clear sustainable future vision, specific goals and tactical approaches to achieve it over time. The survey responses identified which of the above-mentioned planning strategy phases can be used for the effective implementation of the HDMU schemes. This led to thinking to what extent each of these phases and their outputs affect the effective implementation of the SUDP using HDMU schemes in Amman. This was further explored at the questionnaire phase as shown in section 7.6.1.

In the questionnaire phase, as part of the research, a set of questions focused on the planning strategy to be used effectively as part of the main components of the framework for implementing SUDP using HDMU schemes in Amman. Starting from here, the study raises a set of the key questions which it was judged would help to propose the third component of the implementation framework as follows:

1. Please specify which of the following planning strategy phases can be used for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman? You can choose more than one phase.
    - Strategic Vision
    - Strategic Assessment
    - Strategic Analysis
    - Tactical Alternatives
    - Strategic Plan Formulation
    - Implementation and Management
    - Other (Please specify)

2. To what extent does each of the following outputs can be used for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 3.6: The main outputs for the planning strategy phases

Phases	Out puts	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Strategic vision	Identification of stakeholders					
	Creation of a community consensus on sustainability goals					
Strategic assessment	Assessment of current energy consumption (economic state)					
	Assessment of environmental quality control					
	Assessment of transportation systems infrastructure					
Strategic analysis	Identification of the desired future state					
	Identification of the community's current condition					
Tactical alternatives	Political tactics					
	Economic tactics					
	Social tactics					
	Environmental system technologies tactics					
Plan formulation	Creation of a wide range of policies					
	Creation of a wide range of programs					
	Creation of a wide range of budgets					

	Creation of a wide range of deployment schedules					
Implementation and management	Identification of the specific performance measures					
	Identification of the specific performance methodologies					
	Identification of the reporting systems					
	Identification of the progress adjustments					

3. please specify which of the following planning strategy requirements can be used for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman? You can choose more than one choice.
    - Skills and abilities (Leadership)
    - Broad-based community participation
    - Consensus of views
    - Future public and private investments.
    - Financial and convenience incentives
    - Other (Please specify)

4. To what extent does each of the following influence the effective implementation of the sustainable urban design using high density mixed use schemes in Amman?

Table 3.7: Main planning strategy requirements for the implementation of sustainable urban design

Requirements	Positive effect	No effect	Negative effect	Do not know
Skills and abilities (Leadership)				
Broad-based community participation				
Consensus of views				
Future public and private investments.				
The financial and convenience incentives				

5. Please specify the competencies and skills needed to each phase for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 3.8: Competencies and skills for the implementation of sustainable urban design

Competencies and skills	Study of project	Preparation of plans	Design of plans	Implementation of project	Monitoring of project
Local community					
Private sector					
Public institutions					
Outside experts					

6. To what extent can each of the following be used as competencies and skills for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 3.9: Competencies and skills for the implementation of sustainable urban design

Competencies and skills	Highly agree	Agree	Neither agree nor disagree	Disagree	Highly disagree
Local community					
Private sector					
Public institutions					
Outside experts					

7. To what extent does each of the following affect the planning strategy for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 3.10: Community participation for the implementation of sustainable urban design

Community participation	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Local citizens					
Private sector					
Public institutions					

8. Please specify which of the following methods can be used to provide the technical and administrative support for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman? You can choose more than one choice.

Table 3.11: Community participation for the implementation of sustainable urban design

Community participation	Interviews	Focus group	Survey
Local citizens			
Private sector			
Public institutions			

9. To what extent does each of the following affect the planning strategy for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 3.12: Consensus of views for the implementation of sustainable urban design

Consensus of views	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Local citizens					
Private sector					
Public institutions					

10. To what extent does each of the following affect the planning strategy for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 3.13: Investments for the implementation of sustainable urban design

Investments	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Public investments					
private investments					

11. To what extent does each of the following affect the planning strategy for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 3.14: Incentives for the implementation of sustainable urban design

Incentives	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Individual incentives					
Organizational incentives					

Finally, this chapter developed the framework including its components that will be further explored in the next chapters as shown in Figure 3.3.

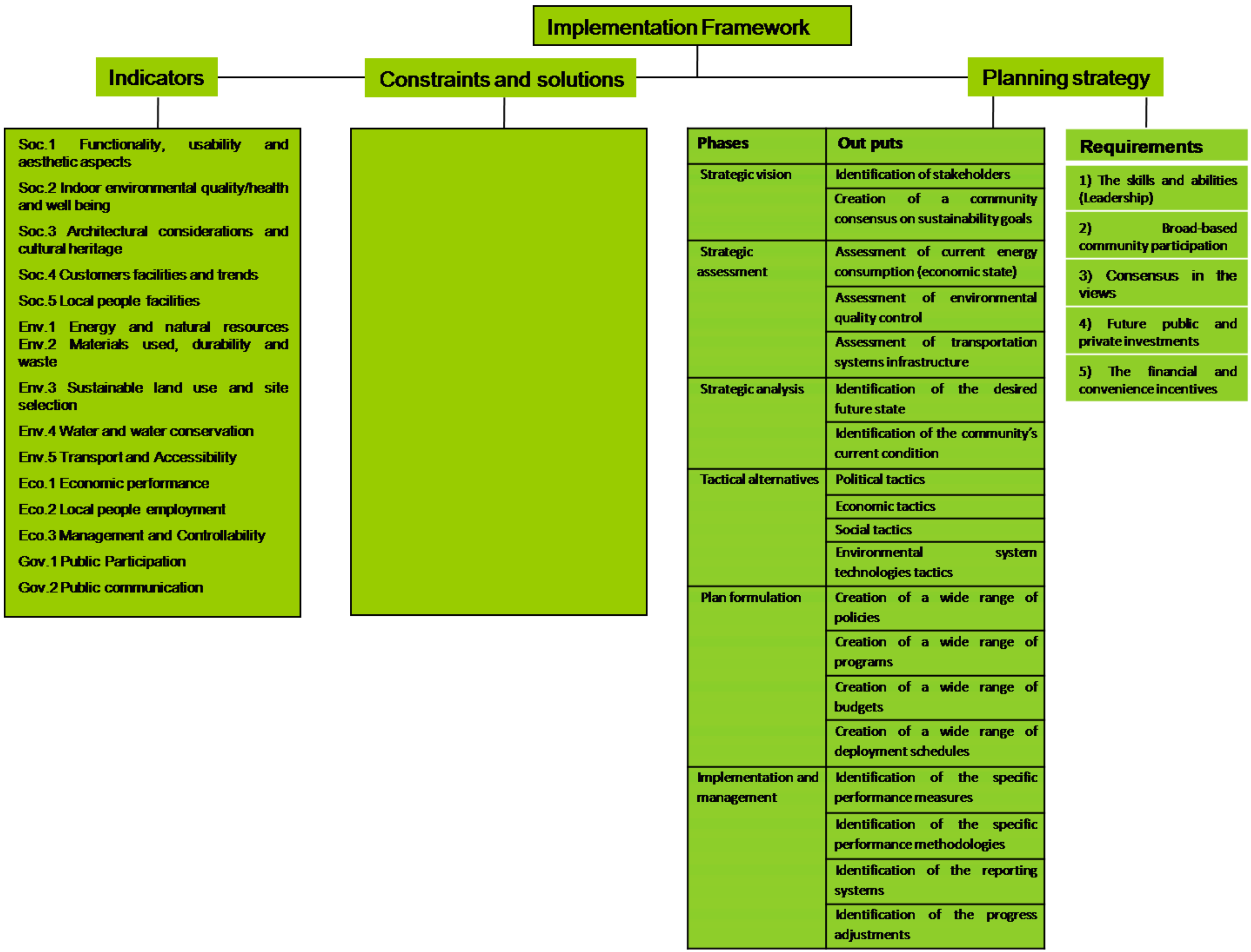

Figure 3.3: Implementation framework (Source: the Author)

3.5 Chapter summary

This chapter identified the main three components constituting the implementation framework to provide the guidelines which can be used effectively in the context of Amman. Firstly, it examined a set of indicators which can be measured to monitor progress towards sustainable urban design at a local level as represented in the master plan for the city of Amman. It then identified the indicators related to the process of application of sustainable urban design principles in the Amman master plan, using high density mixed use schemes (HDMU).

This thesis examined the most important models on the indicators related to sustainability. These indicators were examined by the Council of the European Union Sustainable Development Strategy, the United Nations represented to (CSD) Commission on Sustainable Development, International Urban Sustainability Indicators List and Sustainability Checklist for Regional Shopping Centres (SCRSC). Moreover, it examined the most important recent literature which details different sets of indicators (e.g. BREEAM Communities, LEED ND, ESTIDAMA, Green Star, GORD/GSAS ND, and SuBE Tool).

The rationale for the SCRSC model, which includes the indicators that relate to sustainable urban design and high density mixed use, was then presented. This helped to determine the level of success of the guidelines in the implementation and management of sustainable urban design principles using high density mixed use. Thus, these indicators in the SCRSC aimed to develop a wide range of tools giving local governments a broad variety of opportunities to assess their progress towards sustainable communities. This thesis identified the indicators that should be both limited and sufficiently comprehensive to capture the multidimensional nature of sustainable development. Indicators need to be clear and unambiguous.

Additionally, this chapter identified that the second component of this framework, represented in a set of common constraints and proposed solutions, can be identified through testing the indicators. Moreover, it identified the third component of this framework represented in a planning strategy for the implementation of sustainable urban design practices. This strategy can be applied through insurance the basic phases and requirements for effective planning strategy. The next chapter presents the case study areas in Amman, and high density mixed use schemes used in Amman for testing the indicators identified by the literature review in the context of Amman using HDMU schemes.

Chapter 4

High density mixed use schemes (HDMU) and the case studies in Amman

4.1 Introduction

The thesis found that the HDMU mechanism can be used in this study to implement sustainable urban design principles in the context of Amman within three case study areas which are: A central parkway, B southern gateway, C northern gateway. Two key concepts relevant to this research are, therefore, examined in this chapter. The first is that of high density mixed use HDMU schemes, and the second is that of the city of Amman including three case study areas.

This chapter discusses the suitable mechanisms to achieve sustainable urban principles in Amman, such as high density mixed use (HDMU), compact city and garden city principles. It also presents the nature of the Amman context used in this study. It clarifies the vision for the city of Amman as represented in the guideline policies and general principles of the Amman 2010 master plan. Moreover, it examines the rationale for the selection of this case study in order to investigate the sustainable urban design practices and the content of the selected areas (A, B, C) in the Amman master plan. The evidence for the examination was obtained through the Greater Amman Municipality (GAM) using documents that represent its vision for the master plan. In addition, this chapter provides the rationale for choosing the city of Curitiba to learn from its solutions to be used within the case study areas in the Amman master plan.

4.2 High density mixed use (HDMU) scheme

The study uses the HDMU mechanism to implement sustainable urban design principles. HDMU could achieve sustainable urban principles, because it accords with the topography, offers the lowest cost of infrastructure and architectural intensification for the areas, and efficiently utilizes the already limited land supply (GAM, 2010; GAM, 2007; Leinberger, 2001; Smith,2011; Lietz, *et al.,* 2006; Zaman *et al.,* 2000). Moreover, this mechanism is more innovative than other ways such as the compact city or the garden city, because HDMU encourages mixed use and promotes urban activity in the city over a 24 hour period. Garden City principles have not found much favour in the Middle East. HDMU also ensures economic competitiveness and facilitates infrastructural development (Lau and Gonzalez, 2012; Jenks and Dempsey, 2005; Coupland, 1997). In addition, on more global scales, the HDMU works in several American and Asian cities that have experienced rapid urban growth similar to that experienced by Amman (Masnavi, 2000; Hong Kong Planning Department, 2003).

Jenks and Burgess , (2000), Williams (1999) and Van der Waals (2000) state that the compact city respects the environmental criteria (except for urban air quality and urban heat). However, it includes public transport system insufficient to face the traffic effect of increasing population density, because traffic volumes and congestion increase rapidly. In spite of a reduction in car use per capita there is, nevertheless, increased concentration of motor traffic which results in a worsening of the local environment in those locations (Jenks and Burgess, 2000; Williams,1999). This leads to social and environmental constraints, such as; limitations on car use, mixed land use, and residential uses (Westerink *et al.,* 2012). This, in turn, results in increased social costs and higher construction costs (Breheny, 1996; Striker, 2011). The compact city has been applied in several cities, such as; Leipzig-Halle (Germany), Greater Manchester (UK), Montpelier (France) and The Hague Region (Netherlands) (Striker, 2011). As for the garden city, it has a fragile transport system and social infrastructure. Furthermore, it does not offer employment opportunities for people (Bowie, 2013). Where there is few people they may live within walking distance of their place of work (Gossop, 2006). The garden city has been applied in several cities such as: Letchworth and Welwyn

Garden city (UK), Hellerau (Germany), Canberra (Australia), Mezaparks (Latvia) (Bowie, 2013).

Accordingly, the high density mixed use (HDMU) is used as the most suitable mechanism to achieve sustainable urban principles in Amman, Jordan, because it accords with the topography, presents the successful solutions with the lowest cost of infrastructure for the areas and efficiently use the limited land supply.

4.3 Definition of high density mixed use (HDMU)

Grant, 2002 and Coupland, 1997 referred to HDMU as a panacea for the problems confronting our fragmented urban areas. Therefore, high density mixed-use schemes have been developed in a variety of different configurations (Grant, 2002). The terms 'mixed use' or 'high density mixed use development' are widely used, but seldom defined (Coupland, 1997; Rowley, 1996; Hoppenbrouwer and Louw, 2005; Rabianski *et al*., 2009; Grant, 2007). Therefore, a set of organizations tried to put a more specific definition for 'high density mixed use development' for research purposes. There are two definitions that are consistently referenced in the literature (Grant, 2007; Joshua and Drummond, 2011). The first definition was developed by the Urban Land Institute (ULI) and the other was derived from the results of a cross-organizational survey conducted by a wide range of real estate industry groups (Joshua and Drummond, 2011). Urban Land Institute (ULI) defined high density mixed-use schemes as a set of revenue-producing uses (such as retail/entertainment, office, residential, hotel, and/or civic/cultural/recreation), physical and functional integration of project components including uninterrupted pedestrian connections and development in conformance with a coherent plan (Schwanke *et al*., 2003; Hoppenbrouwer and Louw, 2005; Grant, 2007; Rabianski *et al*., 2009; Joshua and Drummond, 2011). The industry survey definition a mixed-use development as a real estate project with planned integration of some combination of retail, office, residential, hotel, recreation or other functions. It is pedestrian-oriented and contains elements of a live-work-play environment. It maximizes space usage, has amenities and architectural expression and tends to mitigate traffic and sprawl (Niemira, 2007; Joshua and Drummond, 2011).

4.4 Types of high density mixed use (HDMU) in Amman

The Amman plan began at the community scale, with the preparation of the plan for high density mixed use (HDMU) that focused on the location, planning, design, and regulation of high density mixed use development. Similarly this plan includes the locations and regulations of high density mixed use (HDMU) (GAM, 2007; GAM, 2010).

High density mixed use schemes include two types of buildings. Firstly, the HDMU podium which includes four types of buildings that are represented as:- medium: 31m to 50m, high: 76m to 100m, medium-high: 51m to 75m and landmark: 101m and higher. Secondly, HDMU is typically divided according to height into five types:-medium-low: min.18m to max.30m, medium: 31m to 50m, high: 76m to 100m, medium-high: 51m to 75m and landmark: 101m and higher (GAM, 2010; Schwanke *et al*., 2003). Figure 4.1 shows the details relating to plans of high density mixed use (HDMU) such as: distances between buildings, lot size, setback at podium, and setback at tower. These types were designed into the three case study areas in Amman for implementing sustainable urban design principles using high density mixed use.

In addition, there are three types of the high density mixed use scheme represented in high rise with low coverage, low rise with high coverage and medium rise with medium coverage (Schwanke *et al*., 2003; Joshua and Drummond, 2011). Therefore, these types were distributed within three study areas in Amman (A, B, C) according to the nature of the areas and the need for such types.

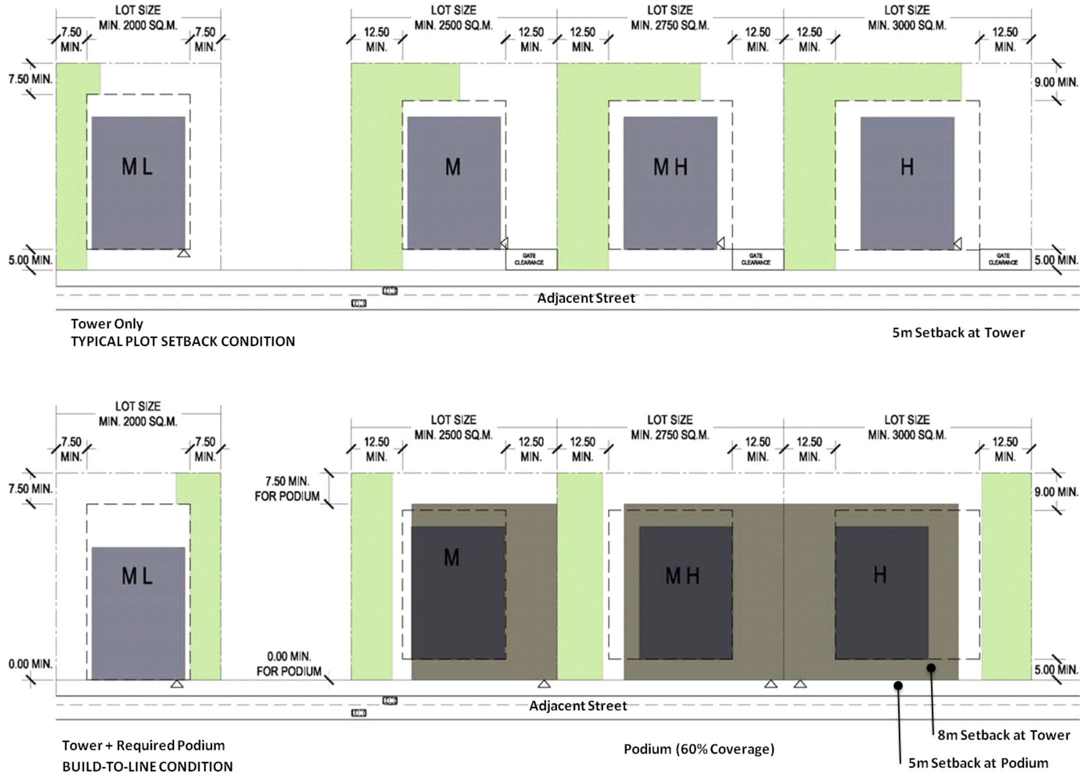

Figure 4.1: Building envelope plans, (Sources: GAM, 2010). Modified by the researcher

Figure 4.2 presents the key elements composed of the Building Envelope Standard for high density mixed use. This was achieved by addressing minimum and maximum building height, minimum lot size, maximum lot coverage, minimum landscaped open space (LOS), maximum floor plate (podium and tower), and minimum building setbacks. Floor area ratios (FAR) are excluded, because these ratios are the product of the floor plates and building heights. Moreover, the height limits are expressed in meters to ensure a maximum building height. It also includes a ramp to underground parking, underground parking, vehicular access, service lane, building lot, and setbacks tower (GAM, 2010; 2008).

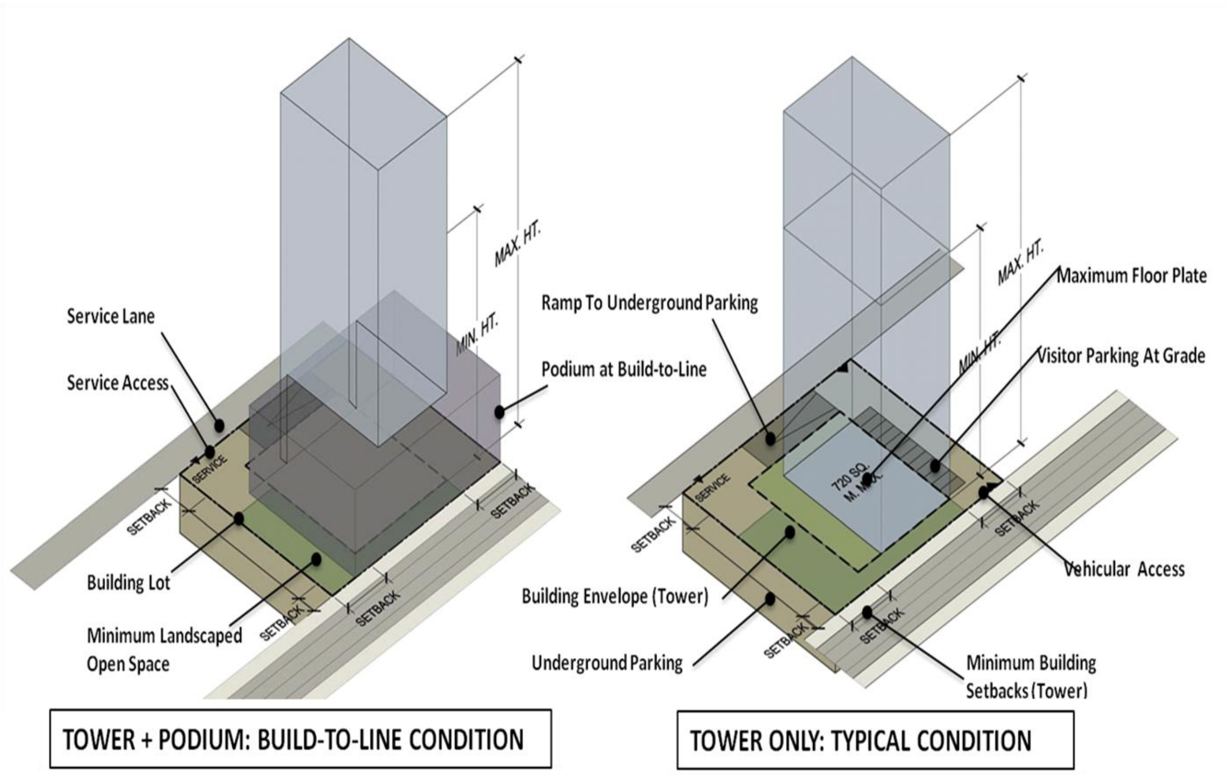

Figure 4.2: Building envelope standards, (Sources: GAM, 2010). Modified by the researcher

These types are the core zoning designation for the development plots upon which high density development will be considered. These include all permitted uses under HDMU including residential hotels, retail, restaurants, offices, clubs (sports, social, and recreational) and other compatible commercial uses such as cinemas (entertainment). The predominant use within each HDMU cluster was residential supported by other permitted uses as follows (GAM, 2010; GAM 2008):

- Open Space: This general designation can ultimately contain both active and passive open space, and constitutes 'Green Areas' that contain limited physical (buildings) development. Open space includes parks (Jabal Parks, Wadi Parks, Stair Parks, Trails/Paths), sports fields, buffer strips, public gardens /landscaping, and civic monuments.
- Community Facilities: This is a broad designation that includes both public and private facilities which provide services and amenities to the general public. This includes religious facilities, education facilities, health facilities, libraries, social service offices, community centres, Government offices, etc.

- Road Reserves: This is land dedicated to roads, service alleys, public paths and stairways. In addition to providing car and bus lanes, the reserves contain space for landscaping, sidewalks, and transit facilities (bus turn-offs and shelters).
- Residential: This includes the current low density, low rise residential zoning classifications (A, B, C, and D) in the current zoning regulation.
- Local Commercial: This includes the current low density, low rise commercial zoning classification in the current zoning regulation (local commercial within residential A with special regulations).

To understand the nature of high density mixed use schemes. This section defines the high density mixed use scheme used in Amman and the main types of HDMU schemes. It also presents the key elements composed of the Building Envelope Standard for high density mixed use.

4.5 The geographical context of Amman

In its short modern history, the nation of Jordan has been largely influenced by events occurring across the Middle East. Figure 3.1 shows that Jordan is bordered by Syria to the north, Iraq to the northeast, Saudi Arabia to the east and south, and Palestine to the west (RJGC, 2012).

Amman is the capital of Jordan and it attracts additional investment, skilled labour, and value added industries. In terms of trade, Amman shares direct transportation and transit links to other national centres including Cairo, Damascus, Beirut, Jerusalem, Riyadh, and Dubai (Potter *et al.,* 2009; Campbell, 2012).

Amman's regional importance dominates the nation's economy, commanding the majority of Jordan's total investment while accounting for 39 percent of the nation's population (Dayyeh, 2004b; Al Rawashdeh and Saleh, 2006). Amman shares regional development considerations with the municipalities of Madaba, Salt, and Zarqa and with portions of the Dead Sea Valley as shown in Figure 4.3 (GAM, 2007; Potter *et al.,* 2009; Abu-Dayyeh, 2004a; Al Rawashdeh and Saleh, 2006).

Figure 4.3: The Hashemite Kingdom of Jordan: National and Regional context, (Sources: RJGC, 2012). Modified by the researcher

Amman is a bustling world city that has been able to blend its rich natural and cultural heritage, and its unique cityscape with modern urban development. The city takes special pride in its cultural mosaic, celebrates pluralism, and has become a model of multiculturalism in the Arab world. In Amman's hinterland, the city government has been careful to protect the traditional villages that dot the landscape, maintaining their cultural integrity and traditional lifestyles (GAM, 2007; Al Rawashdeh and Saleh, 2006; Dayyeh, 2004a).

Amman has become a favourite destination for visitors. The annual Amman Festival is a world event, attracting more than a million visitors. The Festival celebrates Arab arts and culture and explores the spirituality of Islam (GAM, 2010). The city has established itself as the capital of agreement and reconciliation within the region as well as a major centre for investment in the Middle East (GAM, 2008; Dayyeh, 2004b). Therefore, the city of Amman seeks to ensure that future development complements its beauty and serenity. This was achieved through creating its vision for the master plan (Principles and Policies), which fit with sustainable urban design. These principles include urban design, culture and heritage, green city, governance and service delivery, and public spaces and social inclusion (GAM, 2007). It also has adopted these principles, for selecting case study areas for the application of the urban sustainability indicators, using high density mixed use (HDMU) schemes in the Amman master plan. These areas have been proposed to implement urban sustainability principles without negatively affecting the surrounding environment.

The Amman master plan is an ongoing and evolving series of interrelated and coordinated plans for the city of Amman. The main challenge is to accommodate Amman's projected growth to 2025 as follow:

- Population growth

Amman faces a number of key demographic challenges as its population grows over the next two decades. This predominantly young population will mature and require housing, employment, social facilities, transportation, and other urban amenities. Figures 4.4 and 4.5 provide a summary of some key population projections to 2025 for Amman (DC, 2011).

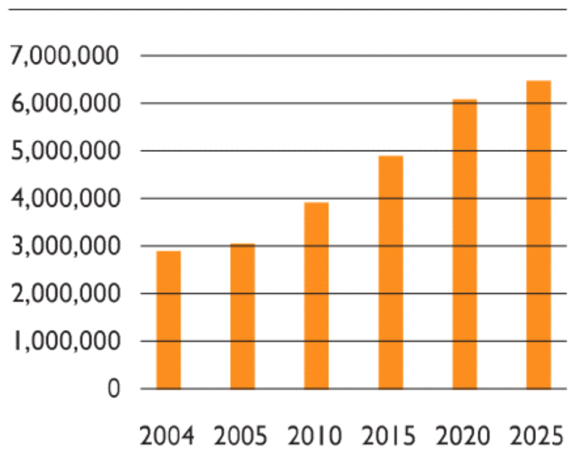

Figure 4.4: Population growth of Amman to 2025, (Sources: GAM, 2007). Modified by the researcher

	Current	**2025**
Population (persons)	2,200,000	6,500,000
Workforce (persons)	500,000	1,800,000
Employment Land Supply (du)	89,000	108,000
Employment Demand*	40,000	65,000
Housing Demand (units)	500,000	1,300,000

*Major employment demand – does not include population-serving employment beyond large commercial districts and government employers

Figure 4.5: Projected population of Amman to 2025, (Sources: GAM, 2007). Modified by the researcher

Figures 4.4 and 4.5 indicate that the projected population of Amman will be 6.4 million by 2025. Therefore, there will be an increase in workforce ranging from 500,000 to 1,800,000 and an increase in employment demand from 40,000 to 65,000 by 2025. In addition, these figures indicate that demand for housing and recreational facilities will rise from 500,000 to 1,300,000.

- Planning Boundary

The Greater Amman Municipal Boundary serves as the Metropolitan Planning Area boundary for the Amman Plan. Figure 4.6 shows that the Metropolitan Planning Area consists of 1,662 Km², It also includes the recent 2007 amalgamation areas (GAM, 2007; Potter *et al.,* 2009).

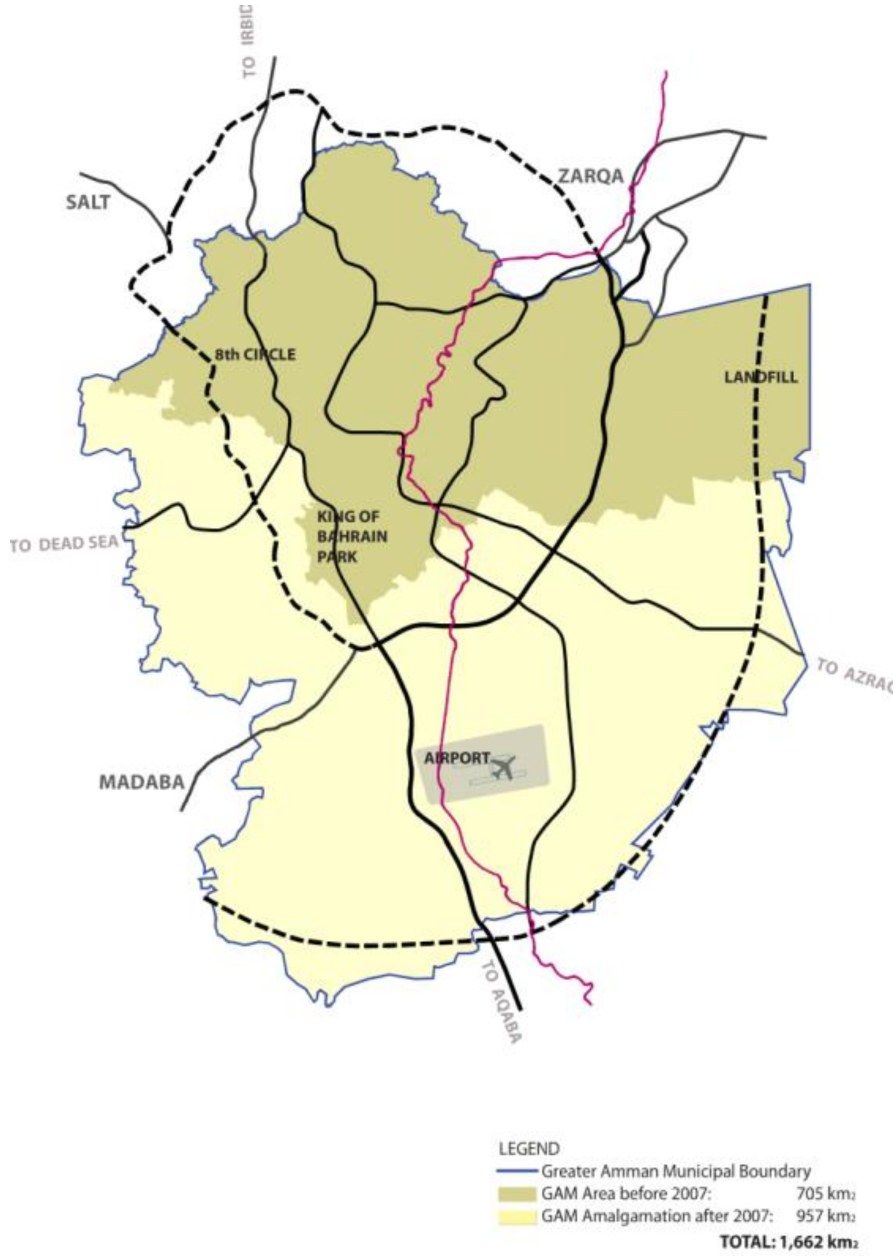

Figure 4.6: Greater Amman Municipality boundary and amalgamation areas, (Sources: GAM, 2007). Modified by the researcher

4.6 The case study areas in Amman

This section explains the rationale behind the selected areas for this study. Figure 4.7 shows the three case study areas which have been proposed according to outlined criteria relating to the master plan development for the city of Amman. These case study areas are labelled A, B and C where A is the Central Parkway zone of the city, B is the Northern Gateway and C is the Southern Gateway of the master plan for the city of Amman (GAM, 2007).

These criteria include suitability for high density mixed use development, impact on city-wide development and opportunity for the application of sustainable urban design principles (Potter et al., 2009; GAM 2007). Therefore, the rationale behind selecting the three study areas as a case study for this thesis is that it provides a good example of planning and development principles in harmony with sustainable urban design practice. These areas were proposed to implement the principles without negatively affecting the surrounding environment.

For the purpose of this thesis and research into high density mixed use, the primary reasons for selecting the three areas are outlined here.

- Area A in the centre was chosen because it offers the scope for significant intensification (new projects) and densification (of existing areas) close to areas that have seen recent growth and expansion.
- Area B was selected because it could accommodate high density mixed use without impacting on heritage areas in the older parts of the city.
- Area C was selected because it proposes high density projects in new growth areas in the southern part of the city along the airport corridor.

All three, therefore, in addition to being selected by the city as growth areas (GAM, 2007), suit the research objectives as set out in this thesis.

The 2010 Amman Master Plan designated these three areas as Primary Growth Areas where good 'sustainable' planning and development principles can co-exist in harmony with sustainable high-density urban design (GAM, 2010). In 2013, the city of Amman started to implement high density mixed use schemes within areas A and C. However, a set of economic problems emerged within Area C due to complaints by the local community in this area. This required payment of financial compensations for the lands used to construct HDMU schemes (GAM, 2013). This delay meant that the city of Amman started to implement schemes within Area A only. This was also partly because of existing services and available infrastructure in this area, in addition to the increasing demand for HDMU by investors in this central area.

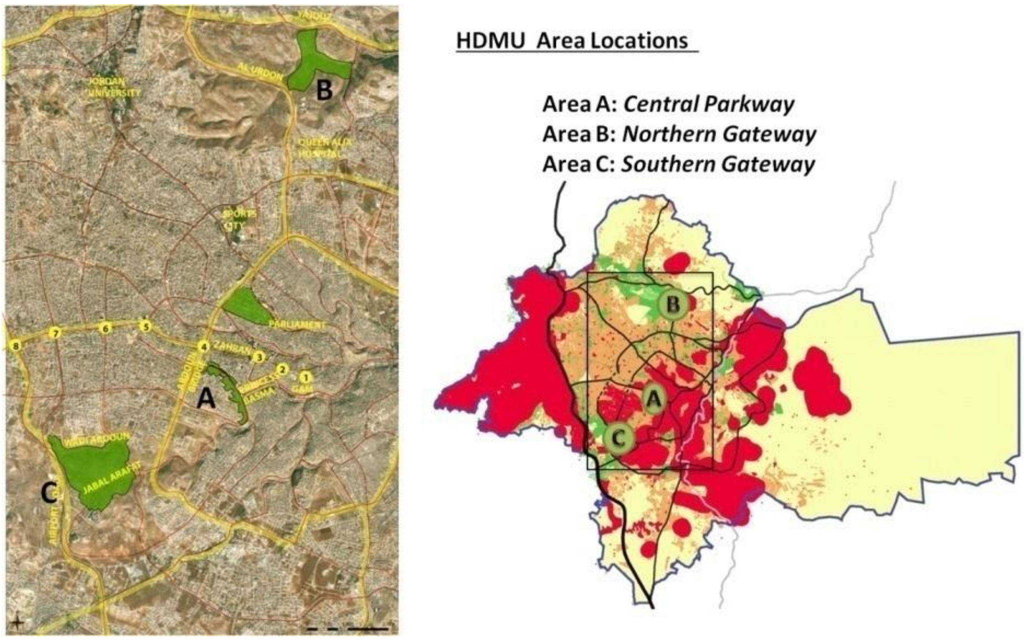

Figure 4.7: HDMU area locations, (Sources: GAM, 2007). Modified by the researcher

4.6.1 Area A: Central parkway

Area A is located in the Wadi Abdoun, which runs northwest to southeast, directly south of Jabal Amman, from the new Abdoun Bridge to the Al-Qaiseyeh Scattered Settlement. Princess Basma Road runs through the northern half of the area and east to the GAM Offices. The proposed intersection with the new Wadi Abdoun Road (i.e. at the "Ten Bridges") is at the southern end of the area and will connect the city centre with the airport. Area A is surrounded by existing, stable neighbourhoods of varying income levels and physical conditions (GAM, 2007).

This area was selected as shown in the Figure 4.7 using the criteria relating the master plan development for the city of Amman as discussed above (GAM, 2007):

- The main reason of the selecting area A is because it is located outside the metropolitan corridor, as it is close to the expansion areas, therefore it gives the opportunity for intensification alongside the metropolitan corridor.

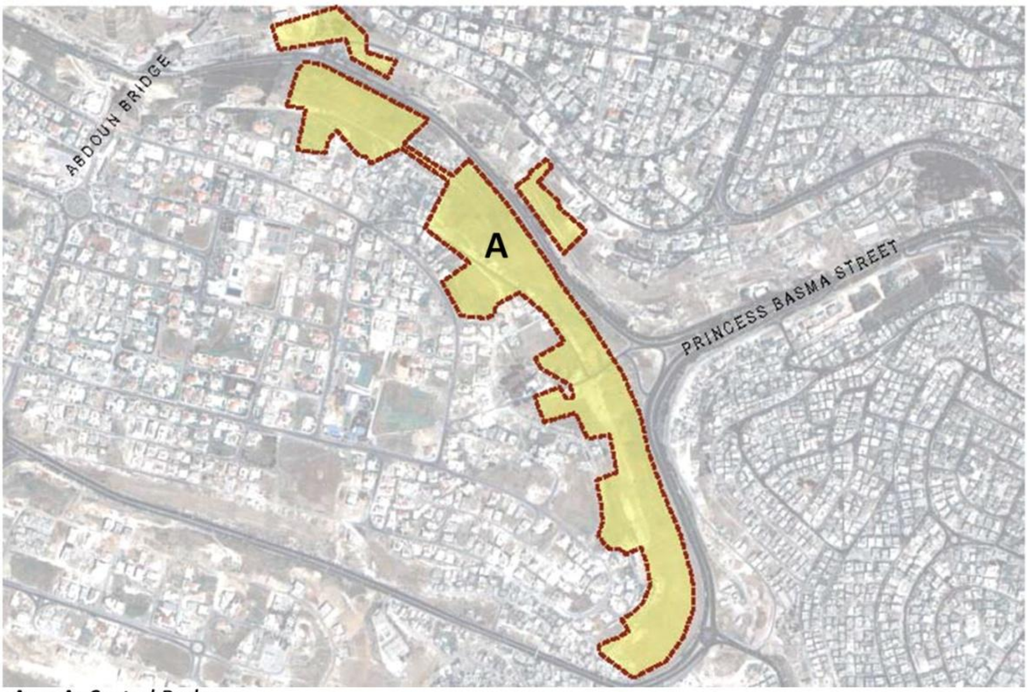

Figure 4.8: HDMU for area A: Central Parkway, (Sources: GAM, 2007). Modified by the researcher

Figure 4.8 shows that area A consists of four types of high density mixed use (HDMU): landmark, medium-high, medium, and medium-low. It is noted that HDMU's fluctuate significantly according to the height of their buildings (landmark: 1, high: 0, medium-high: 8, medium; 16, medium-low: 11). These buildings are distributed across four zones in area A.

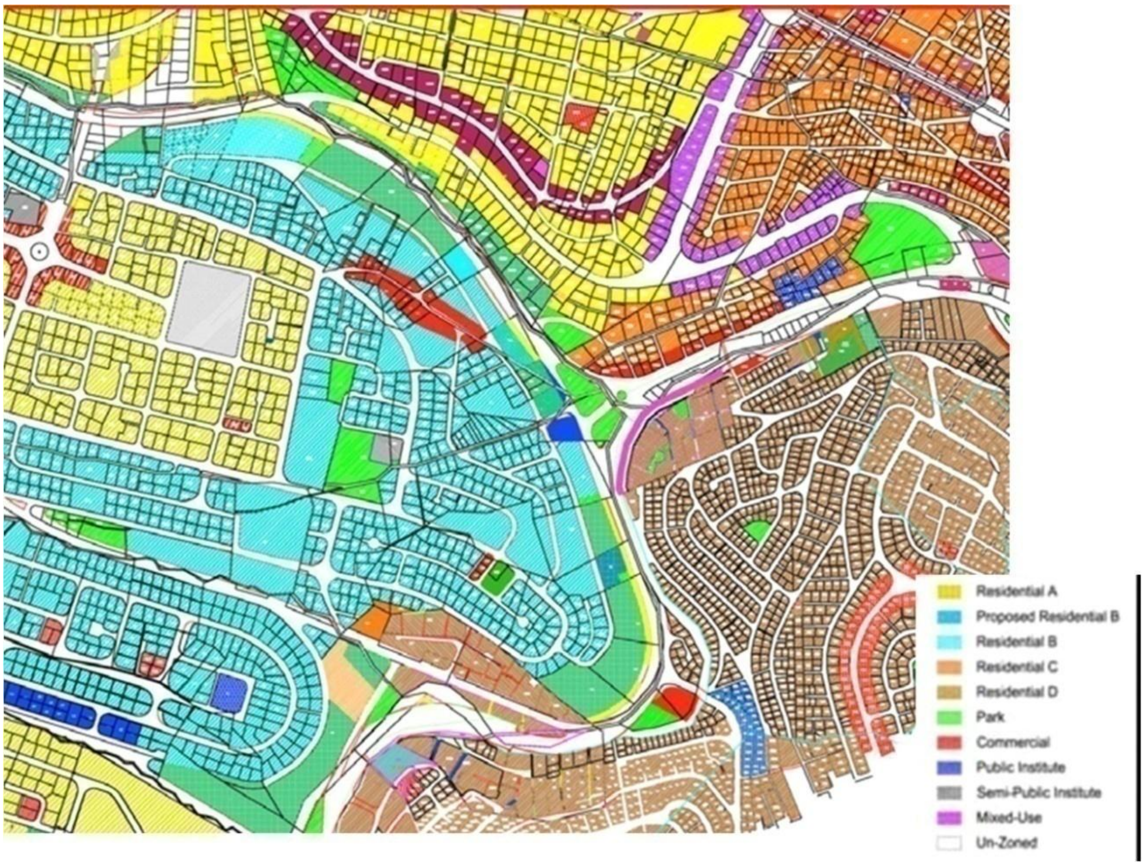

Figure 4.9: Current subdivision and zoning for area A: Central Parkway, (Sources: GAM, 2010). Modified by the researcher

Area A consists of two types of land uses are commercial and residential, public institute, semi-public institute, mixed use, and park land uses (Figure 4.9). In Jordan, there are five types of residential land uses (A, B, C, D and E), and in Area A two of those (A, B) are distributed within the area. It is notable that a high percentage of these are residential B representing about 70%, and a low percentage of them is residential A, representing about 4%, whilst commercial userepresents6%. The remaining 20% comprises the different service uses . The areas surrounding area A comprise four types of residential land use are A, B, C and D along with service uses.

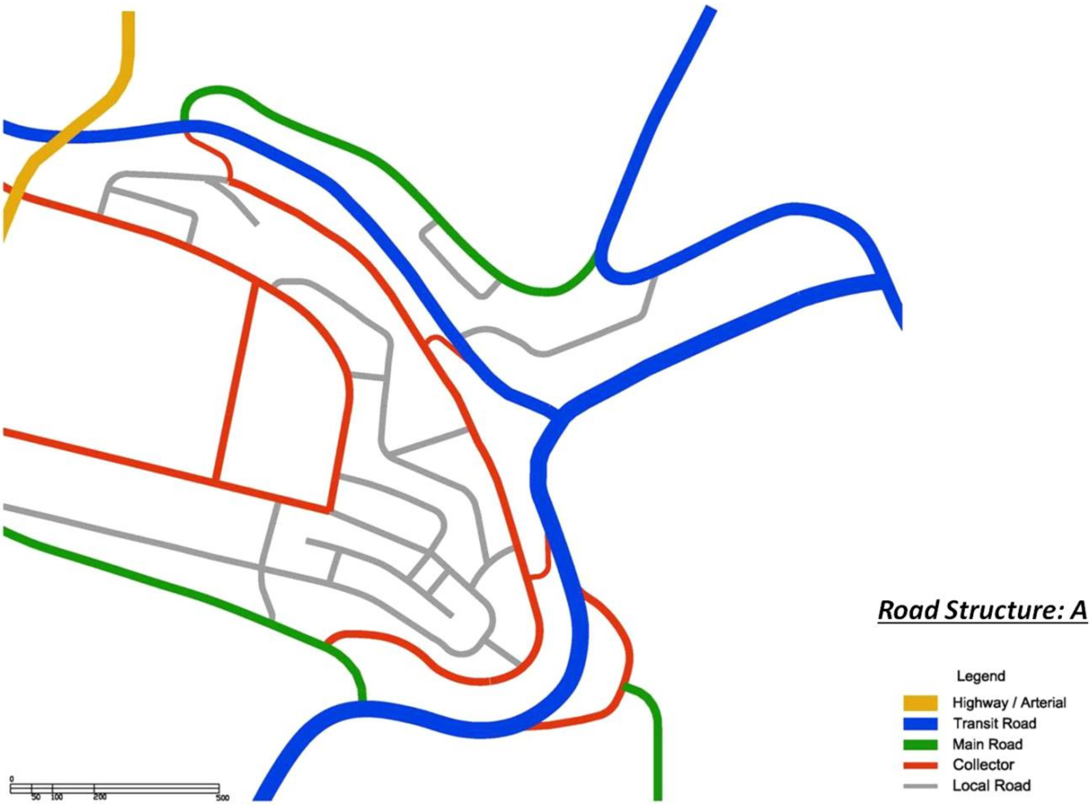

Figure 4.10: Road structure for area A: Central Parkway, (Sources: GAM, 2010). Modified by the researcher

Area A consists of five types of road structures (Figure 4.10). These roads have been designed to reinforce streets as primary public spaces, so the locations of pedestrian, parking and service entrances therefore provide ease of movement for the population without detrimental effect on the surrounding environment. These road types are: highway (60meters), transit Road (40meters), main Road (30meters), collector (24meters) and local Road (16meters). In addition, these roads have contained parking and servicing with the least possible impact on the streetscape and public open spaces. Therefore, principal pedestrian entrances for large buildings have been designed throughout major streets, while parking and servicing areas are via minor streets or lanes, where parking is located below grade.

4.6.2 Area B: Northern gateway

Area B is located in Al-Jubayhah, along the Jordan Road, north of Al-Shaheed Ring Road, and east of the "Northern Corridor" which runs along Queen Rania Road serveing the university district and the Al-Hussein Youth city. Jordan Road serves as a major corridor, linking the city centre with the northern suburbs and Gerash. Area B is located immediately north of the northern bus terminal and could be easily served by public transit in the near future (GAM, 2007).

This area was selected as shown in the Figure 4.7**,** using the criteria relating the master plan development for the city of Amman as discussed above (GAM, 2007):

- The main reason for selecting area B is because it gives the opportunity for the implementation of High Density Mixed Use (HDMU), without affecting cultural heritage areas and natural heritage areas.

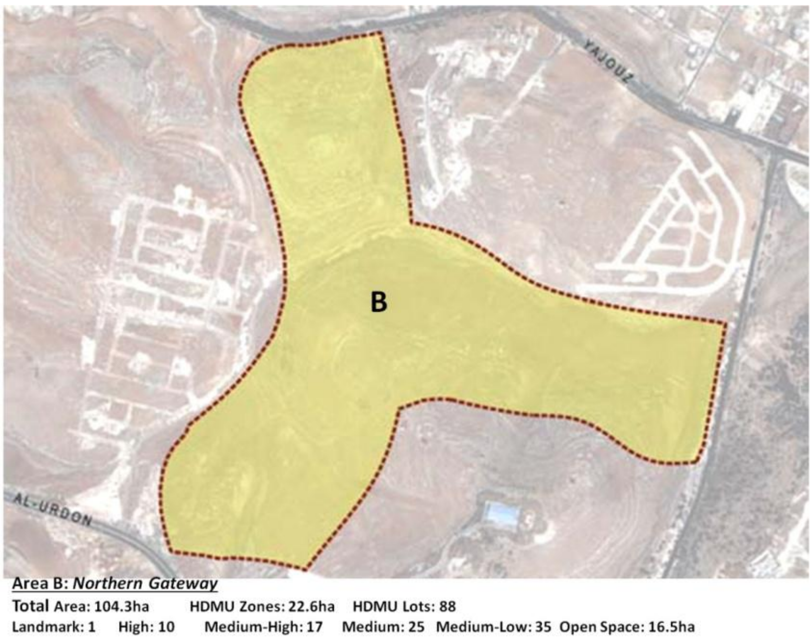

Figure 4.11: HDMU for area B: Northern Gateway, (Sources: GAM, 2007). Modified by the researcher

Figure 4.11 shows that area B consists of five types of high density mixed use (HDMU): landmark, high, medium high, medium, and medium low. It is noted that HDMU's fluctuate significantly according to the height of their buildings (landmark: 1, high: 10, medium-high: 17, medium: 25, medium-low: 35). These buildings are distributed across four zones in area B.

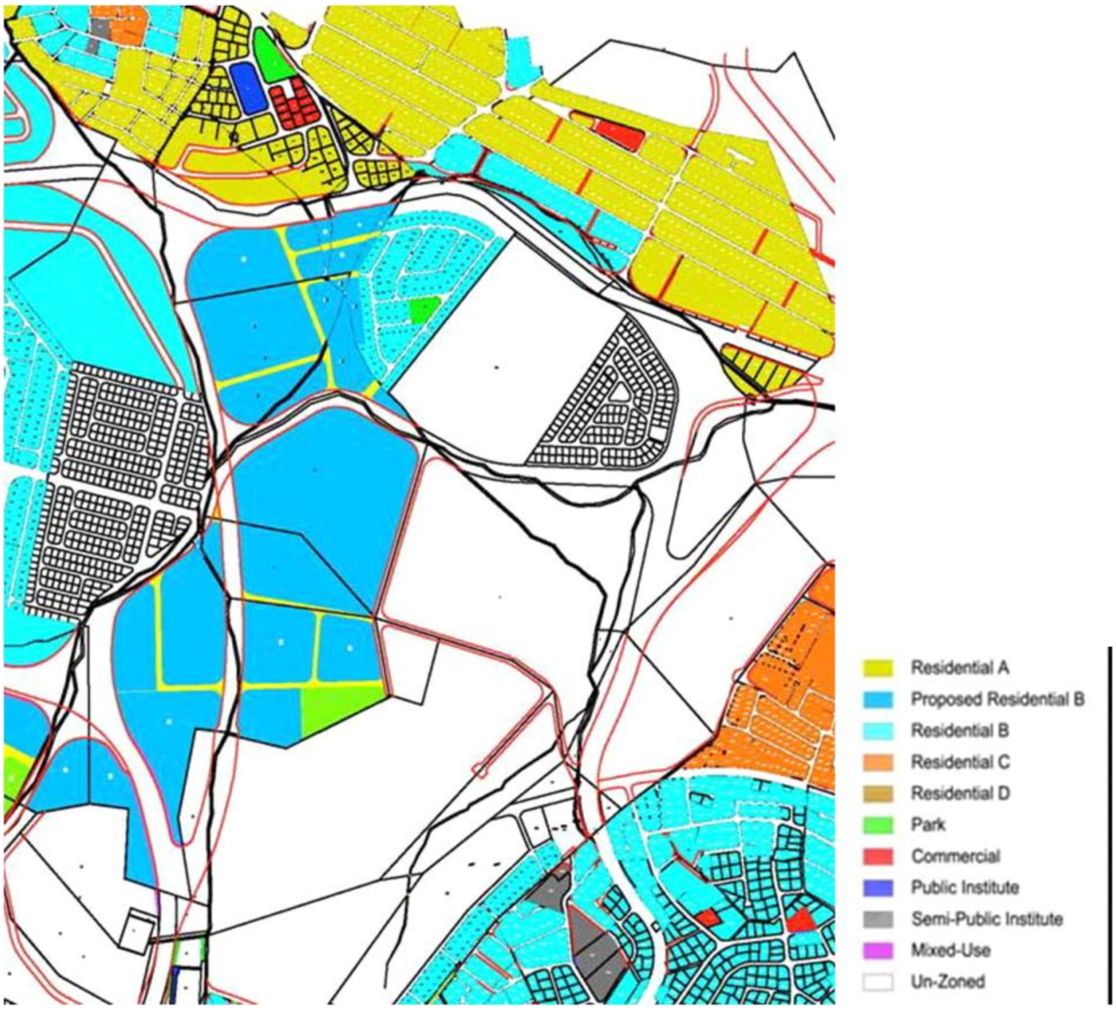

Figure 4.12: Current subdivision and zoning for area B: Northern Gateway, (Sources: GAM, 2010). Modified by the researcher

Area B includes a high percentage of un-zoned lands which amount to about 60% of the land use (Figure 4.12). These different land uses need their own rules and regulations based on the city of Amman. Residential land use within area B consists of types A and B. It is noted that the highest percentage use by far is residential B at about 30% with residential A at only 4% and service areas uses at only 6% within this area. The areas surrounding area B comprise three types of residential land use, are: A, B and C plus service areas.

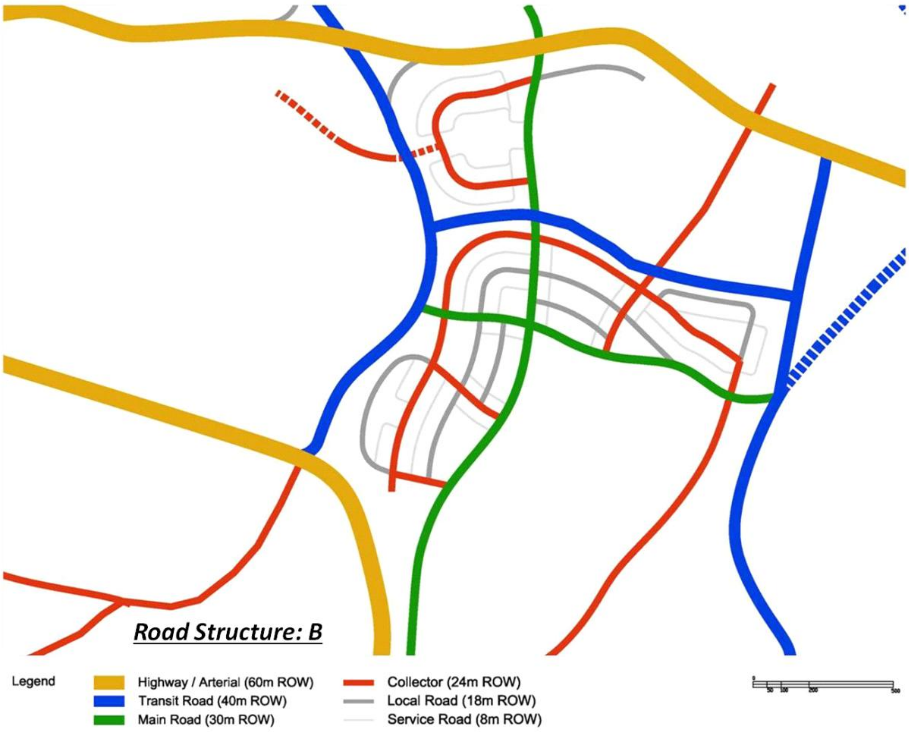

Figure 4.13: Road structure for area B: Northern Gateway, (Sources: GAM, 2010). Modified by the researcher

Area B consists of six types of road structures (Figure 4.13). These roads have been designed to reinforce streets as primary public spaces, so the locations of pedestrian, parking and service entrances therefore provide ease of movement for the population without detrimental effect on the surrounding environment. These road types are: highway (60meters), transit Road (40 meters), main Road (30 meters), collector (24 meters), local Road (16 meters), and service road (8 meters). In addition, these roads have contained parking and servicing with the least possible impact on the streetscape and public open spaces. Therefore, Principal pedestrian entrances for large buildings have been designed throughout major streets, while parking and servicing areas are via minor streets or lanes, where parking is located below grade.

4.6.3 Area C: Southern gateway

Area C is already developing along the east side of Airport Road, south of Abdoun. It will be served by an extension of the inner ring road (currently under construction) as well as the new Wadi Abdoun Road that will link the city centre with the airport, passing through Area A. In addition the future western corridor will likely pass through Area C, on its way to the airport. The site is quite dramatic topographically and significant views extend to the inner city to the east, to Abdoun to the north, and to Hay Al-Yasamin to the south. Area C frontage on, and giving access to, the Airport Road presents obvious opportunities for higher-density residential and mixed-use development (GAM, 2007).

This area was selected as shown in Figure 4.7**,** using the criteria relating the master plan development for the city of Amman as discussed above (GAM, 2007):

- The main reason for selecting Area C is because it explores a different context for metropolitan growth centres, which absorbs significant population growth using HDMU.

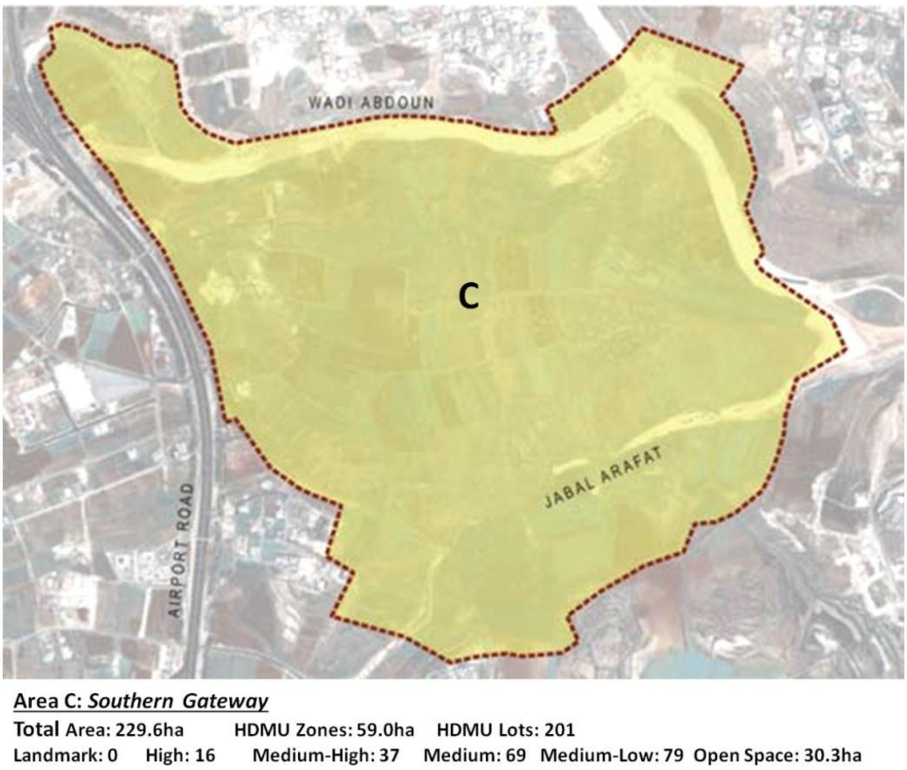

Figure 4.14: HDMU for area C: Southern Gateway, (Sources: GAM, 2007). Modified by the researcher

Area C includes four types of high density mixed use (HDMU): high, medium high, medium, and medium low (Figure 4.14). It is noted that the number of HDMU's fluctuate significantly according to the height of their buildings (high: 16, medium-high: 37, medium: 69, medium-low: 79). These buildings have distributed across four zones in area C.

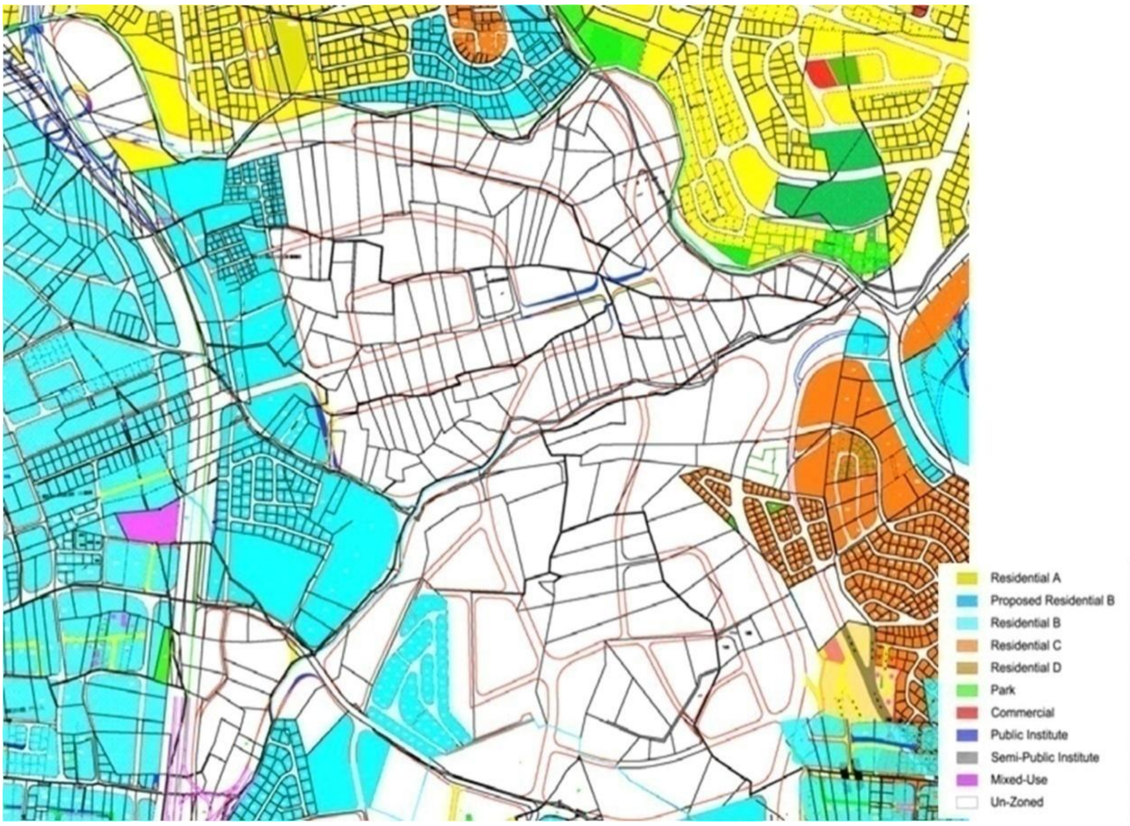

Figure 4.15: Current subdivision and zoning for area C: Southern Gateway, (Sources: GAM, 2010). Modified by the researcher

Area C includes a high percentage of un-zoned lands, which amounts to about 60% of the land use (Figure 4.15). These different land uses need their own rules and regulations based on the city of Amman. Residential land uses within Area C consists of types A, B and C. It is noted that the highest percentage use by far is residential B at about 20% with residential C at only 10% and service uses at only 10%. The areas surrounding Area C comprise two types of residential land use, are: A and B plus service areas.

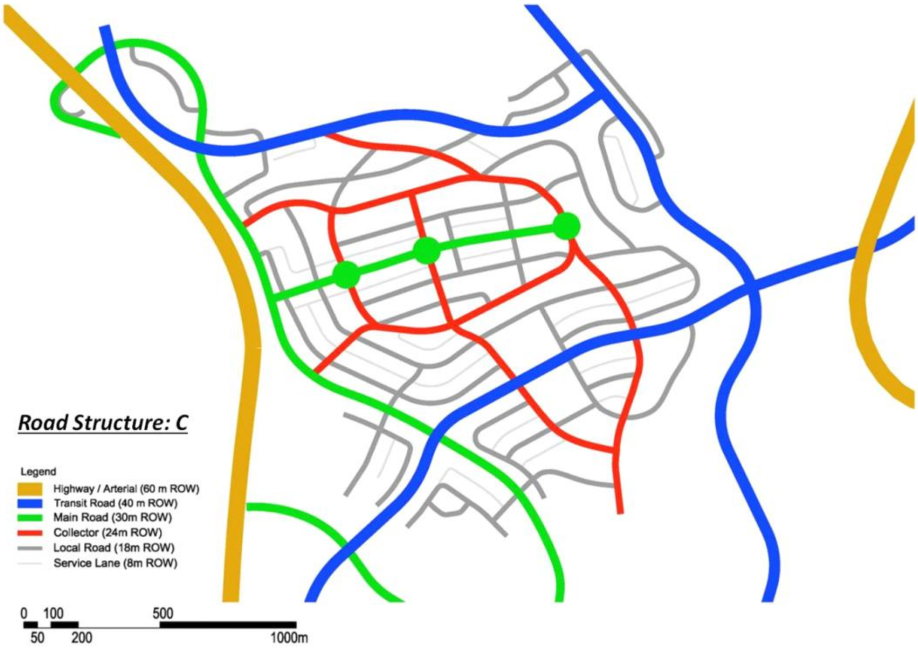

Figure 4.16: Road structure for area C: Southern Gateway, (Sources: GAM, 2010). Modified by the researcher

Figure 4.16 shows that area C consists of six types of road structures which serves these areas. These roads have been designed to reinforce streets as primary public spaces, so the locations of pedestrian, parking and service entrances therefore provide ease of movement for population without effect on the surrounding environment. These road types are: highway (60meters), transit Road (40meters), main Road (30meters), collector (24 meters), local Road (16meters), and service road (8meters). In addition, these roads have contained parking and servicing with the least possible impact on the streetscape and public open spaces. Therefore, Principal pedestrian entrances for large buildings have been designed throughout major streets, while parking and servicing areas are via minor streets or lanes, where parking is located below grade.

As part of the research design work for this thesis, this study sought to learn from the solutions applied in the implementation of high density mixed use schemes in the city of Curitiba, Brazil (Figure 4.17). The learning from successful solutions applied there in the implementation of sustainable urban design principles using HDMU was transferred to the analysis of the Amman master plan. Curitiba was chosen because of the similarities it shares with the city of Amman as shown in Table 4.1 below in terms of area, geography, climate, population growth, population density and temperature (Campbell, 2012; McKibben, 2005). Moreover, Curitiba also used HDMU schemes to implement the sustainable urban design principles for which it won a prestigious award (Globe Award, 2010). It also formulated guidelines for sustainable urban design in terms of implementation and management (Campbell, 2012; Lerner, 1994; IPPUC, 2004) lending further grounds for undertaking this comparison between Amman and Curitiba.

Table 4.1: Comparison between the case study areas (From: McKibben, 2005; Campbell, 2012; GAM, 2013). Modified by the researcher

City	Curitiba	Amman
Location above sea level	914m above sea level	900 above sea level
Number of population	2.3 million	2.8 million
Area	430 km²	694 km2
Temperature	from 12ºC to 29ºC	from 13 to 34 °C
Climate	Temperate climate - seasonal fluctuations	Temperate climate
Location	Eastern Brazil	In the mid of Jordan at the West Asian
Population density	5348 h/ km²	4216 h/ km²

Figure 4.17: HDMU in Curitiba city (Sources: Globe Award, 2010). Modified by the researcher

4.7 The city of Curitiba

The Globe Sustainable City Award was given to Curitiba in 2010. The award was introduced to recognize cities that excel in sustainable urban development (Globe Award, 2010). It is much easier for cities in the developed world to invest in the planning and implementation of measures needed for sustainable urban development and it is a surprise to many people that the award went to a city in Brazil where, in spite of rapid industrial growth in recent years, income levels are still relatively low (Campbell, 2012).

Curitiba is in eastern Brazil (Figure 4.18) and became the capital of the province of Parana in 1853. It attracted local migrants as well as immigrants from Germany, Ukraine, Poland and other European countries (Lowry, 2002; Rabinovitch and Leitmann, 1996; McKibben, 2005; Campbell, 2012). During the 20th century, its population increased rapidly and it became one of the wealthiest cities in Brazil. The region witnessed a large European immigration that left a deep impact on the city's culture. As a result, there is a distinct mixture of German, Polish, and Italian influences (Lowry, 2002; Campbell and Fuhr, 2004; McKibben, 2005).

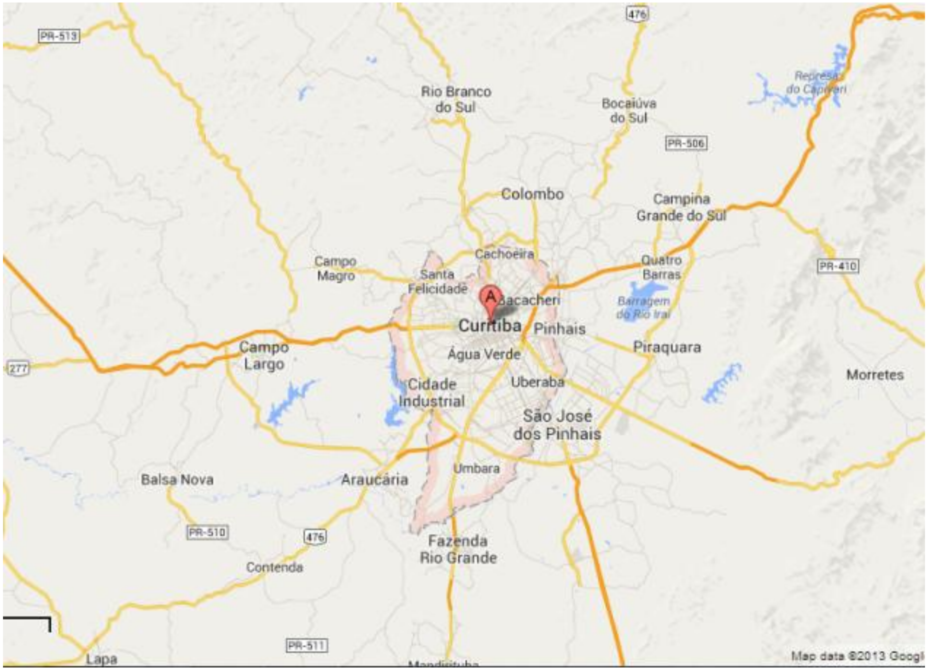

Figure 4.18: Curitiba plan (Sources: map Google, see https://maps.google.jo, 2013). Modified by the researcher

Curitiba is a metropolitan area approximately 400km southwest of Sao Paulo, Brazil that stands 914m above sea level. The entire metropolitan area is 430km² with a population of 2.3 million people (Fazzano *et al.,* 2004; Lowry, 2002; Campbell, 2012). First founded as a gold-mining town in the seventeenth century, the city of Curitiba was also part of the cattle-driving route to Sao Paulo. From there, it gradually evolved into a trading post, attracting merchants at first, and then expanding into a developed city by the end of the nineteenth century. The temperate climate – seasonal fluctuations only range from 12ºC to 29ºC – made the area ideal for agriculture (Fazzano *et al.,* 2004; Campbell, 2012; Rabinovitch and Leitmann, 1996).

For any urban sustainability strategy to be successful, it needs people to be the key actors in formulating and implementing a way to encourage growth (IPPUC, 2004). This requires good leadership and cooperation between public sector, private sector, government and civic leaders. Therefore, Curitiba's Institute for Urban Research and Planning (IPPUC) held public discussions, took opinion polls, and collected land-use surveys to keep residents involved in the planning process (IPPUC, 2004; Fazzano *et al.,* 2004; Campbell, 2012). Curitiba's master plan helped to forge a vision and strategic principles to guide future developments. Hence, that vision was transformed into reality by reliance on the right systems and incentives. This vision was represented in land use and transportation, open spaces and green areas, affordable housing, public transportation system, planning process and water, sanitation and garbage (Campbell, 2012; Rabinovitch, 2008; Campbell and Fuhr, 2004; Fazzano *et al.,* 2004; Rabinovitch and Leitmann, 1996).

4.8 Chapter Summary

In summary, this chapter examined the content of the Amman context used in this thesis. It also outlined the three selected areas in the Amman master plan which should be tested, to monitor progress towards of sustainable urban design at a local level for the city of Amman. In addition, it defined the high density mixed use (HDMU) scheme and their elements used in the Amman master plan. Also it identified the main types of HDMU schemes. Moreover, this chapter examined the city of Curitiba, Brazil, in order to learn from the solutions applied in the implementation of sustainable urban design principles using HDMU there, and to compare with the case study areas in the Amman master plan.

Chapter 5

Research Methodology

5.1 Introduction

The conceptual and theoretical content of the thesis relates to debates in the literature over sustainability indicators. This chapter provides a discussion of the rationale for the methodological framework of the thesis. Flick (2006) emphasises that in qualitative research, validity is underpinned by the trustworthiness, credibility and authenticity of the data, and that this is achieved if the researcher uses appropriate research methods, clearly outlined criteria, accepted procedures, systematic analysis, adequate discussion and a clear distinction between data and interpretation.

The researcher being a native of Jordan, was able to facilitate participant involvement in the research. This offered valuable insights and provided the convenience and opportunity to overcome accessibility constraints, access to information and political nuances. This also enabled the researcher to become closely involved with the data collection which created human conditions that generated enough trust for the participants to disclose their views on the subject under investigation.

5.2 Theoretical issues around research design

There are three main classifications of research: testing-out, exploratory, and problem-solving (Phillips and Pugh, 2005; Blaxter *et al.*, 2001). Phillips and Pugh (2010) point out that these approaches can be applied to both qualitative and quantitative research. For a PhD student in the social sciences, they recommended the testing-out or exploratory approach. Although the exploratory approach on its own can be useful to address the kind of problems and issues outlined in this thesis, the testing-out approach further enables clarification and detailed study of the issues in order to fully achieve the research objectives.

This particular doctoral work in Amman examined concepts, indicators, measurements and theories identified through a thorough literature review which was used to highlight gaps, problems and issues of importance. These issues of research were then picked up at the data collection stage.

The methods used to achieve the research objectives are as outlined in Figure 5.1 below:

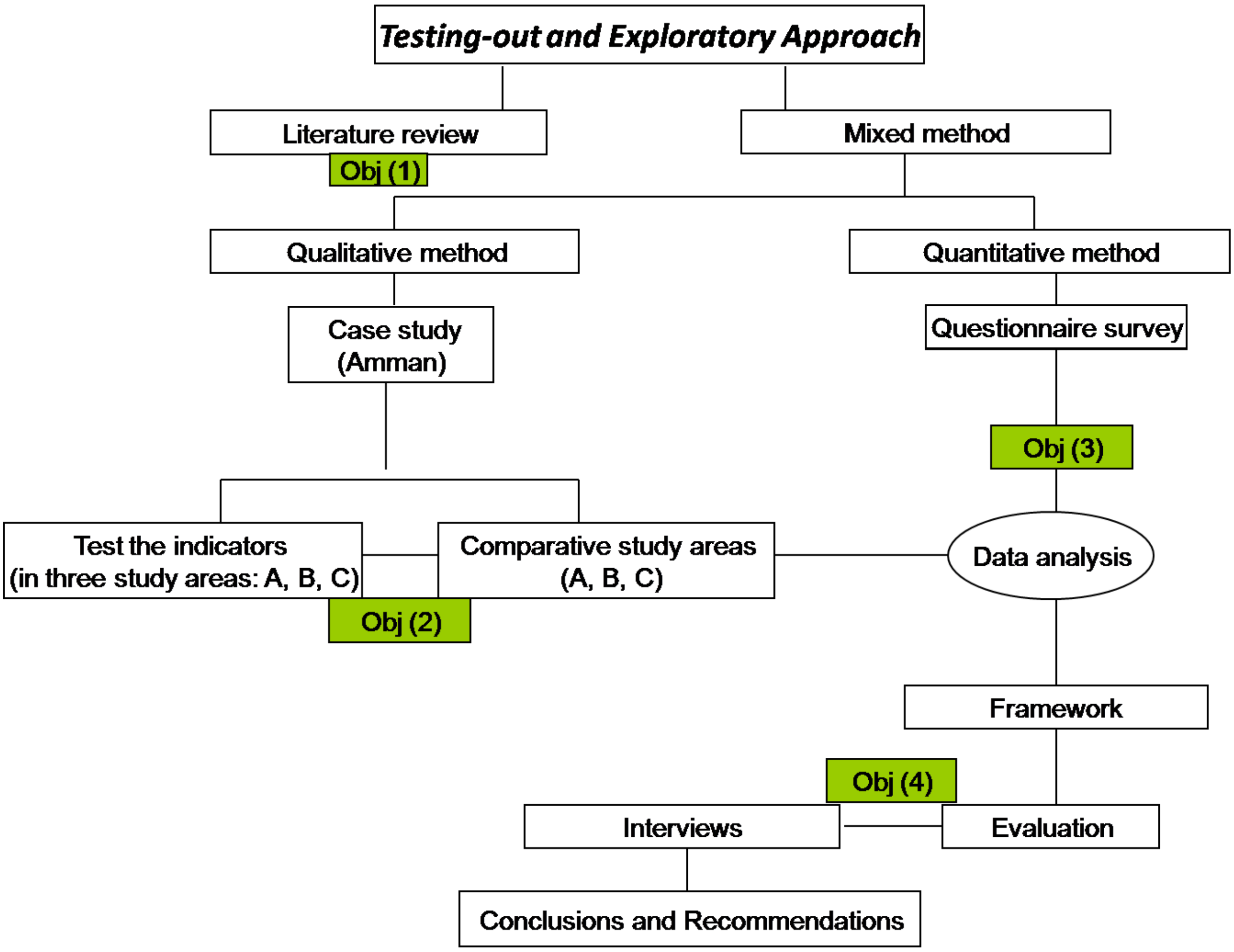

Figure 5.1: Research design (drawn up by the author)

Figure 5.1 shows the research design and includes the main steps of research and how the researcher transitioned through the key stages of this research. It also includes the methodology used to achieve the main research objectives. The research design shows that two approaches were used to achieve the main objectives. The first, the testing-out approach which tested the indicators identified in the literature review in the context of the master plan for Amman. The second, the exploratory approach, which was used to explore variables defined as: suitable indicators, constraints, solutions and planning strategy. These approaches are discussed in the following sections:

5.2.1 Testing-out approach

The testing-out approach is the process of using quantitative methods and qualitative methods to evaluate hypotheses, theories and indicators (William, 1982; McIntyre, 2006).

These methods involve the evaluation by stakeholders or numeric facts (Sternberg, 1999). McIntyre (2006) pointed out that the testing-out approach can be performed using field surveys, personal interviews and focus groups, in combination with various quantitative methods, to generate and evaluate concepts (Sternberg, 1999; Runco and Pritzker 1999; Mclntyre, 2004). This approach, therefore, gives an opportunity to identify the problems and issues through undertaking comparisons between the results, whether using numeric facts or stakeholder perceptions, in order to reflect the true outcomes (McIntyre, 2006; Sternberg, 1999). Nevertheless, the testing-out approach is limited as a means of identifying and quantifying the criteria on which hypotheses are based (Runco and Pritzker 1999; Mclntyre, 2004). This is because it depends on concentrations tested, its statistical power is influenced by variability and its inability to calculate confidence intervals (Martien and Taylor, 2003; Stockburger, 2007). Therefore, this study also utilised the exploratory approach to support the results of the testing-out approach.

5.2.2 Exploratory approach

The exploratory approach is typically used to research a problem that is not clearly defined (Shields and Rangarjan, 2013).It often relies on secondary research such as reviewing available data and/or literature, or qualitative approaches such as in-depth interviews with employers or managers, focus groups, pilot studies or case studies (Brains *et al*., 2011). Kumar and Karoli (2011) pointed out that the exploratory approach is used to gain experience that can be helpful for more definitive investigation. It helps to gain familiarity with a phenomenon or acquire new insight into it for developing a hypothesis or formulating a more precise problem (Brains *et al*., 2011; Kumar and Karoli, 2011). It also aims to gather preliminary information that will help define problems and suggest hypotheses (Kotler and Armstrong, 2006). The results of the exploratory approach can provide significant insight into a given situation (Babbie, 2007).

Schutt (2011) stated that exploratory research "seeks to investigate social phenomena without explicit expectations." Also Earl Babbie (2007) pointed out that the exploratory approach is used when problems are in a preliminary stage (Babbie, 2007). Also this approach is used when data is difficult to collect and when the issue is new (Armstrong, 1970). Shields and Tajalli (2006) stated that the exploratory approach can address all research question types i.e. why, what and how.

The researcher's role in this process, according to Yin (2009), McDonough and McDonough (1997) and Tellis (1997a, 1997b), is to ask questions and to open doors for further examination of the phenomena observed. Schutt (2008) suggested that exploratory work relied on secondary research such as reviewing available literature, case study and data from in-depth interviews and focus groups with willing participants.

The conclusions from the exploratory approach were solely beneficial for a preliminary review through developing the conclusions from the literature review. This was achieved through using a set of research methods such as a questionnaire and interviews. In this case, the weaknesses of one kind of data were addressed by using the strengths of the other kind. This gave an opportunity to increase the reliability and validity of the research findings.

5.3 Research methodology

The research methodology is a systematic approach giving a clear idea of which methods or process the researcher is going to use in the research to achieve research objectives (Saravanavel, 2004). Rajasekar et al. (2013) define research methodology as the science of studying how research can be carried out through drawing up the whole research work plan, giving credibility to the whole effort of the researcher. Essentially, it is also defined as the study of methods by which knowledge is gained.

Research methods include theoretical procedures, experimental studies, numerical schemes, statistical approaches, etc (Phillips and Pugh, 2010). More precisely, research methods help to collect samples, data and find a solution to a problem. On the other hand, research methodology is concerned with the explanation of how a particular research study was undertaken? It is therefore necessary for a researcher to design a methodology for the problem chosen (Rajasekar *et al.,* 2013).

Methods used in social sciences research largely depend on the main interest of the researcher Flick (2006). A mixed-methods research approach is described as a dynamic option for getting an expanding scope and improving the method of analysis for the study (Phillips and Pugh, 2005; Blaxter, *et al*. 2001). Mixed-method research, operationally, also includes an almost limitless array of combinations of sampling, data collection and analysis techniques using combinations of qualitative and quantitative techniques (Sutton, 1997 and Sandelowski, 2000). The mixed method was chosen for this study because the research sought to explore a framework for implementing SUDP using HDMU schemes. A mixed methodology was necessary to guarantee a multifaceted exploration of the research.

This research used a mixed-method approach that includes a qualitative method (a set of interviews) and a quantitative method(questionnaire survey). This research used two separate rounds of interviews, one before the survey, one after. This was achieved as follows:

1. The first round of interviews was used to test the qualitative and mixed type indicators using a set of professionals involved in preparing, designing and implementing HDMU schemes within the Amman master plan. This gives an opportunity to test the indicators by those professionals who know better than anyone else how these schemes could be implemented in the Amman master plan.
2. The survey was used to test the findings derived from testing the indicators by the first round of interviews and numeric facts. These findings identify part of the components of the framework that are represented in suitable indicators for Amman and a set of constraints. In addition, the questionnaire identifies the other components of this framework represented in a set of solutions and a planning strategy.
3. The second set of interviews sought to provide more in-depth explanations for evaluating the results of the survey constituting the proposed framework. These interviews were conducted with a wide range of professionals; architects and planners who are members of the Amman master plan team. They are responsible for implementing the SUDP using

HDMU schemes within the Amman master plan. This increased the validity of this framework.

The thesis outlines the methodological approach which was designed to achieve the main research objectives by using the main research methods as follows:

5.3.1 Questionnaire surveys

5.3.1.1 Questionnaire surveys as a methodology

The questionnaire survey is a research method used for gathering information about the characteristics, behaviours and attitudes of a population by administering a standardized set of questions, or questionnaire, to a sample of individuals (McLafferty, 2003). The primary objectives of the questionnaire survey are to identify a set of solutions and a planning strategy for the implementation of sustainable urban design principles (SUDP) using HDMU, and to check the suitable indicators and constraints identified by testing the indicators in Amman.

The questionnaire survey was adopted as the basic element of the research process. It is a valuable method for investigating complex behaviours and social interactions by exploring experiences and people's attitudes (Robinson, 1998; Parfitt, 1997). The most valuable effect of a questionnaire survey is that it can provide both qualitative and quantitative data (Flick, 2006). Moreover, it is flexible in how it can be completed and administrated. The researcher can also ask the respondents questions in an interview format. This provides some opportunities for demonstration and assistance, and takes into account any difficulties by the respondents to answer questions (Flick, 2006).

5.3.1.2 The questionnaire design

McLafferty (2003, p. 89) stated that good questions are those which try to present useful information about the main research aim. Therefore, questionnaire survey gives the researchers an opportunity to convey exactly what they want to get from respondents, in order to provide accurate and 'real' data.

With this in mind, it is important to note that surveys allow for a variety of question types to be included, both fixed-response questions and open-ended (Oppenheim, 1992). McLafferty (2003) states that open-ended questions allow respondents to form their own answers. It also allows respondents to express their thoughts, comments and true feelings. This provides a true representation, and does not force respondents to give their answers (Parfitt, 1997). Moreover, Oppenheim(1992, p.113) states that "free-response questions distinguish with that easy to ask, difficult to answer and still more difficult to analyze".

Fixed-response questions offer a range of answers for the respondents to choose from. one advantage of such questions is that they are easier to ask, answer and process than open-ended questions. But the main disadvantage of this type of questions is that they may force the respondents to accept a false opinion (Parfitt, 1997).

Therefore, the questionnaire survey incorporated both open-ended and fixed-response questions. A variety of fixed-response questions was included as raw statistics in order to begin analysis. Open-ended questions were also integrated and consolidated with the fixed-response data. This approach with open-ended questions not only strengthens the fixed-response data, but opens up new ways of thinking and also provides a robust source of data. Furthermore, a clear methodology was used for the structure of the questionnaire survey as identified by Eiselen et al. (2005). This structure focused on the nature of the questions, length of the questionnaire and format and layout.

The questionnaire was designed for the purpose of achieving specific objectives. The main questionnaire survey consisted of five sections. Section A was designed as a brief introduction to the study. Section B required the respondents to provide broad information about themselves, and their background. Section C was for the purpose of identifying and evaluating the constraints, solutions and suitable indicators for the implementation of sustainable urban design principles in Amman. Section D aimed to explore the planning strategy for the implementation of sustainable urban design principles. Section E was designed with the intention of obtaining information on the additional (optional) data for the participants. The questions used in the questionnaire survey came from the literature review as discussed in section 3.4, and the findings of testing the indicators in Amman as discussed in section 6.4. The questionnaire can be found in Appendix 2.

5.3.1.3 Piloting the questionnaire surveys (*Pilot testing)*

McLafferty (2003, p. 92) states that ''the final and critically important step in questionnaire construction is pre-testing (pilot testing)''. A pilot survey is usually carried out among a small sample of respondents before a full-scale industry-wide survey is implemented (Lim and Low, 1992). Pilot studies give an opportunity to clarify and understand research question boundaries, and to focus the research questions effectively (Walker, 1997). Pilot studies are important as they reveal any flaws in the questionnaire. Often these errors are not obvious to the researcher themselves (McLafferty, 2003). Parfitt (1997) suggests five aspects to be checked by carrying out a pilot study: questionnaire design and format, questionnaire length, classification questions and serialization, questionnaire outputs, and other information.

Before distributing the questionnaire to the formal participants, it was tested in Amman on a group of 10 participants. This group varied in age, educational level, gender, and experience, and included architects and planners who were at the time working at the Greater Amman Municipality (GAM) as part of the Amman master plan team. This gave some assurance of coherence and comprehension, as well as accurate collection and meaningful analysis of the data (Kometa *et al*., 1995; Ling *et al.*, 1998). Furthermore, this test offered feedback to help improve the survey. Altogether 10 completed questionnaires were collected from the pilot survey. A common concern about the questionnaire was difficulty in understanding the requirements of some of the questions. Many participants also suggested shortening the length of questionnaire to make it more appealing. Therefore, the questions were rewritten to improve the questionnaire with taking into account this feedback.

5.3.1.4 Sampling of participants

The primary reason for conducting the questionnaire surveys was for exploratory purposes, which was adopted as the structure in which a sampling frame and method could be identified. From this point there were three stages to the sampling method, which ultimately identified the sampling frame, and which was broadly conducted in terms of pre-defined aims as follows:

- Responsible professionals who are working in the GAM and who understand the constraints facing the implementation of sustainable urban design practices. Their competencies and skills enable the implementation and management of the principles of sustainable urban design in the master plan for the city of Amman.
- Local architects and planners who are working in the private sector in order to learn their views on the process of application of urban sustainability indicators of the master plan for the city of Amman.

- Outside experts who work in the private sector in order to understand their views on the obstacles facing the implementation and management of sustainable urban design practices, taking into account guideline policies and general principles of sustainable urban design.

5.3.1.5 Sampling method

The selection of construction companies, engineering offices and the Greater Amman Municipality for the survey was based on probability sampling, using the stratified simple random sampling method within each of the output areas selected, because it reduces the percentage of error in sampling. A stratum is a subset of the population that shares at least one common characteristic. The researcher first identified the relevant strata and their actual representation in the population. Random sampling is then used to select a sufficient number of subjects from each stratum. "Sufficient" refers to a sample size large enough for us to be reasonably confident that the stratum represents the population. Stratified sampling is often used when one or more of the strata in the population has a low incidence relative to the other strata. This was selected in order to gain a fair cross-section of the population within each of the output areas, all units having an equal chance of selection (Eyles, 1998). The limitation of this sampling method is that members of a subgroup of interest may not be included in appropriate proportions (Parfitt, 1997). In probability sampling, it is important to distinguish between three groups: the population, the sampling frame and the sample. The population (professionals) refers to the group from which the sample was drawn and to which the findings were to be generalized. The sampling frame is a listing, or operational definition, of all of the population elements. The sample referred to the subset of the population that was selected as respondents (Babbie, 2007).

The target sample size was set at 100 for the main architect, planner and outside experts covering both inside and outside the Greater Amman Municipality in order to receive a sufficient number of responses to justify generalisation of findings. The list of participants was acquired by visits to the Jordan Engineers Association and utilisation of local company directories.

The questionnaire survey used engineer, planner and contractor registration systems and classification according to turnover, financial capacity, track records and professional manpower to determine main samples. Valid responses were much easier to acquire this way.

The work was done on the basis that there were approximately 100 professionals within each output area. It was decided that this research would require a 10% sample of professionals, equating to 10 completed questionnaire surveys per output area and assuming a 40%response rate will be received (Parfitt, 1997). It was calculated because it was needed to receive response rate and the desired 10% of professionals (Higley, 2008).

5.3.2 Semi-structured interviews

5.3.2.1 Semi-structured interviews as a methodology

This section explores the use of semi-structured interviews with architects and planners in Amman. It addresses why this method has been chosen and the disadvantages and advantages of this approach.

This type of interview considers one of the methods of qualitative analysis. The interviewer cannot undertake the research to test a specific hypothesis (David and Sutton, 2004). In this type of interview, the researcher should have a list of key questions and issues to be covered during the interview. The researcher can also change the order of the questions according to the direction of the interview, as well as consider a set of additional questions which may be useful to ask (Clifford and Valentine, 2003; Rolfe, 2006).

Malesky (2004) says that we use semi-structured interviews when we need more in-depth data, or need to have some follow-up, when complex questions or behaviours need to be explored, and when it is suspected that other methods aren't getting the whole picture. Additionally, this type of interview gives an opportunity to the researcher to probe for different views and opinions about the main theme, and to explore new paths which were not initially considered (Gray, 2004). David and Sutton (2011) state that the key issues and questions can give the researcher a good sense, which then generates further unplanned questions.
The primary objectives of the semi-structured interviews in this research are to test the qualitative and mixed indicators by their measurements, and to evaluate key findings for the study and assess the validity of the proposed framework for implementing SUDP using HDMU schemes.

5.3.2.2 Identifying a sampling frame

The research used a set of interviewees (architects and planners) who are working to develop the master plan within the public sectors(Greater Amman Municipality) and private sectors, as well as outside experts. This gave an opportunity to provide the necessary information regarding the implementation and management of the process of applying the principles of sustainable urban design on the master plan for the city of Amman.

It is important for the researcher to be aware of the biased standpoint of the local architects and planners during interview. The information given regarding change of social, economic, cultural or physical nature is solely the interviewees' own interpretation. The researcher approached the interviews in a semi-structured manner in order to stimulate conversation about essential topics. The primary reason for conducting the interviews was for exploratory purposes, and were broadly conducted in terms of pre-defined topics as follows:

- Responsible professionals who are working in the GAM and who understand the constraints facing the implementation of sustainable urban design practices. Their competencies and skills enable the implementation and management of the principles of sustainable urban design in the master plan for the city of Amman.
- Local architects and planners who are working in the private sector in order to learn their views on the process of application of urban sustainability indicators of the master plan for the city of Amman.
- Outside experts who work in the private sector in order to understand their views on the obstacles facing the implementation and management of sustainable urban design practices, taking into account guideline policies and general principles of sustainable urban design.

Furthermore, semi-structured interviews were used alone, as a supplement to the questionnaire surveys, and was also applied within a multi-method approach (Longhurst, 2003; Denzin and Lincoln, 2008). This conforms to the triangulation approach being adopted for this research.

The list of interviewees was acquired by visits to the Jordan Engineers Association and utilisation of local company directories. Most interviews with local architects and planners were conducted via a telephone conversation. All interviews were given by consent and recorded (with the permission of the interviewee) for transcribing purposes only.

5.3.2.3 Identifying the Semi-Structured Interviews method

According to Malesky (2004) a Semi-Structured Interviews Process should be developed. This process helps to increase the reliability of qualitative research conducted. A summary of this process comprising 7 steps is as follows (Malesky, 2004):

1. State the objective
2. Determine research questions
3. Select a sample
4. Perform the interview
5. Transcribe my data
6. Analyse my data
7. Report my findings

5.3.2.4 Validity and Reliability for this phase:

As the interviews contain the set of subject data, this can be criticised on grounds of reliability and validity of research. In order to increase the reliability and validity, Yin (2003; 2009) suggests the use of multiple sources of evidence: ''Triangulation = searching converging findings from different sources to increase construct validity''. In addition, Yin found that validity of data can be increased through the review of respondents of the draft report. In this research validity was assured by:

1. Connecting the evidence from different viewpoints such as those of managers and those who implement.
2. Sending the draft transcript to interviewees to clarify points and ensure that they agree with the interviewer's interpretation of the responses.
3. Providing a presentation to the interviewees in which the data and findings were clarified, and an opportunity for reflection and modification given.

Thus they were able to validate and ensure the findings and interpretation of results reflected their true viewpoints.

5.4 Data Collection

This section discusses how the data was collected. The research adopted a triangulation approach, drawing upon different sources of information in order to maximize the understanding of the research question (Clifford and Valentine, 2003). This ensured that rich and succinct data (both qualitative and quantitative) was collected concurrently (Phillips and Pugh, 2005). In general terms, this meant that weaknesses of one kind of data were countered by strengths of the other (Keith, 2005).

In this study, evidence was obtained through the cooperation of the Greater Amman Municipality (GAM). Documentary evidence of proposals for Amman was obtained looking forward to the next 50 years, as well as looking back through annual reports associated with the master plan for the city. The historical documents covered the years 2002-2010. This was achieved in collaboration with the United Nations' Commission on Sustainable Development (CSD) in Jordan, (2007b), Department of Statistics in Jordan (DS, 2011) and Royal Jordanian Geographical Centre (RJGC), Geographical Information System (GIS) services, (2012). The thesis used the data collected from these sources, which were consistent across the sources. This supported the reliability and validity of the data for the research.

The questionnaire was piloted in Amman as shown in section 5.3.1.3, and the content and language were adapted where necessary. The questionnaire was collected by hand directly, by the researcher. Dress-code and behaviour were modified as appropriate to the audience and the persons being interviewed. The interviews were recorded and later transcribed. Every interview needed one day to be transcribed. One-to-one interviews were generally of one hour duration in a setting chosen by the participants themselves in order to allow them to feel relaxed and at ease when talking to the researcher. The longest interview lasted 125 minutes and on average interviews were 60 minutes. In the first round, the interviews were conducted during a three-month period, whilst the second round of interviews took two months. Every participant signed a meeting information sheet and confidentiality form at the start of the interview. The in-depth interviews were used to gain further insights into complex narratives and matters of process around the Amman master plan. The researcher was able to guide the interview to ensure that questions requiring a “softer” approach yielded insight into issues of substance. Field notes were taken by the researcher before, during and after the interviews and were kept with interview notes to enable the researcher to reflect on issues and which offered a clear audit trail. This validity of data through credibility was at the core of the research findings.

5.5 Data analysis

This section presents the data analysis process used for this research in order to achieve the main research objectives. The qualitative and quantitative data were analysed separately, and the mix of processes undertaken during interpretation of the findings. This is because there are differences between the two methods that could lead to low levels of agreement in the results (Harris and Brown, 2010). Kendall (2008) pointed out that qualitative data can be used to support quantitative results in condition that both methods separately are analysed. This gave the opportunity to check the different kinds of findings against each other, thus ensuring greater validity (Keith, 2005). This was achieved as follows:

5.5.1 Content analysis of Amman of the compliance with testing the indicators

Content analysis is a type of textual investigation (Silverman, 2006). Texts analysis, such as the text-based analysis of the local sustainable urban design factors in this study, enables large amounts of data to be simplified and grouped (Flick, 2002).

According to Silverman (2006, p.159), quantitative content analysis involves simple tabulations and frequency counts of particular pre-determined categories. The method of content analysis used within this research is, however, different. It is more akin to what Wilkinson (2004, p.186) describes as "qualitative data as a thematic analysis sometimes as a discourse analysis, and may be presented with the quotations integrated into the text rather than in tabular form." Qualitative content analysis in this research adopted the organization and coding of themes and ideas, by making use of drawings, tables and mapping that explains the content under review, in order to avoid distortion or misinterpretation of particular text. This may occur if text is taken out of its original context.

Content analysis was also used as a method to explore key processes that had taken place in Amman, as well as to clarify the vision for the city of Amman represented in its planning policies. Gaining this information was necessary as there was no consolidated knowledge base of urban sustainability indicators in this context. This helped in the exploration of the local nature of sustainable urban design practices based on the high density mixed used (HDMU) in the proposed Amman master plan. This content analysis provides a set of data which helped to test the indicators in the Amman master plan.

5.5.2 Testing-out the indicators by their benchmarks

The approach to testing the urban sustainability indicators identified as a part of the literature review, were based around the three types of indicators as follows:

1. Qualitative indicators take into account the performance-based evaluation that depends on the quality of process of performance, not simply the

outcomes (Alexander, 2006). Hecht (2003) and Hietbrink et al. (2012) state that performance-based evaluation does not depend on pre-identified benchmarks to evaluate a building, project or community. It is difficult to identify a set of benchmarks to measure and evaluate performance based on the subjective views (Gann et al., 2011). Entrop and Dewulf (2011) state that qualitative indicators take into account the difficulties of interpreting judgment data and, therefore, rely on human responses (stakeholders) to evaluate project based on its design criteria and requirements. Consequently, this type of data was tested using human responses (stakeholders). The data collection method was a set of interviews to test these indicators. These interviews were conducted with a set of professionals who work as part of the Amman master plan team responsible for the implementation of HDMU schemes using SUDP, and who are, therefore, aware of the quality of process of performance of these schemes. This gives an opportunity to evaluate the performance of these schemes based on its design criteria and requirements effectively. In this context, the HDMU schemes in Amman were designed according to high performance criteria and requirements that include recycled materials, water management, transportation and energy resources, and which help to improve the quality of process of performance of these schemes (CSD, UN, 2007b; GAM, 2008; RJGC, 2012; Potter *et al.,* 2009). These criteria and requirements were adopted by the UN Commission on Sustainable Development, which is responsible for sustainability in Jordan (CSD, UN, 2007b; GAM, 2007).

2. Quantitative indicators take into account the conformance-based evaluation that depends on a conformance methodology in the outcomes according to the criteria and statistics pre-established by this system

(Alexander, 2006). Dewulf and Meel (2004) suggest that it relies on the existing statistics to evaluate project, building and community therefore it takes into account the numeric facts. Hence, this type of data depended on the existing statistics to test these indicators. The data collection method was primary data and secondary data from historical documents and content analysis. In this context, the study adopted a triangulation approach, drawing upon different sources of information in order to ensure that rich and succinct data was collected (Clifford and Valentine, 2003).

3. Mixed type indicators depend on both the qualitative and quantitative methodology. The tested indicators rely on qualitative data to confirm or plug gaps in quantitative data. The data collection approach was statistics represented in actual figures for the indicator measurements, and human responses to achieve its objectives.

The indicators above were measured and categorised using the scoring system adopted by the UN Commission on Sustainable Development, which is responsible for sustainability in Jordan (CSD, UN 2007b; Shen *et al.,* 2011). Accordingly, the compliance analysis consists of three types of indicators as shown in Table 3.4 (CSD, UN 2007b; Shen *et al*., 2011) in the following steps:

- The included indicators (met threshold) which have a greater number of achieved measurements than not achieved measurements.
- The not included indicators (that did not meet threshold)which have a lower number of achieved measurements than number not achieved measurements.
- The similar indicators (equals threshold) which have an equal number of achieved measurements and not achieved measurements.

Thereafter, the research took the existing data from testing the indicators to be addressed in various figures, to be used in calculating the percentages of indicators for each category. Moreover, the research took the percentages for each indicator, according to its achieved measurements, in order to rank the indicators within a scoring system, and identify which ones are suitable for the city of Amman. This ranking depends on the categorization of indicators (included, similar and not included) and the scoring system.

5.5.3 Data processing and statistical analysis for questionnaire survey

This section explains the approach that was taken to identify and to analyse the questionnaire surveys. The questionnaire was collected by hand directly by the researcher. After the answered survey forms were received by the author, the responses were edited to ensure completeness, consistency and readability. Once the data had been checked and arranged in a form that enabled it to be analysed, quantitative data from the questionnaires analysed using the Statistical Package for Social Sciences (SPSS). This method was selected to analyse the data collected from the survey, because it was considered to be user-friendly.

5.5.4 Qualitative interviews data analysis

This section discusses how the qualitative data was analysed. Miles et al. (2014) suggest guidelines for the analysis of qualitative data which should be categorized and placed in a matrix, putting information into arrays, creating data display, and tabulating the frequency of different events (see also Saladana, 2012). This research was adapted accordingly by putting individual transcript data into a table, categorizing data based on factors data and summarizing all individual data into a table to compare all of the answers. Sample transcriptions of the interviews are provided in Appendix 4.

5.6 Ethical Consideration

The consideration of ethics in research is of growing importance. Therefore, it is important that the researcher understands the basics of ethical research and how this might affect your research project. Especially, if the research involves interaction with businesses or members of the general community who serve as participants in the research (APA, 2003), where this research will contain a range of interactions, including semi structure interviews/ focus groups, and questionnaire surveys.

This section will discuss a wide range of ethical issues, and will explore the ethical considerations which are required to be considered throughout this research. This research will cover a broad variety of the issues which relate to ethical considerations by considering a set of social research ethics generally (Homan, 1991), covering a wide variety of approaches of data collection, such as; semi structured interviews, and surveys (Sieber, 1982).

5.6.1 Ethical Principles

Though all researchers (professional or academic) are well-intentioned, there is the possibility that interaction with participants may inadvertently harm them in some unintended way (APA, 2003). This could include psychological harm, financial harm, and social harm. In addition, this research should avoid risk to all participants (Denscombe, 2007). Therefore, the most important responsibilities which the researcher should be concerned with are: behaviour according to appropriate ethical standards, consideration of how research might negatively affect participants, protection of researcher and supervisors/teachers, and risk minimisation by taking into account the most important principles of ethical considerations as following (Timothy, 1998; University of Brighton, UK, 2007):

1. Ethical acceptability: the researcher should take some necessary steps for ensuring the dignity of all participants in this research.
2. Inducement to Participate and Plagiarism: the researchers should not present any type of financial support to participants to be involved in the project, and they should not use any kind of deception such as, fabrication or falsification of data in any publications.
3. Institutional Approval: an important priority when conducting the research is a proposal prepared by the researcher. This proposal includes a description of the main purpose of the research, and the general nature of the study. This requires a knowledge of how the participants will participate in the research.
4. Informed Consent: the research process does not require the informed consent of participants. The participants should be told about the general nature of the research, and about any type of potential risk or harm during their participation in this study. All participants should be assured that all information supplied is confidential and is treated in the strictest confidence throughout the research. Participants should also be told that they are free to participate or not in the research.

In addition, the participants were offered a copy of the report with final conclusions of the study and taking into account the potential use of these conclusions. As Denscombe (2007) states, ''researchers should operate in an honest and open manner''. In addition, the participants were told that they may withdraw from the study at any time without penalty and without giving a reason (Hay, 1998). Moreover, the researcher was obligated to respect each participant decision regarding their participation in the study (Timothy, 1998).

5.6.2 Confidentiality and data storage

The principles set out in the 1998 Data Protection Act (www.opsi.gov.uk) was adhered to throughout the research, as well as the University of Brighton's staff guidelines for the handling of personal data (University of Brighton, 2007).

Confidentiality is the process of protecting an individual's privacy. It pertains to treatment of information that an individual has disclosed in a relationship of trust, with consideration that this information should not be disclosed to others without their permission (NHGRI, 2005). So the researcher took into account how to protect each participant, taking all necessary precautions to avoid any possibility that the participants will not be protected during their involvement(Timothy, 1998). In addition, the researcher respected participants' right to be assured about confidentiality between the researcher and participant, and avoid intrusion into personal affairs of each participant (University of Brighton, 2007). The Data Protection Act in the UK (1998) states that the gathered information should be adequate and relevant to the purpose.

All participants were contacted (University of Brighton email only) and asked if there were any interpretation issues and other issues such as confidentiality. All Participants in the research were informed about the data storage methods. All electronic data related to the research process was saved on a password protected computer, a data stick and a removable disk which were locked away, and only accessible to the researcher and supervisors. Documentation and physical material, such as interview tapes relating to the research, was stored in a locked cabinet to which only the researcher had access. For interviews, participants were taken to a private place to ensure conversations could not be breached or overheard. All data was disposed of securely once the research project ceased. Any queries relating to data-handling or storage were addressed in the first instance by the university's Data Protection Officer. This ensured maintenance of confidentiality by establishing trust between the researcher and the participant.

5.6.3 Risk

The University of Brighton's guidance on good practice for research ethics and governance (University of Brighton, 2007) states that research, where more than minimal risk is identified, should be reviewed by an ethics committee. The criteria that constitute 'minimal' can be obtained from the University of Brighton's Guidance on Good Practice for Research Ethics and Governance document. The researcher ensured that this research project did not involve more than minimal risk by submitting it to the ethics committee for approval.

Furthermore, the elements of risk (participant and researcher risk) were managed throughout the research process, in order to avoid potential risks in social research. Cristina (2008) shows that potential risks include physical risks (bodily harm and simple inconvenience), psychological risks (emotional suffering and breach of confidentiality), social risks (employment or social discrimination), and economic risks (financial costs related to participation).

In addition, the researcher carried the University of Brighton student card as proof that he is a current registered student at the university.

5.6.4 Dissemination

To disseminate the research, the researcher should take into consideration fundamental ethics issues. In particular, those that relate to ethical responsibility for research findings to be made accessible for others to benefit from; the development of knowledge within the field of research; and ensuring transparency according to core principles of ethical practice for dissemination in research. These are summarised as follows (University of Brighton, 2007; Data Protection Act in the UK, 1998):

1. Some journal editors may require from the researcher some evidence of ethics approval for the work.
2. The researcher should ensure that he has the resources to disseminate the research effectively.
3. The researcher should consider involving interested parties at an early stage of the project.
4. The researcher should consider how the research findings may be interpreted and used by those to whom the work is disseminated.

5.7 Chapter summary

This chapter outlined the research methodology to achieve the main research objectives by using the main research methods. Taking the objectives of the research one by one, the first objective was achieved by identifying a broad variety of urban sustainability indicators to be measured. These indicators were applied in the context of Amman. The second objective was achieved by testing a broad variety of urban sustainability indicators and measurements as identified by the literature review. To achieve this, the research tested these indicators by measuring values and comparing the outcomes, such as suitable indicators and constraints. Thereafter, the thesis used the successful solutions used in the city of Curitiba to help explore the solutions for the constraints facing the implementation of sustainable urban design principles using high density mixed use (HDMU).

The third objective was achieved by using the questionnaire survey with architects and planners in Amman. These professionals were chosen given their positions, working on the implementation of the master plan either within the public (Greater Amman Municipality and its divisions) or the private sector. To ensure balance for the master plan was achieved, the research used two categories of professionals: architects and planners. The planners are responsible for creating the master plan while the architects are responsible for delivering the master plan. The thesis used this method to check the outcomes from comparative study areas such as, the suitable indicators, constraints and solutions for the city of Amman. In addition, the questionnaire survey explored the planning strategy to manage this scheme in Amman. Moreover, the thesis used the in depth interviews as outlined above. The interviewees included technical experts. This method was used to evaluate the framework consisted of the research outcomes.

Chapter 6

Testing the urban sustainability indicators in Amman

6.1 Introduction

This chapter evaluates the efficacy of implementing High Density Mixed Use (HDMU) schemes in the three case study areas identified in the master plan of Amman, Jordan. The study tested, at the neighbourhood level, the urban sustainability indicators in all three areas, ranking and comparing their HDMU potential against the minimum measurable thresholds as specified by the UN Commission on Sustainable Development which is responsible for sustainability in Jordan (CSD, UN, 2007b; Shen *et al*., 2011). This system has been applied to many cities, such as: Melbourne, Hong Kong, Iskandar, Barcelona, Mexico City, Taipei, Singapore, Chandigarh and Pune (Shen *et al*., 2011). The testing-out approach utilized the indicators identified in the literature review and applied it to the context of the Amman master plan.

The first section of this chapter presents the proposed high density mixed used schemes in the case study areas. This is followed by testing the identified urban sustainability indicators within three case study areas in Amman.

A discussion of the main findings is then presented and the chapter concludes by identifying the most suitable case study area for HDMU schemes and for further in-depth studies at the second stage of this study.

6.2 Proposed high density mixed used schemes in case study areas

This section uses maps to explore the distribution of High Density Mixed Use (HDMU) schemes in the selected areas A, B and C within the master plan for the city of Amman.

6.2.1 HDMU in Area A: Central Parkway

Figure 6.1 shows that area A consists of land use areas and allocated HDMU land areas distributed within four zones. The total area is 255,732m^2 of which the HDMU allocated area is 118,689m^2. This area does not contain low density residential or commercial developments. The remaining land areas are allocated as follows: open space (60,519m^2), community facilities (20,882m^2), and public services (55,742m^2) - a total area of 255,732m^2. Furthermore, the high density mixed use land areas contain landmark (5,200m^2), medium-high (29,893m^2), medium (54,635m^2), and medium-low (28,861m^2) allocations to the total area of 118,689m^2. It is noted that the percentage of open view area is 68% while open space area is 24% in area A.

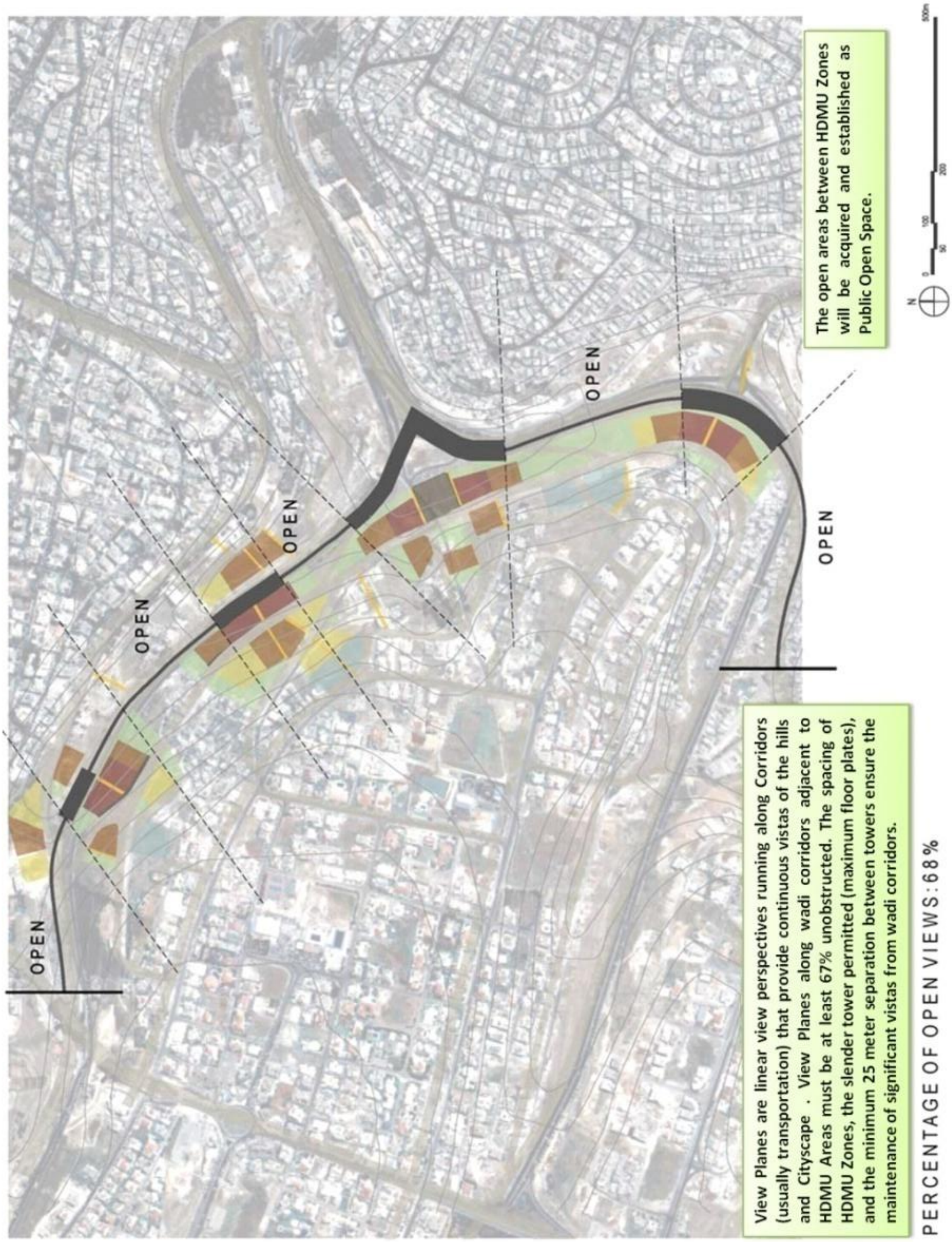

Figure 6.1: Map of open space and land uses for Area A: Central Parkway (Source: GAM, 2010). Modified by the researcher

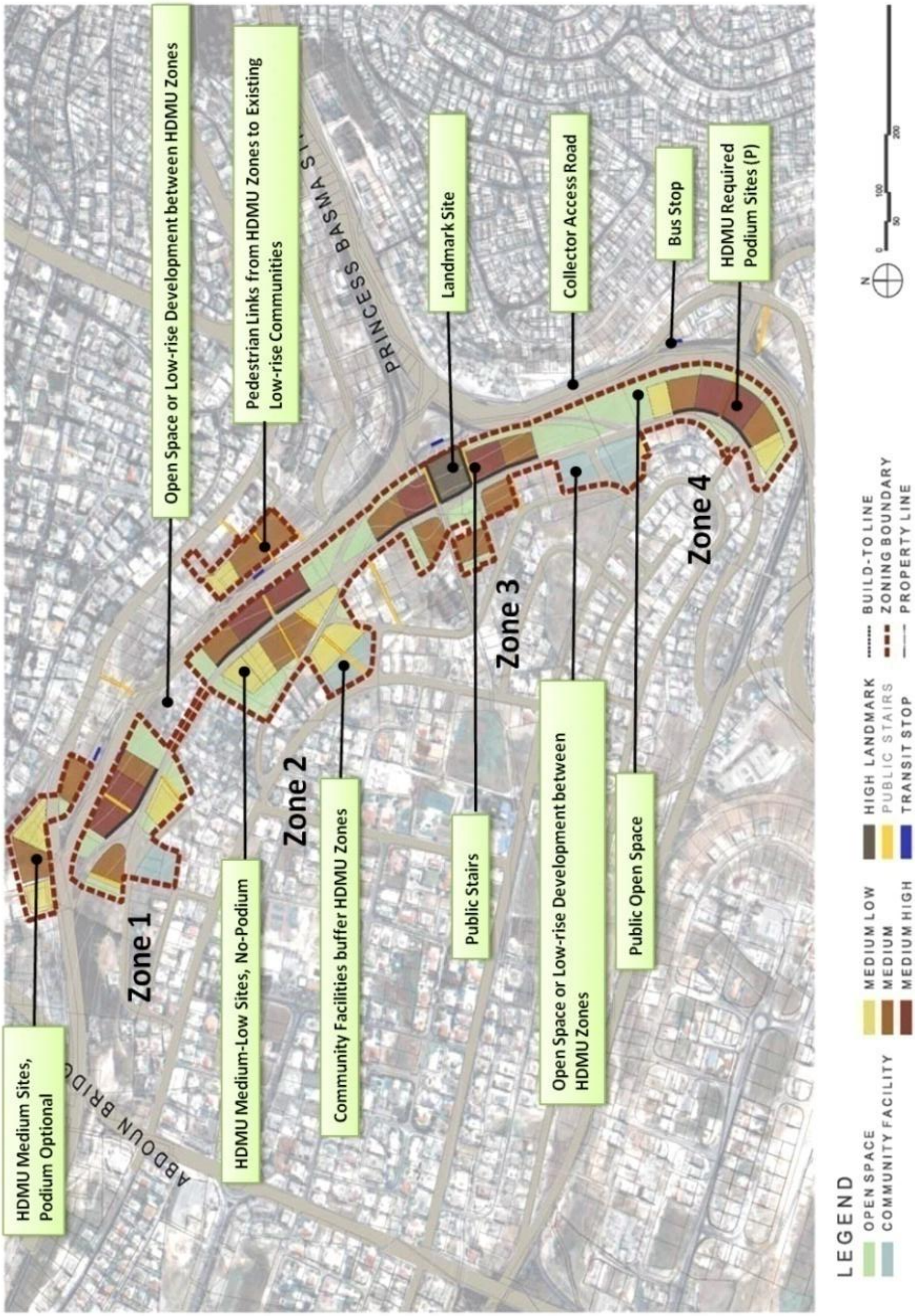

Figure 6.2: Map of concept plan for Area A: Central Parkway (Source: GAM, 2010).M modified by the researcher

Area A consists of four types of high density mixed use (HDMU) sites: landmark - 1, medium-high - 8, medium - 16, and medium-low - 11. Figure 6.2 shows that high density mixed use designs within area A are distributed across four zones. **Zone 1** consists of HDMU required podium sites, HDMU medium sites with podium optional, HDMU medium-low sites without podium, community facilities buffer HDMU zones, public stairs and open space between HDMU. **Zone2** consists of HDMU required podium sites, HDMU medium sites with podium optional, HDMU medium-low sites without podium, community facilities buffer HDMU zones, public stairs and open space between HDMU. **Zone 3** consists of landmark site, HDMU required podium sites, HDMU medium sites with podium optional, public stairs and open space between HDMU. **Zone 4** consists of HDMU required podium sites, HDMU medium sites with podium optional, HDMU medium-low sites without podium, public stairs and public open space.

6.2.2 HDMU in Area B: Northern Gateway

Figure 6.3 shows that area B consists of land use areas and allocated HDMU land areas distributed within four zones. The total area is 1,042,638m^2 of which the HDMU area is 225,880m^2. The land use areas contain low density residential (175,846m^2), low density commercial (71,276m^2), open space area (164,669m^2), community facilities (33,408m^2), and public services (371,559m^2) -a total area of 1,042,638m^2. Furthermore, the high density mixed use land areas contain landmark (4,551m^2), high (32,549m^2), medium-high (49,156m^2), medium (63,446m^2), and medium-low (78,304 m^2) schemes -a total area of 225,880m^2. It is noted that the percentage of open view area is 72% while open space area is 16% in area B.

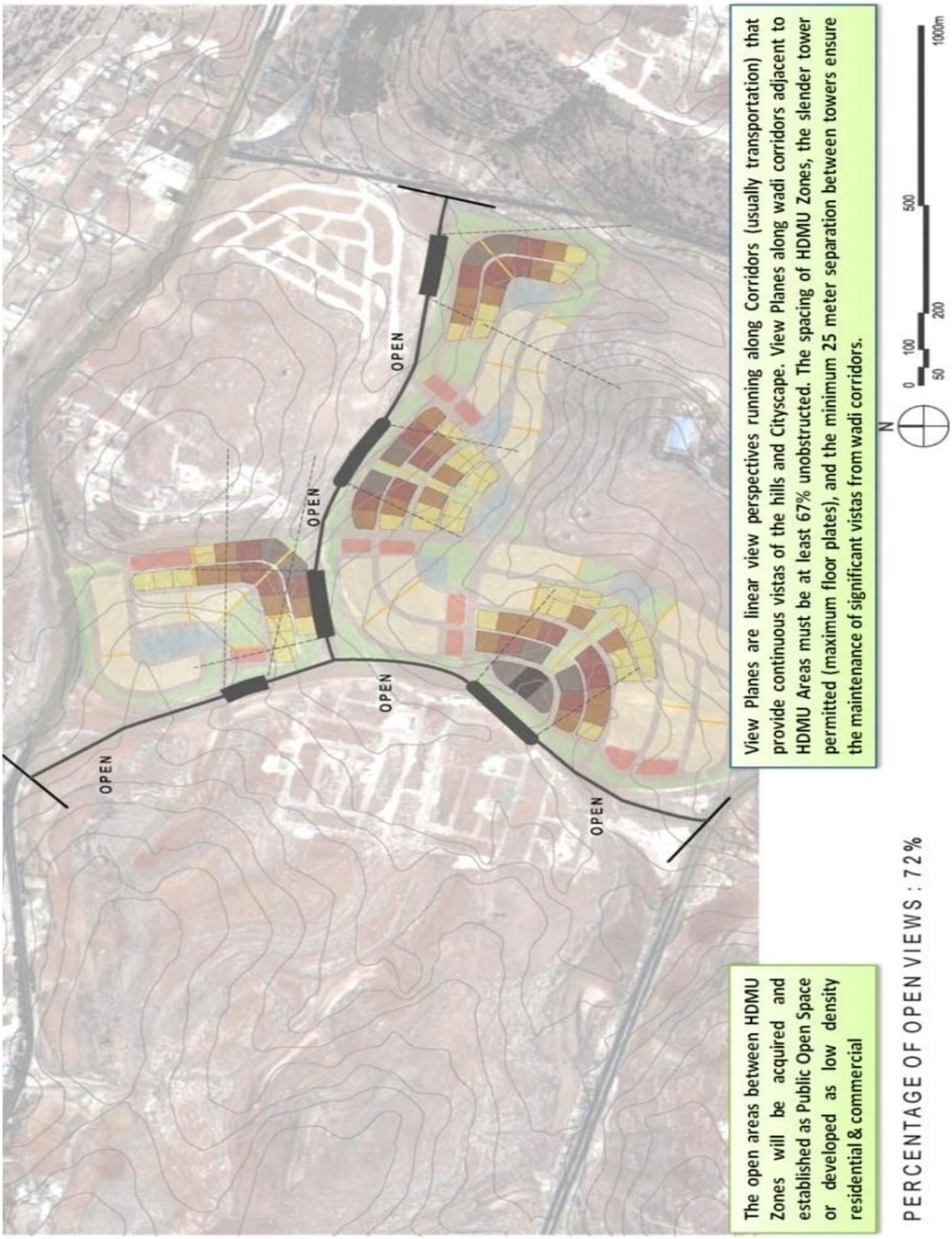

Figure 6.3: Map of open space views and land uses for Area B: Northern Gateway (Source: GAM, 2010). Modified by the researcher

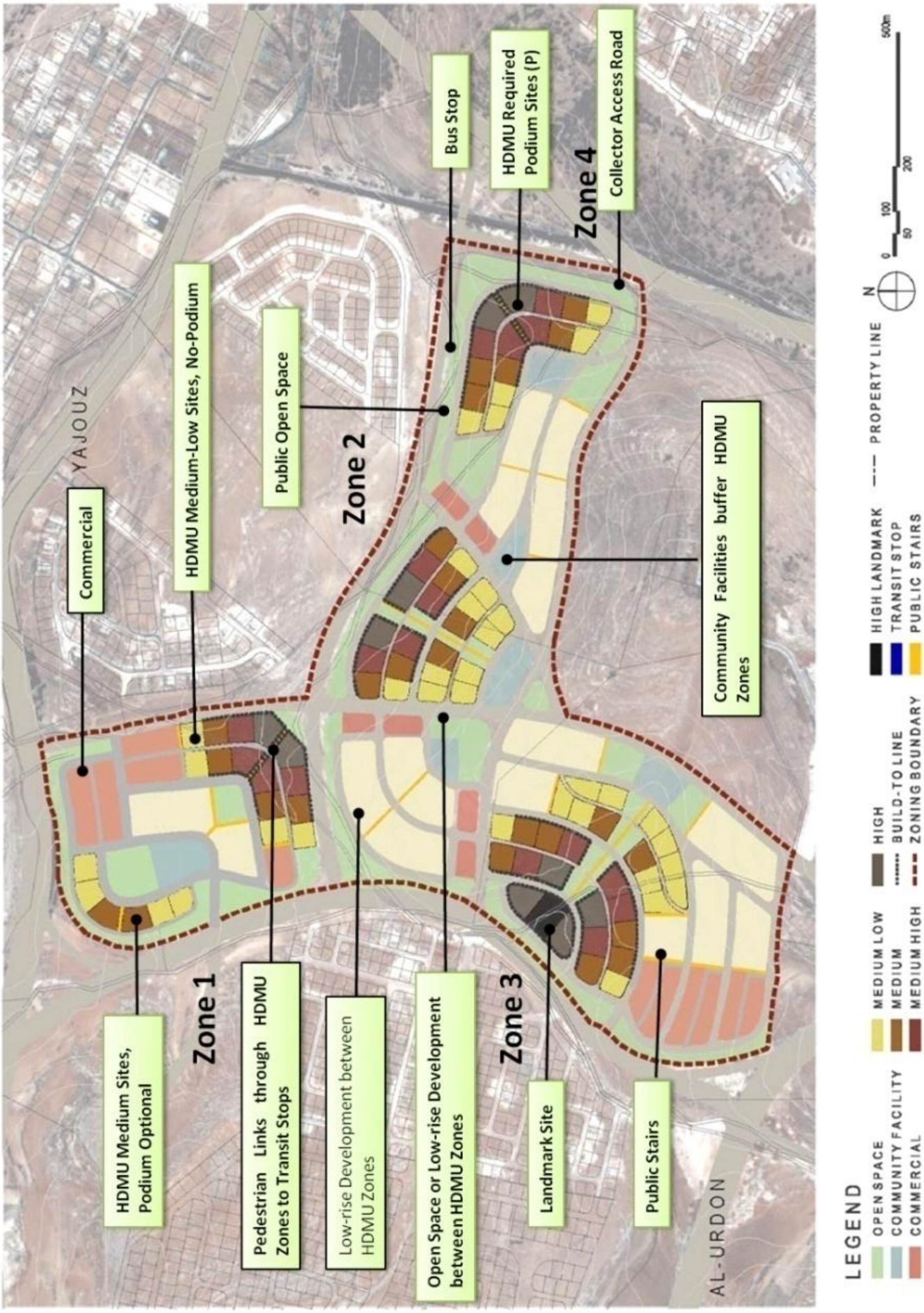

Figure 6.4: Map of concept plan for Area B: Northern Gateway (Source: GAM, 2010). Modified by the researcher

Area B includes of five types of high density mixed use (HDMU) sites: landmark - 1, high - 10, medium-high - 17, medium - 25 and medium-low - 35. Figure 6.4 shows that the high density mixed use designs within area B are distributed across four zones. **Zone 1** consists of HDMU required podium sites, HDMU medium sites with podium optional, HDMU medium-low sites without podium, community facilities, pedestrian links, open space, commercial and low-rise development between HDMU zones. **Zone2** consists of HDMU required podium sites, HDMU medium sites with podium optional, HDMU medium-low sites without podium, community facilities, open space, commercial, low-rise development between HDMU zones and public stairs. **Zone 3**consists of landmark site, HDMU required podium sites, HDMU medium sites with podium optional, HDMU medium-low sites without podium, community facilities, open space, commercial, low-rise development between HDMU zones and public stairs. **Zone 4** consists of HDMU required podium sites, HDMU medium sites with podium optional, HDMU medium-low sites without podium, public stairs and public open space.

6.2.3 HDMU in Area C: Southern Gateway

Figure 6.5 shows that area C consists of land use areas and allocated HDMU land areas distributed within four zones. The total area is (2,296,000m^2) of which the HDMU allocated area is (590,000m^2). The land use areas contain low density residential (478,727m^2), low density commercial (124,682m^2) open space (302.664m^2), community facilities (76,315m^2), and public services (723,763m^2) - a combined area of 2,296,003m^2. Furthermore, the high density mixed use land areas contain high (61,587m^2), medium-high (126,002m^2), medium (207,659m^2), and medium-low (194,612m^2) allocations in a total area of (590,000m^2). It is noted that the percentage of open view areas is 75% while open space area is 13% in area C.

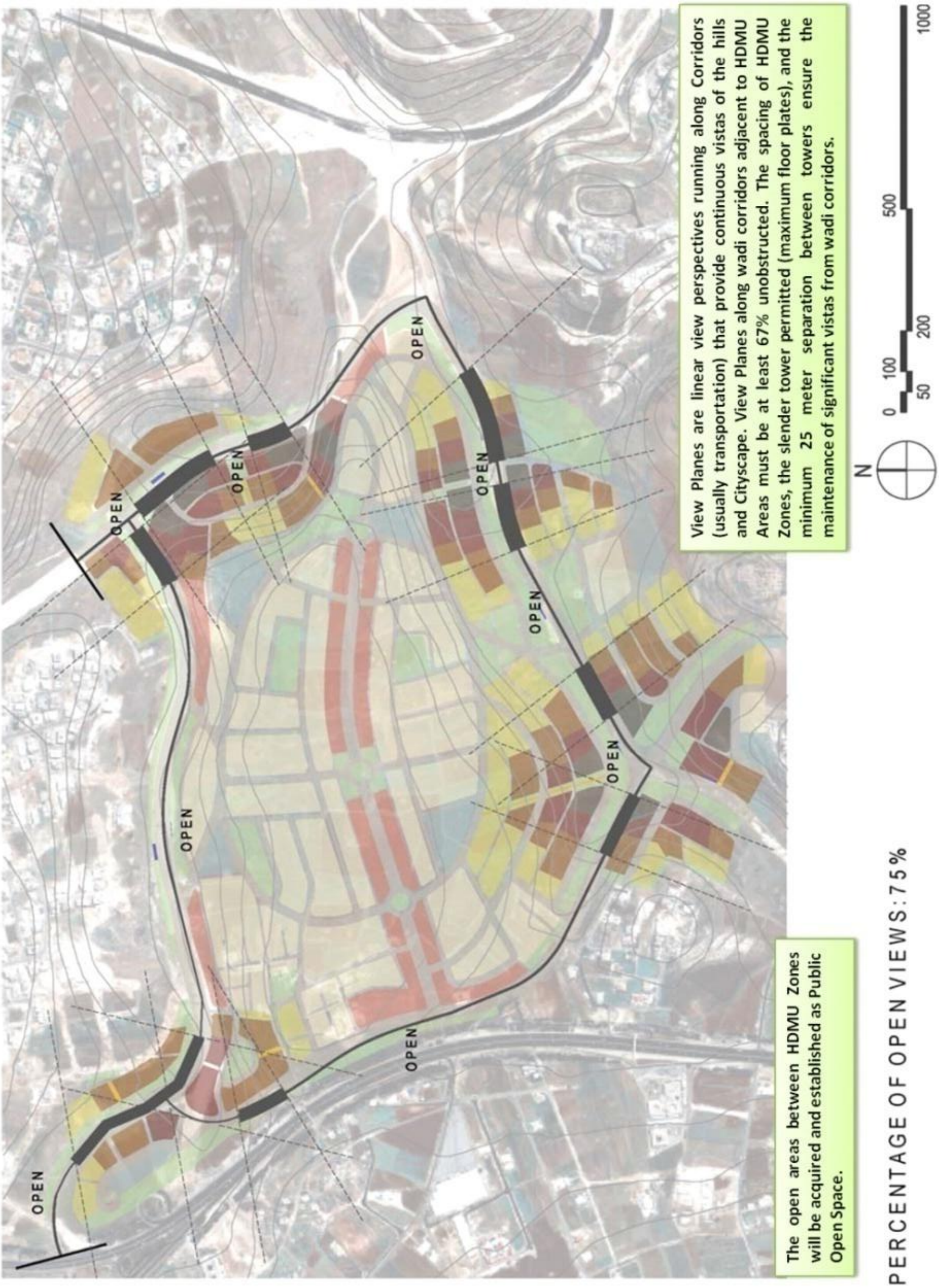

Figure 6.5: Map of open space views and land uses for Area C: Southern Gateway (Source: GAM, 2010). Modified by the researcher

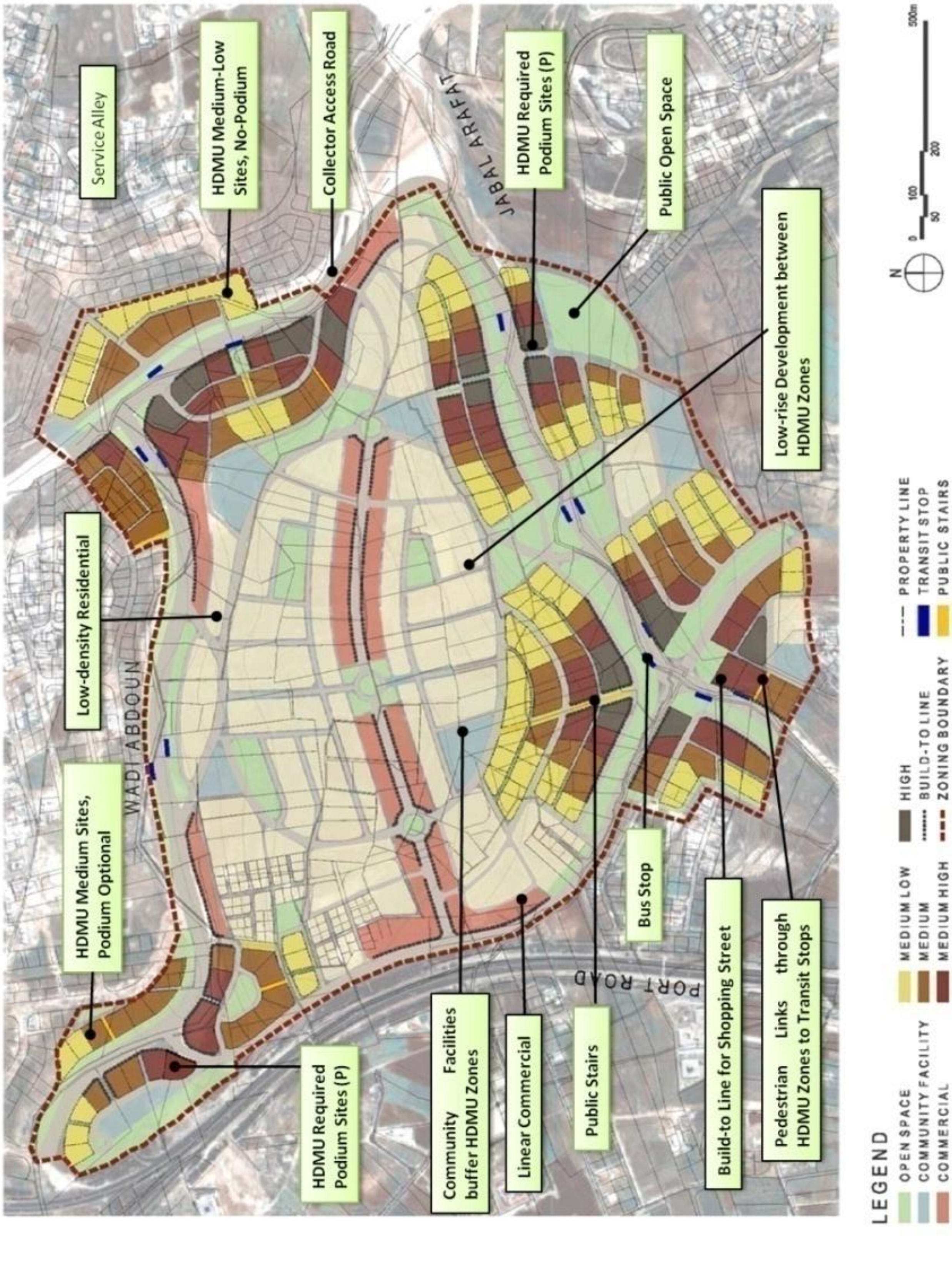

Figure 6.6: Map of concept plan for Area C: Southern Gateway (Source: GAM, 2010). Modified by the researcher

Area C includes four types of high density mixed use (HDMU) sites: high - 16, medium-high - 37, medium - 69 and medium-low - 79. Figure 6.6 shows that high density mixed use designs within area C are distributed across four zones around a core centre. It consists of a linear commercial area distributed around the low-density residential area. **Zone 1** consists of HDMU medium sites with podium optional, HDMU medium-low sites without podium, community facilities buffer HDMU zones, public stairs and open space between HDMU. **Zone2** consists of HDMU required podium sites, HDMU medium sites with podium optional, HDMU medium-low sites without podium, community facilities buffer HDMU zones, public stairs, open space between HDMU and commercial. **Zone 3** consists of HDMU required podium sites, HDMU medium sites with podium optional, public stairs, open space between HDMU and community facilities. **Zone 4** consists of HDMU required podium sites, HDMU medium sites with podium optional, HDMU medium-low sites without podium and public open space.

The findings from this section are summarised in Table 6.1 below:

Table 6.1: The data extracted from the content analysis of HDMU schemes in the three areas in Amman

Data	Area A	Area B	Area C
HDMU	118,689 m^2	225,880 m^2	590,000 m^2
Low density residential	-	175,846 m^2	478,727 m^2
Low density commercial	-	71,276 m^2	124,682 m^2
Open space	60,519 m^2	164,669 m^2	302.664 m^2
Community facilities	20,882m^2	33,408 m^2	76,315 m^2
Public services	55,742 m^2	371,559 m^2	723,763 m^2
Open views	68%	72%	75%
Combined area (total)	255,732 m^2	1,042,638 m^2	2,296,003 m^2

6.3 Testing the indicators within three case study areas in Amman

The purpose of this section of the thesis is to test the three sets of indicators identified as part of the literature review at the neighbourhood level, in the three case study areas in Amman as shown in section 5.5.2. The first set is qualitative indicators which take into account the difficulties of interpreting judgment data. This type was tested by using a range of interviews. The second set is quantitative indicators which take into account numeric facts. This type was tested by using a range of numeric facts against the minimum measurable thresholds as specified by the UN Commission on Sustainable Development, which is responsible for sustainability in Jordan (CSD, UN 2007b; Shen *et al.,* 2011). The third set it mixed type indicators which depend on qualitative and quantitative approaches to test these indicators.

This research adopts a triangulation approach, drawing upon different sources of information in order to maximize the understanding of the research questions (Clifford and Valentine, 2003). This also ensured that rich and succinct data was collected. Evidence was obtained through the cooperation of the Greater Amman Municipality (GAM, 2010) as well as looking back through annual reports associated with the master plan for the city of Amman, covering the years 2002-2010. This was achieved by collaboration with the UN Commission on Sustainable Development (CSD) in Jordan, (2007b), the Department of Statistics in Jordan (DS, 2011) and the Royal Jordanian Geographical Centre (RJGC), Geographic Information System (GIS) services, (2012). The thesis used the data collected from these sources which ensured constancy and consistency which increases the reliability and validity of the research data.

In addition, a wide range of professionals comprising architects and planners were consulted to test the qualitative indicators. These professionals are sampled because they are involved in the implementation of the master plan either within Greater Amman Municipality or in the private sector, therefore those professionals are aware of the quality of process of performance of these schemes. This gave an opportunity to provide the necessary information regarding the implementation and management of the process of applying the principles of sustainable urban design on the master plan for the city of Amman. Planners were selected because they are responsible for creating the master plan, while the architects are responsible for delivering the master plan. These professionals were shortlisted from the classification of Jordan Engineers Association (JEA) and Greater Amman Municipality (GAM).

The interviews were recorded and transcribed by the researcher over a period of 60 days. One-to-one interviews typically lasted one hour in a setting chosen by the participants themselves in order to allow them to feel relaxed and at ease when talking to the researcher. The longest interview was 125 minutes and on average interviews were 60 minutes. Every participant signed a meeting information sheet and confidentiality form at the start of the interview. Field notes were made by the researcher before, during and after the interviews, and these were kept with interview notes to enable the researcher to reflect on issues and to offer a clear audit trail. This validity of data through credibility was at the core of the research findings.

Table 6.2 introduces the professionals (architects and planners) who are working at the Greater Amman Municipality (GAM) as part of the master plan team.

Table 6.2: Sample of architects and planners for supporting evidence

No	Name	Professional	notiisoP	Experiences
P.1	Tamam Mango	Planner	GAM	10 years
P.2	Rima Odeh	Planner	GAM	15 years
P.3	Hassan Alkaby	Planner	Engineering office	10 years
P.4	Dania Hamadna	Planner	GAM	6 years
P.5	Ihsan abu stateah	Planner	Bearing Point company	5 years
A.1	Nuha Qtaish	Architect	GAM	10 years
A.2	Shireen Da'ana	Architect	GAM	5 years
A.3	Hasan Kiswani	Architect	Engineering office	7 years
A.4	Lana Haddadin	Architect	GAM	5 years
A.5	Murad Kalalda	Architect	Engineering office	20 years

From the literature review, urban sustainability indicators were classified as social, environmental, economic and governance as shown in Table 6.3. The following sections present the findings in each of the appointed case study areas: A central parkway, B southern gateway, C northern gateway.

Table 6.3: The indicators and measures (Source: AlWaer and Sibley, 2006). Modified by the researcher

Dimensions	***Indicators***	***Measurements***
Social	Functionality, Usability and Aesthetic aspects	F1: Efficiency of open space utilization for local community F2: Efficiency of local community movement F3: High aesthetic aspects inside the building
	Indoor Environmental Quality/Health and Well being	I1: Maintain acceptable air temperature inside the building I2: Indoor noise and acoustic control within primary areas I3: Provision of indoor air quality monitoring. I4: Selecting of interior finish materials with minimal off – gazing
	Architectural considerations and cultural heritage	A1: Lot orientation to maximize compatibility of building design with local heritage value A2: Cultural heritage integration A3: Compatibility of urban design with local heritage value
	Local people facilities	L1: Facilities for local community L2: Provision of public transport for local area L3: Cyclist and pedestrian provision for the local area
	Customers facilities and trends	C1: Maximize Security inside the centre C2: Use/ Ignore the internet as a way of online shopping C3: Provision of food courts distribution inside the centre C4: Efficiency of cinema complex utilization C5 Provision of play area for children
Environmental	Energy and Natural Resources	E1: Use/ Waste solar energy E2: Use/ Waste of daylight in the primary area E3: Passive solar gain &cooling E4: high/ Low energy consumption E5: Use/ ignore natural ventilation
	Materials used, Durability and Waste	M1: Toxic/ Non- toxic material M2: Use locally produced materials M3: Use/ ignore recycled materials in the construction of the building M4: Use/ Ignore traditional or modern material M5: Material re- use/ recycling design for disassembly
	Sustainable Land use and Site selection	L1: Destroys/ Protects agriculture land (Site Criteria) L2: Proximity of site to public transportation

Dimensions	*Indicators*	*Measurements*
		L3: New/ Respect built environment surrounding the building L4: Enhance/ Ignore green areas & outdoor Environment L5: Collection & recycling of solid wastes
	Transport and Accessibility	T1: Consider/ Ignore Planning Regulation System PPG6/PPG13 T2: Encourage/ Discourage private car access T3: Provision of Pedestrian routes for population T4: Provision of cycle and cycle facilities T5: Public Transport Provision and facilities
	Water and water conservation (W)	W1: Stores/ Wastes rainwater in the centre for later reuse W2: Uses/ Ignore grey water recycling W3: Obtain the water locally W4: High / low water consumption W5: Design measures and management plans to limit use of potable water
Economic	Economic performance	EP1: Life cycle costs (Gross domestic product (GDP) per capita) EP2: Measure EP2: High/ Low quality of maintenance EP3: Minimization of operating and maintenance costs
	Local people employment	LE1: Job creation for locals (Employment-population ratio) LE2: Participation for local institutions in the building LE3: Ignore/ provide training for locals
	Management and Controllability	MC1: Provision of building management control system MC2: Provision for on-going monitoring and verification performance MC3: Minimize the consumption of energy resources and water
Governance	Public Participation	PP1: Participation of private sector, public institutions (Civic engagement) PP2: Participation of the local community (Citizens participation).
	Public Communication	PC1: The Connection with local community PC2: The Connection with private sector

6.3.1 Social indicators

This chapter discusses the key findings of the thesis with respect to the role of sustainable urban design principles in delivering high density mixed use schemes in Jordan, Amman. The purpose of this section is to test the social indicators.

These indicators include qualitative and quantitative indicators. The qualitative indicators were tested by the interviews with the professionals. The quantitative indicators were tested by the numeric facts using the data collected from the content analysis and multiple sources as specified in section 5.3. This helped to ensure the credibility, reliability and validity of the findings.

Indicator 1: Functionality, Usability and Aesthetic aspects

The purpose of this section was to test the indicator of functionality, usability and aesthetic aspects of the HDMU schemes. These tested indicators included: the efficiency of open space utilization for local community, efficiency of local community movement and high aesthetic aspects for the buildings by the qualitative and quantitative methods. The efficiency of open space utilization for local community was tested by quantitative method. The efficiency of local community movement and high aesthetic aspects for the buildings were tested by qualitative method. The findings are as follows:

Measure F1: Efficiency of open space utilization for local community

This measure refers to the open space areas available for use by the local community.

Table 6.4: Open space allocation in areas A,B and C

Selected Area	A	B	C
Percentage of open space views for total area(DS, 2011)	68%	72%	75%
Minimum threshold of measurement (CSD, UN, 2007b)	70%		
Population (GAM, 2012)	40,900	21,050	25,500
Size(in metres)of open space area	60,519 m^2	164,669 m^2	302,664 m^2
Size (in metres)of open space per capita of population (GAM, 2012)	1.5 m^2	8.1 m^2	12 m^2
Minimum threshold per capita of population (CSD, UN, 2007b)	8 m^2		

It was noted that the percentage of open space views in area A is 68%. This is lower than the percentage threshold of 70% as defined in (CSD, UN, 2007b). In comparison, the percentage of open space in area B is 75%, and area C is 72%. Areas B and C both exceed the minimum threshold of 70%. It was also noted that open space per capita of population within area A is 1.5m^2. This is lower than the minimum threshold of 8m^2 as specified in (CSD, UN, 2007b). In comparison, open space per capita of population within selected area B is 8.1m^2, and area C is 12m^2. Both are higher than the required threshold. Therefore, for Measure F1 (efficiency of open space utilisation for the local community) it was found that case study area A falls short of the requirements whilst areas B and C exceed the requirements.

Measure F2: Efficiency of local community movement

This measure refers to the elements and services which facilitate movement in the local community and increase the efficiency of this movement within HDMU schemes.

With the lack of direct data for this measure, architecture and planning professionals who were directly involved in the design of the master plan for the case study areas were asked to provide information to fill in the gaps in the available documentary evidence. With regards to Measure F2 (efficiency of local community movement) the architects and planners consulted confirmed that credible effort was made to achieve this in all three case study areas, as quoted below:

> "The city was made to increase the efficiency of local community movement. The build-to lines are also shown in association with podiums, in order to create a street wall at a pedestrian scale and are intended to encourage the creation of shopping streets. They were made to provide community services, restaurants, cafes, stores and display windows at grade provides visual interest, encourages the use of sidewalks, promotes retail continuity and feasibility, and contributes to a safer and more vibrant pedestrian movement." (P.2)

"The city has taken into account efficiency of local community movement using high density mixed use schemes. Over time, ground floor uses will change to adapt to a variety of community needs. Buildings should front on to public streets and allow for a variety of uses that would encourage the use of the street." (P.3)

"The city was made so as to place facilities for servicing the local community movement effectively, such as loading docks, and garbage areas in unobtrusive locations and well screened from adjacent public streets." (A.1)

"High density mixed use schemes are working to activate the local community movement. They indicate the location of build-to lines in each HDMU cluster along a street and, in some cases, public pedestrian walkways and stairs." (A.3)

Therefore, this measure was achieved within selected areas A, B and C.

Measure F3: High aesthetic aspects of the buildings

This measure refers to the exterior and interior aesthetic aspects of the buildings, such as elevations, elements and materials and exterior lightings.

With the lack of direct data on this measure, architecture and planning professionals who were involved directly in the design of the master plan for the case study areas, were approached to provide information to fill in the gaps in the available documentary evidence. With regards to Measure F3(high aesthetic aspects for the buildings) the architects and planners consulted confirmed that credible effort was made to achieve this in all three case study areas, as quoted below:

"The city was made to achieve aesthetic aspects for the application of urban sustainability indicators using HDMU schemes. They have designed the buildings and podiums frame in a consistent manner that supports the creation of a pleasant, lively and pedestrian-friendly street frontage area." (P.4)

"High density mixed use schemes are working to achieve aesthetic aspects for these schemes. These include limited signage, and they do not detract from the overall appearance of the building." (P.2)

"The city was made so as to place facilities for servicing the development, such as loading docks, garbage areas in unobtrusive locations and well screened from adjacent public streets. Moreover, it has addressed exterior lighting of the buildings aesthetically, and is not oriented towards adjacent buildings and/or neighbourhoods." (A.5)

"High density mixed use schemes include limited signage, and do not detract from the overall appearance of the building, in order to achieve aesthetic aspects for HDMU." (A.3)

Therefore, this measure was achieved within selected areas A, B and C.

Indicator 2: Indoor Environmental Quality - Health and Well being

This section tests the indicator of indoor environmental quality - health and wellbeing of the HDMU schemes. The measures under this indicator includes: maintaining acceptable air temperature inside the buildings, indoor noise and acoustic control within primary areas, provision of indoor air quality monitoring and selecting of interior finish materials with minimal off-gazing by the qualitative method. The findings are as follows:

Measure I1: Maintain acceptable air temperature inside the buildings

This measure refers to temperature control inside buildings which should be comfortable for the users.

Interviewed architects and planners highlighted that credible efforts were made in the master plan to maintain acceptable air temperature inside the buildings (HDMU) in all three case study areas, as quoted below:

"The city has taken into account the need to maintain acceptable air temperature inside the buildings for high density mixed use schemes." (P.3)

"The city has used specialized companies in this scope to be responsible for air temperature inside the buildings." (P.2)

"High Density Mixed Use have been considered acceptable in terms of maintaining air temperature inside the new designed buildings. This could be achieved using private companies in this field." (A.3)

Therefore, this measure was achieved within selected areas A, B and C.

Measure I2: Indoor noise and acoustic control within primary areas

This measure refers to the control of disturbing or excessive noise that may harm the activity or balance of users.

Interviewed architects and planners highlighted that credible efforts were not made in the master plan to minimize indoor noise and acoustic control in the primary areas inside the buildings (HDMU) within the selected areas, as quoted below:

> "High Density Mixed Use has not been designed according to criteria for reducing indoor noise and acoustic control within primary areas inside the buildings. These designs have tried to use special devices to achieve that. However, this technology is not effective within the schemes in the selected areas, because of the high cost of these devices." (A.4)

> "The city has not taken into account indoor noise and acoustic control within primary areas inside the buildings for high density mixed use schemes. This could not be achieved within the schemes in the selected areas, because of the high cost of this technology." (A.3)

> "The city has not taken into account indoor noise and acoustic control within primary areas inside the buildings for high density mixed use schemes." (P.2)

Therefore, this measure was not achieved within selected area A, B and C.

Measure I3: Provision of indoor air quality monitoring.

This measure refers to monitoring outside air, to keep interior building air circulating, and to prevent stagnation of the interior air.

Interviewed architects and planners highlighted that the city of Amman has not made provision for indoor air quality monitoring inside the buildings (HDMU) in all three case study areas, as quoted below:

> “High Density Mixed Use has not been designed according to criteria for monitoring indoor air quality inside the buildings." (A.5)

"The city has not taken into account provision of indoor air quality monitoring inside the high density mixed use buildings."(A.1)

" The city has not sought to monitor indoor air quality inside the buildings (HDMU) within these areas. The HDMU schemes plans have not taken into account this criteria during the design of these schemes" (P.2)

Therefore, this measure was not achieved within selected areas A, B and C.

Measure I4: Selecting of interior finish materials with minimal off-gazing

This measure refers to the selection of interior finish materials which minimize the resultant effects from the materials on human health and the environment according to environmental specifications.

Interviewed architects and planners highlighted that the city of Amman has managed to select interior finish materials with minimal off-gazing inside the buildings (HDMU)in all three case study areas, as quoted below:

> “High Density Mixed Use have been designed according to criteria for selecting of interior finish materials with minimal off-gazing inside the buildings. These designs could be achieved by using an American company to make this, provided that Greater Amman Municipality are responsible for monitoring the implementation of this process." (A.5)

> "The city has taken into account selecting of interior finish materials with minimal off-gazing inside the buildings for high density mixed use schemes, by using private agencies responsible for this process within this scope." (A.4)

> "The city has taken into account selecting of interior finish materials with minimal off-gazing inside the buildings for high density mixed use schemes." (A.3)

> "There was an American company responsible for this project along with monitoring for implementing this process by Greater Amman Municipality." (A.1)

Therefore, this measure was achieved within selected areas A, B and C.

Indicator 3: Architectural considerations and cultural heritage

This section tests the indicator of architectural considerations and cultural heritage of the HDMU schemes. The measures under this indicator includes: plot orientation to maximize passive solar energy, cultural heritage integration and compatibility of urban design with local heritage value by the qualitative method. The findings are as follows.

Measure A1: Lot orientation to maximize passive solar energy

This measure refers to the collection, storage and distribution of solar energy in the form of heat in the winter, and reject solar heat in the summer.

Interviewed architects and planners highlighted that the city of Amman has managed to maximise passive solar energy in all three case study areas, as quoted below:

> "The city has succeeded in maximising passive solar energy using solar cells into their designs. High Density Mixed Use have been designed according to passive solar energy principles to maximise passive solar energy." (P.4)
>
> "The city has taken advantage of private companies and agencies to maximise passive solar energy for implementing high density mixed use schemes." (A.4)
>
> "The city has taken into account lot orientation to maximise passive solar energy through integrating solar cells into its design for high density mixed use buildings." (A.3)
>
> "The city has designed High Density Mixed Use buildings based on passive solar energy principles to maximise passive solar energy within these schemes." (A.2)

Therefore, this measure was achieved within selected areas A, B and C.

Measure A2: Cultural heritage integration

This measure refers to the development of urban areas with safeguards for the cultural heritage values of a place, to balance and manage the demands and needs of its cultural heritage.

Interviewed architects and planners highlighted that the city of Amman has sought to preserve cultural heritage integration in all three case study areas, as quoted below:

“The city has taken into account architectural considerations and cultural heritage. HDMU have been designed without effect on the cultural heritage buildings. All visible retaining walls are limited in height as much as possible with fencing and vegetation and/or are used to accommodate public art without effect on the architectural considerations." (A.2)

"High density mixed use has been designed without effect on the local architecture negatively. Where they were designed based on the conservation of architecture considerations within selected areas." (A.1)

"The city has taken into account architectural considerations and preservation of city’s cultural heritage. HDMU have been designed without affecting the cultural heritage buildings. The city tried to keep the public informed about cultural heritage issues through conducting meetings with specialised professionals in cultural heritage, to take their views for this project." (P.2)

"The city has taken into account preservation of city’s cultural heritage integration. It has proposed that owners of building designated as having historical value can change the building’s use, but not the fundamental facade and layout." (P.1)

Therefore, this measure was achieved within selected areas A, B and C.

Measure A3: Compatibility of urban design with local heritage value

This measure refers to the role of urban design in the preservation of local heritage values without affecting it.

Interviewed architects and planners highlighted that the city of Amman has sought to achieve of compatibility of urban design with local heritage values in all three case study areas, as quoted below:

"The city has taken into account compatibility of urban design with local heritage value. It has designed high density mixed use scheme without affecting the cultural heritage buildings, and conservation integration and compatibility with local architecture." (P.5)

"The city was concerned to conduct specialised studies on the effect of HDMU on the cultural heritage sites. This was clear, through design of high density mixed use (podium, high, and materials)." (P.2)

"The city has taken into account local urban design principles for these areas for implementing high density mixed use HDMU within the selected areas. This was clear through project elevations and materials." (A.3)

"The city has managed to design HDMU without effect on the cultural heritage buildings, and conservation integration and compatibility with local architecture to complement the overall building design using complementary exterior building materials, screens, vegetation, public art and/or at-grade shops (as a screen)." (A.1)

Therefore, this measure was achieved within selected areas A, B and C.

Indicator 4: Local people facilities

This section tests the indicator of local people facilities for the HDMU schemes. The measures under this indicator includes providing facilities for the local community including the right to adequate housing and housing price and rent-to-income, provision of public transport for local area, such as: transportation systems, bus stops and stations and cyclist and pedestrian provision for the local area, by the quantitative and qualitative methods. The cyclist and pedestrian provision for the local area was tested by qualitative method. The others were tested by quantitative method. The findings are as follows.

Measure L1: Facilities for local community

This measure refers to the facilities which can be available for the local community, such as the right to adequate housing and housing price and rent-to-income, as further highlighted below:

Measure L1.A: Right to adequate housing

This measure refers to the capacity of the city of Amman to provide adequate housing for the local community.

Number of families =401,785 (GAM, 2012)

Number of flats =500,858 (GAM, 2012)

The requirement is that there should be a minimum percentage threshold for the average number of flats per family (EU,1998). This threshold is 10% more flats than families.(WB, 2013).

It is noted that there are 20 % more flats per family in Amman i.e. 10% higher than the minimum percentage threshold required. This was considered sufficient. In addition, the city of Amman is cooperating with the private sector, professional associations, and central government to undertake research into creative housing typologies and alternative construction and insulation techniques that reduce the cost of housing and support the provision of affordable housing. Therefore, this measure was achieved within selected areas A, B and C.

Measure L1.B : Housing price and rent-to-income

This measure refers to the capacity of the population to obtain housing according to housing price and rent-to-income.

Maximum threshold of price = (33.3% x income) x 20 > Average housing price (CSD, UN, 2007b)

Maximum threshold of rent = (33.3% x income) > Average housing rent (CSD, UN, 2007b)

Table 6.5: Housing prices and rent-to-income, drawn up by the author.

Selected Area	**A**	**B**	**C**
Income for population (DS, 2011)	10100 $	7050 $	4680 $
Average housing price (DS, 2011)	110,000$	100,000$	80,000$
Maximum threshold of price for housing price -to-income (CSD, UN, 2007b)	67266 $	46953 $	31168 $
Average housing rent (DS, 2011)	3320$	4320$	2250$
Maximum threshold of rent for housing rent -to-income (CSD, UN, 2007b)	3363 $	2347 $	1558 $

It was noted that average housing rent within selected area A is 3320 $.This is lower than maximum threshold of rent for housing rent-to-income 3363$. This was considered adequate. However, average housing rent within selected area B is 4320 $, and area C is 2250 $. These are higher than maximum threshold of rent for housing rent-to-income (B= 2347$, C=1558$). Therefore, this measure was achieved within selected area A, but not achieved within areas B and C.

Likewise, it was noted that average housing price within selected area A is 110,000$, area B is 100,000$, and area C is 80,000$.These are all higher than the maximum threshold of price for housing price-to-income (A=67,266 $, B= 46,953 $, C=31,168$). This was considered inadequate. Therefore, this measure was not achieved within areas A, B or C.

Measure L2: Provision of public transport for local area

This measure refers to the capacity of the city of Amman to provide public transport for the local area including transportation systems, bus stops and stations. This measure will be discussed in two parts:

Measure L2. A: Number of transportation systems per 100,000 of the population

This measure refers to the number of transportation systems available for the local area:

Table 6.6: Number of transportation systems, drawn up by the author

Selected Area	A	B	C
Number of transportation systems (MT, 2011)	712	324	494
Population (DS, 2011)	40900	21050	25500
Number of transportation systems per 100,000 population	173 T	155 T	193 T
Minimum threshold of measurement per 100,000 population (CSD, UN, 2007b)	100 T		

It is noted that the number of transportation systems per 100,000 population within selected area A is 173, area B is 155, and area C is 193. These are higher than the specified minimum threshold of measurement per 100,000 population, 100 T. This was considered adequate for the population enabling them to choose public transportation instead of their own cars, and subsequently helping to reduce traffic on the roads. Therefore, this measure was achieved within selected areas A, B and C.

Measure L2. B: Number of bus stops and stations per 100,000 of the population

This measure refers to the number of bus stops and stations available for the local area.

Table 6.7: Number of bus stops and stations, drawn up by the author.

Selected Area	**A**	**B**	**C**
Number of bus stops (GAM, 2012)	63	21	22
Number of stations(GAM, 2012)	3	1	1
Population(GAM, 2012)	40900	21050	25500
Number of bus stops per 100,000 population	154	99	86
Number of stations per 100,000 population	7	4	4
Minimum threshold of measurement per 100,000 population (CSD, UN, 2007b)	Bus stops: 250 Bus stations: 5		

It is noted that the number of bus stops per 100,000 population within selected area A is 154, area B is 99, and area C is 86. These are lower than the specified minimum threshold of measurement per 100,000 population, 250. This was considered inadequate for the population within this area, despite the provision of real-time and travel information at all stops. Therefore, this measure was not achieved within selected areas A, B and C.

Similarly, it is noted that the number of bus stations per 100,000 population within selected area A is 7. This is higher than the specified minimum threshold of measurement per 100,000 population, 5. This was considered adequate for population within this area. However, the number of bus stations available per 100,000 population within area B is 4, and Area C is 4. This is lower than the specified minimum threshold of measurement per 100,000 population. This was, therefore, considered inadequate for the population within these areas. Therefore, this measure was achieved within selected area A, but not within areas B or C.

Measure L3: Cyclist and pedestrian provision for the local area

This measure refers to the capacity of the city of Amman to provide cyclist and pedestrian infrastructure for the local area.

Interviewed architects and planners highlighted that Greater Amman Municipality (GAM) has provided pedestrian paths for the local area, but it has not sought to provide cycle paths in all three case study areas, as quoted below:

> "The city has taken into account providing mid-block pedestrian connections within larger development parcels. These are intended to be designed as pedestrian landscaped mews and lit, landscaped and maintained for public use, which are designed to provide an important connection between two streets and public destinations, such as schools, parks, and public transit." (P.2)

> "This is very important for the mid-block connections, which are designed to provide an connection between two streets and public destinations, such as schools, parks, and public transit. They can also provide an address to individual frontages along their lengths." (A.3)

> "The city has used specific design elements (canopies, signage, lighting) to support the creation of shopping streets along build-to lines. In addition, they have encouraged the provision of publicly accessible, privately owned open spaces on individual sites, in order to complement the public open space system. However, it has not considered providing cycle facilities during design processes." (A.4)

> "The city has not taken into account the provision of cycle facilities for the implementation of high density mixed use. However, it has sought to provide pedestrian connections as pedestrian landscaped mews and lit, landscaped and maintained for public use." (A.2)

> "The city has provided pedestrian paths and connections to correlate them, but it has not taken into account the provision of cycle facilities during design processes." (A.5)

Therefore, this measure was achieved for the pedestrians but was not achieved for the cyclist within selected areas A, B and C.

Indicator 5: Customer facilities and trends

This section tests the indicator of customer facilities and trends of the HDMU schemes. The measures under this indicator include: maximise security inside the centre, use/ignore the internet for online shopping, provision of food courts distribution inside the buildings, efficiency of cinema complex utilisation and provision of play area for children, by the qualitative methods. The findings are as follows.

Measure C1. Maximise security inside the centre

This measure refers to the capacity of the city of Amman to maximise security inside HDMU schemes.

Interviewed architects and planners highlighted that the city of Amman has maximised security inside the buildings in all three case study areas, as quoted below:

> "The city has taken into account providing security into these schemes. This could be achieved through contracting with a set of private agencies for maximizing security inside the high density mixed use schemes." (P.2)

> "The city has taken into account providing security into these schemes, using private agencies for achieving that." (A.1)

> "The city has taken into account providing security into these schemes. This could be achieved getting approvals necessary by the competent authorities for ensuring maximizing security these buildings." (A.2)

> "High density mixed use schemes have adhered to codes and regulations in the provision of security for these schemes." (A.3)

Therefore, this measure was achieved within selected areas A, B and C.

Measure C2. Use/Ignore the internet for online shopping

This measure refers to the capacity of the HDMU schemes to provide internet access for shopping.

Interviewed architects and planners highlighted that the city of Amman has not used the internet as a way of online shopping in any of the three case study areas, as quoted below:

> "The city has ignored the internet as a way of online shopping. This could be clarified through designing high density mixed use schemes." (A.5)

> "The city has ignored the internet as a way of online shopping." (A.2; A,3; P4)

Therefore, this measure was not achieved within selected areas A, B or C.

Measure C3. Provision of food courts distribution inside the buildings

This measure refers to the capacity of the HDMU schemes to provide and distribute the interior food courts.

Interviewed architects and planners highlighted that the city of Amman has made provision for food courts distribution inside the buildings in all three case study areas, as quoted below:

> "The city has sought to provide food courts distribution inside the buildings according to their spaces and needs. High density mixed use designs have been adapted to achieve this purpose during the implementation of this project." (A.3)

> "High density mixed use designs have been adapted to provide food courts distribution inside these schemes during the implementation this project." (A.2)

> "The city has taken into account providing food courts distribution inside these schemes." (P.3)

Therefore, this measure was achieved within selected areas (A, B, C).

Measure C4. Efficiency of cinema complex utilisation

This measure refers to the capacity of the HDMU schemes to use cinema complex effectively.

Interviewed architects and planners highlighted that the city of Amman has included cinema complexes in these schemes in all three case study areas, as quoted below:

> "High density mixed use design has included some of the sites for cinemas according to the needs assessment for this type of use in these areas. To achieve that, these designs have provided the main requirements for implementing this purpose." (A.5)

> "High density mixed use design has included some of the sites for cinemas the needs assessment for this type of use in these areas." (A.3)

"The city has increased the efficiency of cinema complex utilisation by using these schemes. This could be achieved through providing the main requirements for implementing this purpose into these schemes." (A.2)

"The city has increased the efficiency of cinema complex utilisation by using these schemes." (A.1)

Therefore, this measure was achieved within selected areas (, B and C.

Measure C5. Provision of play area for children

This measure refers to the capacity of the HDMU schemes to provide play areas for children.

Interviewed architects and planners highlighted that the city of Amman has provided play areas for children in these schemes in all three case study areas, as quoted below:

''The city has provided play areas for children either inside buildings or outside buildings by using these schemes."(P.5)

"High density mixed use HDMU schemes have included large tracts for achieving this purpose." (P.1)

"The city has tried to increase play areas for children inside schemes. Therefore, high density mixed use HDMU schemes have included large tracts for achieving this purpose." (A.4)

"The city has tried to increase play areas for children inside buildings." (A.3)

Therefore, this measure was achieved within selected areas A, B and C.

6.3.2 Environmental indicators

This section tests the environmental indicators. These indicators include qualitative and quantitative indicators. The qualitative indicators were tested by means of interviews with the professionals. The quantitative indicators were tested by the numeric facts using the data collected from the content analysis, and multiple sources as specified in section 5.3. This helped to ensure the credibility, reliability and validity of the findings.

Indicator 1: Energy and natural resources

This section tests the indicator of energy and natural resources of the HDMU schemes. The measures under this indicator includes: use/waste solar energy, passive solar gain and cooling, high/low energy consumption, use/waste of daylight in the primary areas and use/ignore natural ventilation by the qualitative methods. The findings are as follows.

Measure E1: Use/Waste solar energy

This measure refers to the capacity of the HDMU to use solar energy systems.

Measure E2: Passive solar gain and cooling

This measure refers to collection, storage, and distribution of solar energy in the form of heat in the winter, and reject solar heat in the summer.

Measure E3: High/Low energy consumption

This measure refers to the capacity of the HDMU to minimize energy consumption.

Interviewed architects and planners highlighted that the city of Amman has made use of solar energy, passive solar gain and cooling and minimisation of energy consumption, using high density mixed use (HDMU)in all three case study areas, as quoted below:

> "The city has studied all factors related to energy and natural resources. This could be achieved by using coordinated systems of weather and sun protection. Locations for colonnades and canopies are included in key buildings along major streets to take advantage of them fully." (A.5)

> "The city has designed new HDMU buildings, to ensure that direct sunlight can reach adjacent sidewalks and parks and public spaces, during cooler times of the year. Employing where necessary angular planes to facilitate this. Similarly, buildings may be used to shadow public spaces during hot periods of the year, the use of trees and tensile structures for shadowing." (A.1)

"The city has succeeded in incorporating energy-efficiency on the HDMU sites, including the use of renewable energy sources, solar energy systems, heat recovery, zero ozone depletion refrigerants, thermally-efficient glazing, high-efficiency heating systems, natural ventilation for cooling systems, zone-controlled lighting, heating and cooling, and light reflective surfaces." (P.5)

"The city has taken into account energy and natural resources, where possible, using renewable energy within new design for high density mixed use." (P.1)

Therefore, these measures were achieved within selected areas A, B and C.

Measure E4 Use/waste of daylight in the primary areas

This measure refers to the capacity of the HDMU schemes to ensure that sunlight can reach the primary inner areas, adjacent sidewalks and parks and public spaces.

Interviewed architects and planners highlighted that the city of Amman has made use of daylight in the primary areas using high density mixed use (HDMU)in all three case study areas, as quoted below:

"The city has designed new HDMU buildings to ensure that direct sunlight can reach adjacent sidewalks and parks and public spaces, during cooler times of the year, employing where necessary angular planes to facilitate this. Similarly, buildings may be used to shadow public spaces during hot periods of the year, the use of trees and tensile structures for shadowing." (A.1)

"The city has made use of daylight in the primary areas for high density mixed use. It has designed these schemes according to criteria that ensures sunlight can reach the primary inner areas; therefore locations for colonnades and canopies are included in key buildings along major streets to take advantage of them fully." (A.2)

"The city has made use of daylight in the primary areas for high density mixed use. It has designed these schemes according to criteria that ensures sunlight can reach the primary inner areas, adjacent sidewalks and parks and public spaces, during cooler times of the year." (A.3)

Therefore, this measure was achieved within selected areas A, B and C.

Measure E5: Use/ignore natural ventilation

This measure refers to the process of "changing" or replacing air inside buildings to provide high indoor air quality.

Interviewed architects and planners highlighted that the city of Amman has made use of natural ventilation using high density mixed use (HDMU)in all three case study areas, as quoted below:

> "The city has made use of natural ventilation for high density mixed use schemes. These buildings have been designed according to the use of coordinated systems of weather and sun protection to provide natural ventilation for these buildings." (A.4)

> "High density mixed use building elevations have been designed to ensure natural ventilation for these schemes. This was achieved by using a Canadian company (Bearing point)." (A.2)

> "High density mixed use building elevations have been designed to ensure natural ventilation for these schemes." (A.1)

Therefore, this measure was achieved within selected areas (A, B, C).

Indicator 2: Water and Water Conservation

This section tests the indicator of water and water conservation of the HDMU schemes. The measures under this indicator include: stores/wastes rainwater in the building for later r-use, uses/ignore grey water recycling and design measures and management plans to limit use of potable water, by the qualitative method. In addition, obtaining water locally (percentage of city population with potable water supply service), high/low water consumption per capita per year were tested by the quantitative method. The findings are as follows.

Measure W1: Stores/Wastes rainwater in the building for later r-use

This measure refers to the capacity of the HDMU schemes to store rainwater in the building for later r-use and water conservation.

Interviewed architects and planners highlighted that the city of Amman has made provision to collect and store rainwater, using high density mixed use (HDMU)in all three case study areas, as quoted below:

> “The city has dealt with the process of storing rainwater in the building for later r-use, using storm water management including use of permeable surfaces and other techniques, and water conservation, including treatment of on-site water." (A.3)

"High density mixed use design included a programme of storing rainwater in the building for later r-use." (A.4)

"The city has tried to minimise storm water runoff to impermeable areas, and specify and install water-efficient irrigation systems." (A.1)

Therefore, this measure was achieved within selected areas A, B and C.

Measure W2: Uses/Ignore grey water recycling

This measure refers to the capacity of the HDMU schemes to use grey water generated from wash hand basins, showers and baths, which can be recycled on-site for uses such as toilet flushing, landscape irrigation and constructed wetlands.

Interviewed architects and planners highlighted that the city of Amman has made provision to recycle grey water, using high density mixed use (HDMU) in all three case study areas. This helped to overcome difficulties in the management of water resources due to inadequate surface and ground water, as quoted below:

> "The city has tried to recycle grey water using high density mixed use (HDMU) schemes within selected areas. This helped to minimise difficulties facing the management of water resources in Amman" (A.1)
>
> "The city has made provision to treat on-site water, in order to overcome difficulties in the management of water resources as a result inadequate of surface and ground water." (A.2)

Therefore, this measure was achieved within selected areas A, B and C.

Measure W3: Locally-obtained water

This measure refers to the percentage of city population with local water supply service and the capacity of the city to provide water for the population locally.

Table 6.8: Percentage of city population with potable water supply service, drawn up by the author.

Selected Area	A	B	C
Percentage of city population with potable water supply service (PMU, 2012)	99%	98%	99%
Percentage minimum threshold (CSD, UN, 2007b)	90%		

It is noted that the percentage of the city population with authorised water service is at least 98%. This is higher than the percentage minimum threshold of 90% within all of the selected areas.

However, interviewed architects and planners highlighted that there are some difficulties relating to accessibility of water to the population because of a shortage in surface and ground water. In addition, the city lacks the financial capacity to provide new techniques to manage this process. Therefore, the city tries to minimise the difficulties in the management of water resources by undertaking new projects for providing water to the population, for example, directing water from the Al-Disi basin to Amman by pipeline, as quoted below:

> "The city does not have the financial capacity to provide new techniques to manage the process of water accessibility to its population. There is a shortage in the surface and ground water." (A.5)

> "There is a shortage in the surface and ground water. Therefore, the city has used undertaken a project to direct water from the Al-Disi basin to Amman by pipe line to resolve the problem of scarce surface and ground water." (P.2)

> "The city has not had the financial capacity to deal with water management plans to minimise the use of potable water for these schemes." (A.3)

> "The city has tried to minimise difficulties facing the management of water resources in Amman via the Al-Disi project." (A.2)

> "The city has treated on-site water, in order to overcome difficulties in the management of water resources as a result of inadequate surface and ground water." (A.1)

Therefore, this measure was achieved within selected areas A, B and C.

Measure W4: High/low water consumption

This measure refers to the volume of water consumption per capita per year.

Water consumption per capita per year: 36m^3(PMU, 2012)

Maximum threshold of water consumption per capita per year: 40m^3(CSD, UN, 2007b)

It is noted that water consumption per capita per year is $36m^3$ for the population within all of the selected areas. This is lower than maximum threshold of water consumption per capita per year at $40m^3$.Therefore, this measure was achieved within selected areas A, B and C.

Measure W5: Design measures and management plans to limit use of potable water

This measure refers to the capacity of HDMU schemes to use techniques and plans to limit use of potable water.

Interviewed architects and planners highlighted that credible efforts were not made in the master plan to limit use of potable water, using high density mixed use (HDMU) in all three case study areas, as quoted below:

> "The city has not dealt with plans for water management to minimise use of potable water for high density mixed use schemes, because of its high cost." (A.5)

> "High density mixed use schemes have not employed the necessary actions to limit use of potable water. This was because of lack of financial capacity for the city to provide new techniques to manage this process, as there is a shortage in the surface and ground water." (P.2)

> "The city has ignored this technology for these high density mixed use buildings despite inadequate surface and ground water." (A.2)

> "The city has not had the financial capacity to deal with plans for water management to minimise use of potable water for these schemes." (A.1)

Therefore, this measure was not achieved within selected areas A, B and C.

Indicator 3: Materials used, Durability and Waste

This section tests the indicator of materials used, durability and waste of the HDMU schemes. The measures under this indicator include: toxic/non- toxic material, use locally-produced materials, use/ignore traditional or modern material, use/ignore recycled materials in the construction of the centre and material re-use/recycling design for disassembly by the qualitative method.

The findings are as follows.

Measure M1: Toxic/Non- toxic material

This measure refers to the capacity of HDMU schemes to avoid the use of toxic material in buildings.

Interviewed architects and planners highlighted that credible efforts were made in the master plan for the use of non-toxic material in the buildings (HDMU) in all three case study areas, as quoted below:

> "The city has tried to reduce the use of toxic materials in the building construction for the implementation of high density mixed use (HDMU) within selected areas. This was achieved by a panel set off experts comprising architects and planners overseeing the different stages of the process." (A.5)

> "The city has avoided the use of toxic/non- toxic materials for these schemes. There is a specialist panel to monitor the construction process for the building in these areas. This panel includes a range of architects and planners." (A.1)

> "The city has not used toxic materials in the building construction for high density mixed use schemes." (A.2)

Therefore, this measure was achieved within selected areas A, B and C.

Measure M2: Use of locally produced materials

This measure refers to the capacity of HDMU schemes to use locally produced materials in the building construction.

Interviewed architects and planners highlighted that credible efforts were made in the master plan to use locally produced materials in the buildings (HDMU) in all three case study areas, as quoted below:

> "The city has used a wide range of local materials for HDMU, to complement the local architecture, for example, the location of building façade openings (doors and windows), including specific design elements (canopies, signage, lighting) that support the creation of shopping streets along build-to lines." (A.1)

> "The city has focused on building cladding, which include the variety of limestone found in the Jordan Valley Region, in combination with glass and pre-finished metal panel systems." (A.2)

> "High density mixed use schemes include the use of locally produced materials in the building construction." (A.4)

Therefore, this measure was achieved within selected areas A, B and C.

Measure M3: Use/Ignore traditional or modern material

This measure refers to the capacity of HDMU schemes to use the materials which seem to have a natural affinity with each other, and are compatible with neighbouring buildings.

Interviewed architects and planners highlighted that credible efforts were made in the master plan to use traditional materials in the buildings (HDMU) in all three case study areas, as quoted below:

> "The city has encouraged using traditional materials to complement the character of the overall city by employing a relatively consistent palette of building materials and referencing (not necessarily copy) the traditional, and relatively simple and orthogonal geometries of the city, which provide a contrast to the ever-changing and variable natural landscape." (A.5)

> "The city has encouraged individual building designs within the HMDU areas to be elegant and differentiated rather than garishly individualistic, using traditional materials." (A.4)

> "The city has been keen to use local and traditional materials for the implementation of high density mixed use schemes." (A.3)

> "The city has taken into account the use of traditional materials for the implementation of high density mixed use (HDMU) within selected areas." (A.1)

Therefore, this measure was achieved within selected areas A, B and C.

Measure M4: Use/ignore recycled materials in the construction of the centre

This measure refers to the capacity of HDMU schemes to use the recycled materials that are potentially usable, which helps accomplish other goals such as conserving natural resources and decreasing energy use.

Measure M5: Material re-use/recycling design for disassembly

This measure refers to the capacity of HDMU schemes for material re-use/ recycling design for disassembly which makes it easier for the product to be repaired or upgraded, thereby prolonging its useful life. It can also help to ensure the product is recycled, and enable whole components to be reused.

Interviewed architects and planners highlighted that the city of Amman has ignored recycled materials in the buildings construction (HDMU)in all three case study areas, as quoted below:

> "The city has not taken into account the use of recycled materials in the buildings construction. It also has not sought materials reuse/recycling design for disassembly." (A.1)
>
> "The city has not been keen to use recycled materials to be included for implementing high density mixed use schemes within the selected areas." (A.3)
>
> "The city has not used recycled materials in the building construction for high density mixed use schemes." (A.5)

Therefore, these measures were not achieved within selected areas A, B and C.

Indicator 4: Sustainable Land use and Site Selection

This section tests the indicators of sustainable land use and site selection of the HDMU schemes. The measures under this indicator include: destroys/protects agricultural land, proximity of site to public transportation, new/respect built environment around the building, enhance/ignore green areas and outdoor environment and collection and recycling of solid wastes by the quantitative method. The findings are as follows.

Measure L1: Destroys/Protects Agriculture Land

This measure refers to protected agricultural surfaces as a percentage of the total municipal area

Table 6.9: percentage of protects agriculture land, drawn up by the author.

Selected Area	A	B	C
Percentage of protected agriculture land (MA, 2012)	98%	60%	91%
Percentage minimum threshold (CSD, UN, 2007b)	90%		

It is noted that the agricultural surfaces as a percentage of the total municipal areas within selected area C is 91%, and area A is 98%. These are higher than the percentage minimum threshold of 90%. Whereas the percentage of total municipal areas within area B is 60%. This is lower than the percentage minimum threshold of 90%. Therefore, this measure was achieved within selected areas A and C, but not within area B.

Measure L2: Proximity of Site to Public Transportation

This measure refers to the number of bus stops and stations available for the local area.

Table 6.10: Number of bus stops and stations, drawn up by the author.

Selected Area	A	B	C
Number of bus stops (GAM, 2012)	63	21	22
Number of stations(GAM, 2012)	3	1	1
Population(GAM, 2012)	40900	21050	25500
Number of bus stops per 100,000 population	154	99	86
Number of stations per 100,000 population	7	4	4
Minimum threshold of measurement per 100,000 population (CSD, UN, 2007b)	Bus stops: 250 Bus stations: 5		

It is noted that the number of bus stops per 100,000 population within selected area A is 154, area B is 99, and area C is 86. These are lower than the specified minimum threshold of measurement per 100,000 population, 250. This was considered inadequate for the population within this area, despite the provision of real-time and travel information at all stops. Therefore, this measure was not achieved within selected areas A, B and C.

Similarly, it is noted that the number of bus stations per 100,000 population within selected area A is 7. This is higher than the specified minimum threshold of measurement per 100,000 population, 5. This was considered adequate for population within this area. However, the number of bus stations available per 100,000 population within area B is 4, and Area C is 4. This is lower than the specified minimum threshold of measurement per 100,000 population. This was, therefore, considered inadequate for the population within these areas. Therefore, this measure was achieved within selected area A, but not within areas B or C.

Measure L3: New/Respect Built Environment Around the Building

This measure refers to protected areas as a percentage of total municipal area A according to the city rules and regulations.

Table 6.11: Percentage of protected areas, drawn up by the author.

Selected Area	**A**	**B**	**C**
Percentage of protected areas (GAM, 2012)	94%	81%	70%
Percentage minimum threshold (CSD, UN, 2007b)	90%		

It is noted that the protected areas as a percentage of total municipal area within selected area A is 94%. This is higher than the percentage of specified minimum threshold of 90%. However, the percentage of protected area within area B is 81%, and area C is 70%.This is lower than the percentage of specified minimum threshold of 90%. Therefore, this measure was achieved within selected area A, but not within areas B and C.

Measure L4: Enhance/Ignore Green Areas and Outdoor Environment

This measure refers to number of citizens that can access nearby public green areas and the size of green space areas per capita of population.

Table 6.12:Green Areas and Outdoor Environment, drawn up by the author.

Selected Area	A	B	C
Number of public green areas (parks and wooded areas) (GAM, 2012)	3	6	6
Population(GAM, 2012)	40900	21050	25500
Number of public green areas (parks and wooded areas) per 100,000 population	7	28	23
Minimum threshold of measurement per 100,000 population (CSD, UN, 2007b)	10		
Population (GAM, 2012)	40900	21050	25500
Area of green space per capita of population.	$1m^2$	$6m^2$	$10m^2$
Minimum threshold of measurement per capita of population. (CSD, UN, 2007b)	$25m^2$		

It is noted that access to nearby public green areas available per 100,000 population within selected area A is 7. This is lower than the specified minimum threshold of measurement per 100,000 population of 10. This was considered inadequate for the population within this area. However, the number in area B is 28, and Area C is 23. These are higher than the specified minimum threshold of measurement per 100,000 population. This was considered adequate for the population within these areas. Nevertheless, it is noted that the area of green space per capita of population within selected area A is $1m^2$, area B is $6m^2$, and area C is $10m^2$. These are lower than the specified minimum threshold of measurement per capita of population of $25m^2$. This means that these areas have small amounts of green space per capita of population. This is not considered adequate for population within these areas.

Therefore, this measure was not achieved within selected areas A, B and C.

Measure L5: Collection and Recycling of Solid Waste

This measure refers to the percentage of the city population with regular solid waste collection, and percentage of waste treatment and disposal.

Measure L5.1: Percentage of city population with regular solid waste collection

The city of Amman provides solid waste management policies, such as solid waste disposal in an integrated waste management system, to minimise land-filling by reducing solid waste volume, and providing solid waste management services and facilities.

Number of employees in collection of waste per 100,000 population=200(DS, 2011)

Minimum threshold of measurement = 100(CSD, UN, 2007b)

Number of transport vehicles per 100,000 population = 22(DS, 2011)

Minimum threshold of measurement = 20(CSD, UN, 2007b)

Number of containers per 100,000 population = 12,030(DS, 2011)

Minimum threshold of measurement = 10,000(CSD, UN, 2007b)

It is noted that the number of employees in the collection of waste per 100,000 of the population is 200, which is higher than the specified minimum threshold of measurement of 100. The number of transport vehicles per 100,000 of the population is 22, which is higher than the specified minimum threshold of measurement of 20. The number of containers per 100,000 of the population is 12,030, which is higher than the specified minimum threshold of measurement of 10,000. This means that these are adequate for the population within selected areas. Therefore, this measure was achieved within selected areas A, B and C.

Measure L5.2: Percentage of Waste Treatment and Disposal

Table 6.13: Waste Treatment and Disposal, drawn up by the author.

Total	Dumped	Landfill	Incineration in open areas	Recycled	Agricultural uses
1,331,467 (Tons)(DS, 2011)	1,324,259	343	3,433	0	3,433
Percentage of waste treatment and disposal	99.45%	0.00025%	0.0025%	0%	0.0025%
Percentage minimum threshold (CSD, UN, 2007b)	Recycling should be more than 50%				

It is noted that a high percentage of waste disposal within the selected areas is by dumping and amounts to 99.45%. There is a very low percentage of waste treatment and disposal within the selected areas by landfill, incineration in open areas, and agricultural means. This amounts to only about 0.00525%. There is no recycling at all within the selected areas and therefore clearly does not satisfy the specified minimum threshold of 50%.

Interviewed architects and planners confirmed that credible efforts were not made in the master plan for collecting and recycling or treating solid waste, using high density mixed use (HDMU) in all three case study areas, as quoted below:

> "The city has not made provision for the collection and recycling of solid waste, using high density mixed use (HDMU) schemes. This is because of its high cost." (A.3)

> "High density mixed use schemes have not made provision to address collection and treatment issues for solid waste. This needs high financial capacity for the city to implement these techniques within HDMU schemes." (A.2)

> "There are many financial obstacles facing the implementation of special technologies for recycling of solid wastes using high density mixed use schemes." (A.1)

Therefore, this measure was not achieved within selected areas A, B or C.

Indicator 5: Transport and Accessibility

This section tests the indicator of transport and accessibility of the HDMU schemes. The measures under this indicator include: consider/ignore planning regulation system, provision of pedestrian routes for population, provision of cycling and cycle facilities by the qualitative method. In addition, the following were tested by the quantitative method: encourage/discourage private car access and public transport provision and facilities, such as provision of public transport, provision of public transport facilities and frequency of public transport.

The findings are as follows.

Measure T1: Consider/Ignore Planning Regulation System

This measure refers to the consideration of planning regulation systems through designing HDMU schemes.

Interviewed architects and planners highlighted that the city of Amman has ignored planning regulation systems in all three case study areas. This created ineffective integration as quoted below:

"The city has not taken into account the use of planning regulation systems for transport and accessibility for the implementation of high density mixed use schemes." (P.5)

"The city has not taken into account the use of planning regulation system for transport and accessibility for the implementation of high density mixed use schemes. In addition, it has used a set of special regulations, which helped to organise the design process for transportation." (P.1)

Therefore, this measure was not achieved within selected areas A, B or C.

Measure T2: Encourage/Discourage Private Car Access

This measure refers to identifying average travel speed on primary thoroughfares during peak hours, which encourages or discourages private car access.

Table 6.14: Average travel speed on primary thoroughfares during peak hours, drawn up by the author.

Selected Area	A	B	C
Average travel speed during peak hours(MT, 2011)	40 km/h	60 km/h	60 km/h
Threshold of average travel speed (CSD, UN, 2007b)	60	70	80

It is noted that the average travel speed on primary thoroughfares during peak hours within selected area A is 40km/h , area B is 60km/h, and area C is 60 km/h. These are lower than the specified threshold of average travel speeds(A=60, B=70, C=80). This means that there is traffic within these areas.

Therefore, this measure was not achieved within selected areas A, B or C.

Measure T3: Provision of Pedestrian Routes for Population

This measure refers to the capacity of HDMU schemes to provide pedestrian routes for the population.

Interviewed architects and planners highlighted that the city of Amman has made provided pedestrian routes for the population in all three case study areas, as quoted below:

> "The city has provided mid-block pedestrian connections within larger development parcels, and these are intended to be designed as pedestrian landscaped mews and lit, landscaped and maintained for public use, which are designed to provide an important connection between streets and public destinations, such as schools, parks, and public transportation." (P.5)

> "The city has designed parking and servicing to have the least possible impact on the streetscape and public open spaces." (P.3)

> "The city has designed principal pedestrian entrances for large buildings through major streets, while parking and servicing areas are through minor streets or lanes, where parking is located below ground." (P.2)

> " The city has provided pedestrian routes for the population." (A.3)

Therefore, this measure was achieved within selected areas A, B and C.

Measure T4: Provision of Cycling and Cycle Facilities

This measure refers to the capacity of HDMU schemes to provide cycle facilities such as dedicated lanes and routes.

Interviewed architects and planners highlighted that the city of Amman has not sought to provide cycling and cycle facilities for the population in all three case study areas, as quoted below:

> "The city has not designed cycle facilities and routes through design processes. However, it has designed parking and servicing with the least possible impact on the streetscape and public open spaces." (P.1)

> "High density mixed use schemes do not include cycle facilities and routes through design processes. However, it has used six types of road structure which serve

these areas and which provide safety for the population without affecting the surrounding environment." (P.2)

"The city has not designed cycle facilities and routes for implementing high density mixed use schemes. However, it has used six types of road structure: highways (60miles), transit roads (40miles), main roads (30miles), collectors (24miles), local roads (16miles) and service lanes (8miles)." (P.3)

Therefore, this measure was not achieved within selected areas A, B or C.

Measure T5: Public Transport Provision and Facilities

This measure refers to the number of transportation systems available for the local area.

Measure T5.1: Provision of public transport

This measure refers to the number of transportation systems available for the local area:

Table 6.15: Number of transportation systems, drawn up by the author

Selected Area	**A**	**B**	**C**
Number of transportation systems (MT, 2011)	712	324	494
Population (DS, 2011)	40900	21050	25500
Number of transportation systems per 100,000 population	173 T	155 T	193 T
Minimum threshold of measurement per 100,000 population (CSD, UN, 2007b)	100 T		

It is noted that the number of transportation systems per 100,000 population within selected area A is 173, area B is 155, and area C is 193. These are higher than the specified minimum threshold of measurement per 100,000 population, 100 T. This was considered adequate for the population enabling them to choose public transportation instead of their own cars, and subsequently helping to reduce traffic on the roads. Therefore, this measure was achieved within selected areas A, B and C.

Measure T5.2: Provision of public transport facilities

This measure refers to the number of bus stops and stations available for the local area.

Table 6.16: Number of bus stops and stations, drawn up by the author.

Selected Area	A	B	C
Number of bus stops (GAM, 2012)	63	21	22
Number of stations(GAM, 2012)	3	1	1
Population(GAM, 2012)	40900	21050	25500
Number of bus stops per 100,000 population	154	99	86
Number of stations per 100,000 population	7	4	4
Minimum threshold of measurement per 100,000 population (CSD, UN, 2007b)	Bus stops: 250 Bus stations: 5		

It is noted that the number of bus stops per 100,000 population within selected area A is 154, area B is 99, and area C is 86. These are lower than the specified minimum threshold of measurement per 100,000 population, 250. This was considered inadequate for the population within this area, despite the provision of real-time and travel information at all stops. Therefore, this measure was not achieved within selected areas A, B and C.

Similarly, it is noted that the number of bus stations per 100,000 population within selected area A is 7. This is higher than the specified minimum threshold of measurement per 100,000 population, 5. This was considered adequate for population within this area. However, the number of bus stations available per 100,000 population within area B is 4, and Area C is 4. This is lower than the specified minimum threshold of measurement per 100,000 population. This was, therefore, considered inadequate for the population within these areas. Therefore, this measure was achieved within selected area A, but not within areas B or C.

Measure T5.3:Frequency of public transport

This measure refers to the average frequency of public transport in the Amman master plan within selected areas.

Table 6.17:Frequency of public transport, drawn up by the author.

Selected Area	**A**	**B**	**C**
Average frequency of public transport (MT, 2011)	10 min	15 min	10 min
Minimum threshold of average frequency of public transport (CSD, UN, 2007b)	(10-20) min		

It is noted that the average frequency of public transport within selected area A is 10 min, area B is 15 min and area C is 10 min. These are all within the minimum threshold of10-20 min. This was considered adequate for the population within these areas. Therefore, this measure was achieved within selected areas A, B and C.

6.3.3 Economic

This section tests the economic indicators. These indicators include qualitative and quantitative indicators. The qualitative indicators were tested by interviews with professionals. The quantitative indicators were tested by the numeric facts using the data collected from the content analysis and multiple sources as specified in section 5.3. This helped to ensure the credibility, reliability and validity of the findings.

Indicator 1: Economic performance

This section tests the indicator of economic performance of the HDMU schemes. The measures under this indicator include lifecycle costs by the quantitative method. In addition high/low quality of maintenance and minimisation of operating and maintenance costs were tested by the qualitative method. The findings are as follows.

Measure EP1: Life Cycle Costs

Measure EP1.A: Lifecycle costs for the building

Interviewed architects and planners highlighted that lifecycle costs for the building are low for this scheme in all three case study areas, as quoted below:

> “The city has drawn up a set of policies to minimise lifecycle costs for the HDMU schemes with high quality performance." (P.2)

> "The city has sought to minimise life cycle costs for high density mixed use with the help of experts in this field from Jordan Engineers Association (JEA)." (P.1)

Therefore, this measure was achieved within selected areas A, B and C.

Measure EP1.B: Life cycle costs for the local community (Gross Domestic Product (GDP) per capita)

This measure refers to the Gross Domestic Product (GDP) per capita per year within selected areas to offset life cycle costs.

Table 6.18: Gross Domestic Product (GDP) per capita, drawn up by the author.

Selected Area	**A**	**B**	**C**
Gross Domestic Product (GDP) per capita (DS, 2011)	10100 $	7050 $	4680 $
Minimum threshold of Gross Domestic Product (GDP) per capita (WB, 2013)	It should be above the poverty line in Jordan (5930 $)		

It is noted that the Gross Domestic Product (GDP) per capita per year within selected area A is 10100 $, and area B is 7050 $. These are higher than the specified minimum threshold of measurement of Gross Domestic Product (GDP) per capita per year in Jordan of 5930 $. This was considered adequate for the population within these areas. However, Gross Domestic Product (GDP) per capita within area C is 4680 $.This is lower than the specified minimum threshold and was considered inadequate for the population within this area.

Therefore, this measure was achieved within selected areas A and B), but not within area C.

Measure EP2: High/Low quality of maintenance

This measure refers to the capacity of HDMU schemes to receive high quality periodic maintenance.

Measure EP3: Minimization of operating and maintenance costs

This measure refers to the capacity of HDMU schemes to minimise operating and maintenance costs.

Interviewed architects and planners highlighted that the operating and maintenance costs are low along with high quality of maintenance for this scheme in all three case study areas, as quoted below:

> "High density mixed use schemes have taken into account economic performance. They minimised the operating and maintenance costs whilst achieving a high quality level of maintenance for this scheme (HDMU)." (A.2)

> "The city has taken advantage of experts in this field from Jordan Engineers Association (JEA) designing these schemes to minimise the operating and maintenance costs, and achieving a high quality level of maintenance." (A.4)

> "High density mixed use schemes have taken into account economic performance. They minimised the operating and maintenance costs whilst achieving a high quality level of maintenance for this scheme (HDMU), using a wide range of experts in this field from Jordan Engineers Association (JEA)." (P.4)

Therefore, this measure was achieved within selected areas A, B and C.

Indicator 2: Employment of Local People

This section tests the indicator of employment of local people of the HDMU schemes. The measures under this indicator includes 'job creation for locals’ by the quantitative method. In addition, 'participation of local institutions in the building’ and ‘ignore/provide training for locals’ were tested by the qualitative method. The findings are as follows.

Measure LE1: Job Creation for Locals (employment: population ratio)

This measure refers to the capacity of HDMU schemes to create job opportunities for the local community to increase the employment: population ratio

Percentage of minimum threshold: (50%) (WB, 2013)

Percentage of employment: population: (15%) (GAM, 2011)

It is noted that the percentage of employment: population is 15% within all the selected areas. This is lower than the percentage minimum threshold of measurement of 50%. This means that the city of Amman has not sought to create job opportunities for the local population using HDMU schemes, because it faces a number of key economic challenges regarding employment: population ratio. Therefore, it should try to improve opportunities and access to jobs for disadvantaged communities using HDMU schemes.

Therefore, this measure was not achieved within selected areas A, B and C.

Measure LE2: Participation of Local Institutions in the Building

This measure refers to the job opportunities for local institutions in the scheme.

Interviewed architects and planners highlighted that the participation of the city of Amman in civic engagement (with private sector and public institutions) was effective in the building processes in all three case study areas, as quoted below:

> "The city has provided opportunities for the local institutions to participate in these schemes. These schemes offer several activities that can be operated by the local institutions." (A.5)

> "High density mixed use schemes offer opportunities for the local institutions to participate via several projects within these schemes. Participants include the Jordan Engineers Association (JEA) and the Amman Commission (AC)." (P.2)

> "The city has provided opportunities for the local institutions to participate. Sessions were held with different sectors within local institutions (such as the Jordan Engineers Association (JEA) and the Amman Commission (AC))who provided technical and administrative support." (A.2)

Therefore, this measure was achieved within selected areas A, B and C.

LE3: Ignore/Provide Training for Locals

This measure refers to the capacity of HDMU schemes to provide training opportunities for the local community.

Interviewed architects and planners highlighted that the city of Amman has not made training provision for locals in all three case study areas, as quoted below:

> "The city has not taken into account training provision for locals in the design of high density mixed use (HDMU). In addition, they have not tried to provide training programs for locals using HDMU schemes." (P.3)

> "The city has not provided training programs for locals in the design of high density mixed use (HDMU). This has led to constraints to improving their opportunities and access to jobs through these programmes." (A.4)

> "The city has not tried to create more training opportunities for the population through commercial sites within selected areas." (A.2)

Therefore, this measure was not achieved within selected areas A, B and C.

Indicator 3: Building Management and Controllability

This section tests the indicator of building management and controllability of the HDMU schemes. The measures under this indicator includes 'provision of building management control system' and 'provision for on-going monitoring and verification performance' by the qualitative method. In addition, 'minimise the consumption of energy resources' and 'minimise the consumption of water' were tested by the quantitative method. The findings are as follows:

Measure MC1: Provision of building management control system

This measure refers to the capacity of HDMU schemes to provide a building management control system which consists of a computer-based control system installed in buildings that controls and monitors the building's mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems.

MC2: Provision for on-going monitoring and verification performance

This measure refers to the capacity of HDMU schemes to ensure on-going monitoring and verification performance for the building management control system.

Interviewed architects and planners highlighted that the city of Amman has taken into account a building management control system and on-going monitoring and verification performance in all three case study areas, as quoted below:

> "The design of high density mixed use schemes has used modern control systems to manage these sites. These designs have the capability to provide on-going monitoring and verification performance." (A.1)
>
> "High density mixed use schemes will be contained in control systems to manage this project. This can be achieved by private companies in collaboration with Greater Amman Municipality in order to manage this process." (A.5)
>
> "High density mixed use sites will be divided into zones to facilitate the management and monitoring of these schemes by private agencies." (A.2)
>
> "High density mixed use schemes include control systems to manage this project. Greater Amman Municipality has ability to monitor these sites, using the private sector for on-going monitoring performance of these schemes within selected areas." (A.3)

Therefore, this measure was achieved within selected areas A, B and C.

Measure MC3: Minimise the consumption of energy resources

Measure MC3.1: Minimisation of annual energy consumption - total and by main user category

This measure refers to the capacity of HDMU schemes to minimise the annual energy consumption - total and by main user category as shown in Table 6.17.

Table 6.19: Annual energy consumption, drawn up by the author.

Total	Electricity	Renewable energy	Natural gas	Crude oil & oil products
7355 (Tons)(DS, 2011)	168	124	2289	4774
Percentage of annual energy consumption	2.2%	1.7%	31.1%	65%
Percentage minimum threshold (CSD, UN, 2007b)	20%	20%	10%	50%

It is noted that the total annual energy consumption within selected areas A, B and C is 7355 tons. The percentage of crude oil & oil products is 65%, and the percentage of natural gas is 31.1%. These are higher than the percentage of specified minimum threshold of total energy consumption for the population. However, the percentage of renewable energy is 1.7%, and the percentage of electricity is 2.2%. These are lower than the percentage of specified minimum threshold of total energy consumption for the population.

Interviewed architects and planners highlighted that credible efforts were made in the master plan to minimise the consumption of energy resources, using high density mixed use (HDMU) in all three case study areas, as discussed in section 5.3.2.1. Nevertheless, this measure was not achieved within selected areas A, B and C.

Measure MC3.2: Share of renewable energy sources in total energy use

This measure refers to share of renewable energy sources in total energy consumption:

$$\text{Share of renewable energy sources in total energy use} = \frac{124}{7355} \times 100\% = 1.7\%$$

It is noted that the percentage of renewable energy sources in total energy use is 1.7% of the annual energy consumption. This is lower than the percentage of measurement of total energy consumption for the population. Therefore, this measure was not achieved within selected areas A, B and C.

Measure MC4: Minimise the consumption of water

This measure refers to the techniques used to minimise water consumption.

Interviewed architects and planners highlighted that the city of Amman has taken action necessary to minimise the consumption of water in all three case study areas, as quoted below:

> "The city has used a wide range of techniques in water supply through design of high density mixed use buildings to minimise the consumption of water. These were designed by one of the local companies." (A.1)

> "There were some sessions for the minimisation of water consumption using high density mixed use scheme designs through using high-level techniques in this field to reduce the consumption of water." (P.2)

Therefore, this measure was achieved within selected areas A, B and C.

6.3.4 Governance

This section tests the governance indicators. These indicators are qualitative and were tested by means of interviews with professionals.

Indicator 1: Participation

This section tests the indicator of participation of the HDMU schemes. The measures under this indicator include participation by the local community and by the private sector and public institutions, using the qualitative method.
The findings are as follows.

Measure PP.1: Participation by the local community (citizens participation)

This measure refers to the participation by the local community (citizens) during the implementation of the HDMU schemes in the Amman master plan.
Interviewed architects and planners highlighted that the participation between the city of Amman and the local community was ineffective in all three case study areas, as quoted below:

> "The city has tried to hold some sessions and to have several dialogues in order to take account of their views about these designs for HDMU. Their views were not taken into account for the selected areas due to lack of good media coverage for the project, which led to the emergence of local community resistance to many issues related high density mixed use." (A.1)

"There was participation by the local community to hear their views about Greater Amman Municipality's proposals for high density mixed use (HDMU) sites. However, there were no responses from the city of Amman to their objections, because there are many existing issues between them which have not yet been resolved. These problems arose because of the unsuitability of a set of regulations and laws which govern land use. " (P.3)

"There were some meetings with the local community to take account of their views for the selected areas for the master for the city of Amman. However, these meetings were not effective for the master plan, because there were conflicts between them due to a set of old regulations since 1964 which still govern land use." (P.2)

"There wasn't any role for the local community in the design of high density mixed use within selected areas. This was because of the emergence of local community resistance and negative media coverage for the Amman master plan, due to lack of communication between the private sector, local citizens and local government bodies." (P.4)

Therefore, this measure was not achieved within selected areas A, B and C.

Measure PP.2: Participation of private sector and public institutions (Civic engagement)

This measure refers to the participation of private sector and public institutions during the implementation of the HDMU schemes in the Amman master plan.

Interviewed architects and planners highlighted that the participation between the city of Amman and the private sector was not effective in all three case study areas, as quoted below:

"The city of Amman has tried to hold some sessions with different sectors within the private sector to provide technical and administrative support to the city of Amman, and to hear their views about regulations relating to some studies for the master plan for the city. such as; Jordan Engineers Association (JEA) and Amman Commission (AC) However, there are difficulties in providing the skills and experience needed in delivering sustainable urban design practices due to the scarcity of professionals in this field." (A.1)

"There was a problem sourcing the skills necessary to develop the master plan for the city of Amman according to urban sustainability practices even though meetings were held with the private sector to try and overcome this obstacle." (P.1)

"There were several meetings with planners regarding land prices and commercial sites within selected areas." (P.3)

"The city hired some outside experts from the private sector, because the public sector cannot provide the experience and skills needed for the application of high density mixed use schemes using urban sustainability practices." (A.5)

Interviewed architects and planners highlighted that the participation between the city of Amman and public institutions was effective in all three case study areas, as quoted below:

> "There was participation with public government institutions, where they have provided many services for the local community in the selected areas regarding infrastructure. (A.4)

> "The city received all the necessary approvals and proposals for the final designs of high density mixed use from organisations such as: the National Electric Power Company (NEPC), and the Programme Management Unit (PMU) of the Ministry of Water and Irrigation and of Civil Defence institution. Their main role, however, was to calculate the economic cost of this project." (A.1)

> "Public institutions have helped Greater Amman Municipality to get the necessary approvals for these designs of high density mixed use, from the institution of Civil Defence among others." (P.3)

> "The city hired some of the existing expertise within public institutions to calculate the economic cost of this project." (P.2)

Interviewed architects and planners highlighted that the political participation with the city of Amman was effective in all three case study areas, as quoted below:

> “There were several meetings with the region vice in the Parliament who represents political participation. Since some of the politicians participating were members some city of Amman committees, this helped to push through many positive decisions for the selected areas." (A.3)

> "The city has tried to meet with region vices in order to explain the implementation of this project on the ground.” (A.4)

> "Political participation has played key decisional role in the application of this project of high density mixed use.” (P.4)

> "The city invited some region vices to meet with them and to hear their views on the application of high density mixed use within selected areas." (P.3)

Therefore, this measure was achieved within selected areas A, B and C.

Indicator 2: Communication

This section tests the indicator of communication of the HDMU schemes. The measures under this indicator include 'connection with the private sector' and 'connection with the local community', by the qualitative method.

The findings are as follows.

Measure PC.1: Connection with the private sector

This measure refers to the capacity of the city of Amman to provide the connection between the competent authorities in the Amman master plan and the private sector.

Interviewed architects and planners highlighted that the communication between the city of Amman and private sector is effective within areas A and C, but not within area B, as quoted below:

> "There were communications between the city of Amman and the competent authorities within the private sector, by means of several meetings with the Amman commission including architects and planners, to hear their views on the regulations and laws relating to HDMU." (P.4)
>
> "There is communication between Greater Amman Municipality and the private sector. Greater Amman Municipality has taken some of their solutions and proposals relating to final designs within selected areas A and C, in order to overcome constraints shown by the indicators, but they have not taken their views regarding area B." (P.2)
>
> "There is direct communication between Greater Amman Municipality and the competent authorities represented by the Amman Commission, which comprises architects and planners." (A.3)

Therefore, this measure was achieved within selected areas A and C, but not within area B.

Measure PC.2: Connection with the local community (citizens)

This measure refers to the capacity of the city of Amman to provide the connection between the competent authorities in the Amman master plan and the local community (citizens).

Interviewed architects and planners highlighted that the communication between the city of Amman and the local community is effective within areas A and C, but not within area B, as quoted below:

> "The city seeks to hold some sessions with the local community about any designs relating to high density mixed use (HDMU)." (A.1)
>
> "There is an official time period for showing any new proposals of Greater Amman Municipality to the local community. This period is for two to four months but does not apply to area B." (A.3)
>
> "The city always seeks to hold meetings with the local community to explain any change of design relating to high density mixed use (HDMU)." (P.1)
>
> "There is a period of time for any new proposals by the Greater Amman Municipality to be shown to the local community. This period allows the local community to object to new proposals within their areas, but time was not given for this to the local community in area B." (P.3)

Therefore, this measure was achieved within selected areas A and C, but not within area B.

6.4 Discussion of findings

This section presented a comparative study of the three case study areas in Amman, Jordan. The testing of the theoretical sustainable urban indicators in the context of the three case study areas in Amman is summarised in Table 6.20. This comparison uses the compliance analysis which consists of three types as represented by the included indicators (met threshold, denoted by *), the similar indicators (equals threshold, denoted by -, and the not included indicators (did not meet threshold, denoted by O).

Table 6.20: The comparison between the three selected areas (A, B, C) in Amman

Dimensions	***Indicators***	***Selected Areas***		
		A	***B***	***C***
Social	Functionality, Usability and Aesthetic aspects	*	*	*
	Indoor Environmental Quality/Health and Well being	---	---	---
	Architectural considerations and cultural heritage	*	*	*
	Local people facilities	*	O	O
	Customers facilities and trends	*	*	*
Environmental	Energy and Natural Resources	*	*	*
	Materials used, Durability and Waste	*	*	*
	Sustainable Land use and Site selection	*	O	O
	Transport and Accessibility	O	O	O
	Water and water conservation	*	*	*
Economic	Economic performance	*	*	*
	Employment of local people	O	O	O
	Management and Controllability	---	---	---
Governance	Public Participation	---	---	---
	Public Communication	*	O	*

- * met threshold (included) A: Central Parkway, B: Northern Gateway, C: Southern Gateway
- O did not meet threshold (not included)
- \- equals threshold (similar)

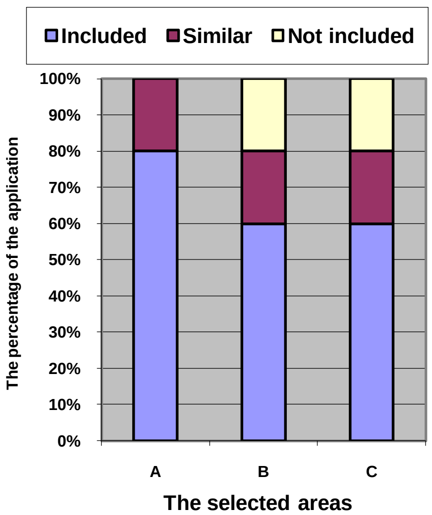

Figure 6.7 Social indicators

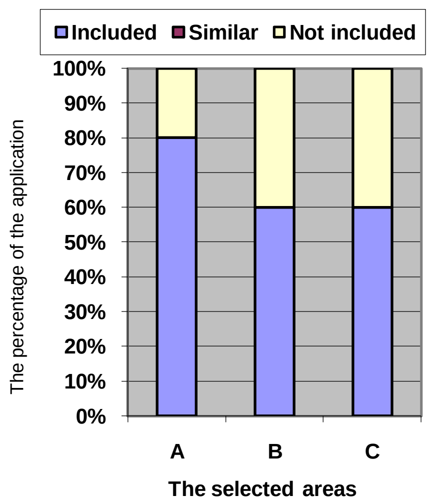

Figure 6.8 Environmental indicators

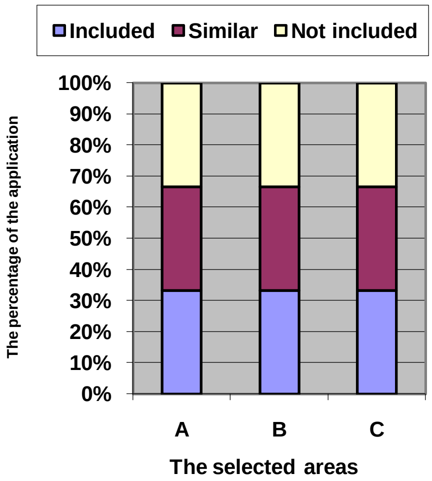

Figure 6.9 Economic indicators

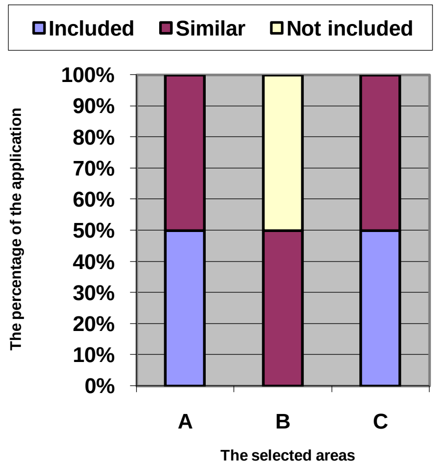

Figure 6.10 Governance indicators

At the neighbourhood level of the selected areas (A, B, C), it was found that the social and environmental indicators were the most implemented within the proposed HDMU schemes (Figure 6.7 and 6.8).

Figure 6.9 shows that economic indicators that were applied at the neighbourhood level of the selected areas (A, B, C), represent the lowest percentage of urban sustainability indicators, because the employment indicator at the local level was not considered and included in the proposed implementation of the HDMU schemes. However, efforts are being made to address the economic challenges in order to overcome constraints in the application of these indicators. This includes commercial sites within each of the case study areas aimed at creating more job opportunities for the population.

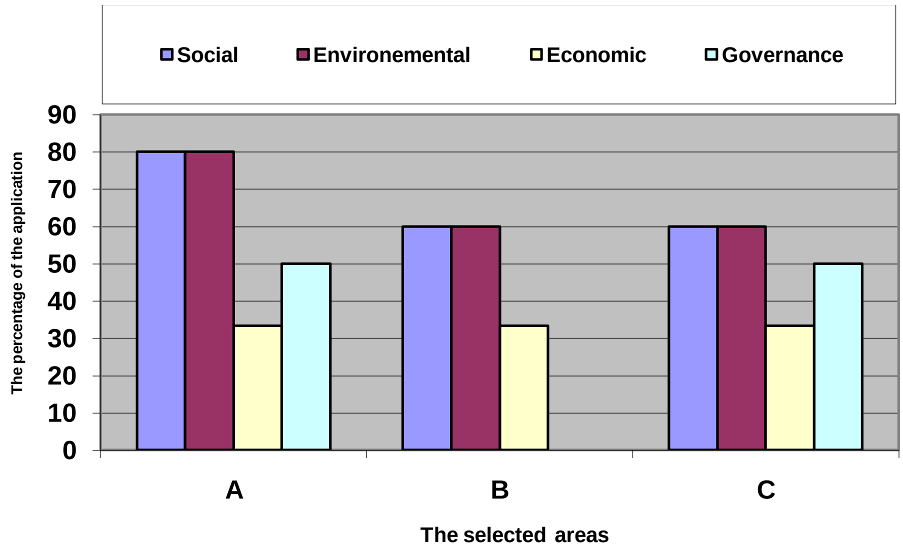

Figure 6.11: Compliance with the 4 dimensions

A priority was found for social and environmental indicators in the master plan (Figure 6.11) of the city of Amman. It was also found that the high density mixed use have positively influenced the selected areas, through the increase of the percentage of environmental provisions. In addition, the social indicators implemented in the master plan have contributed to improvements to infrastructure for the selected areas which in turn positively serves the local community and investors.

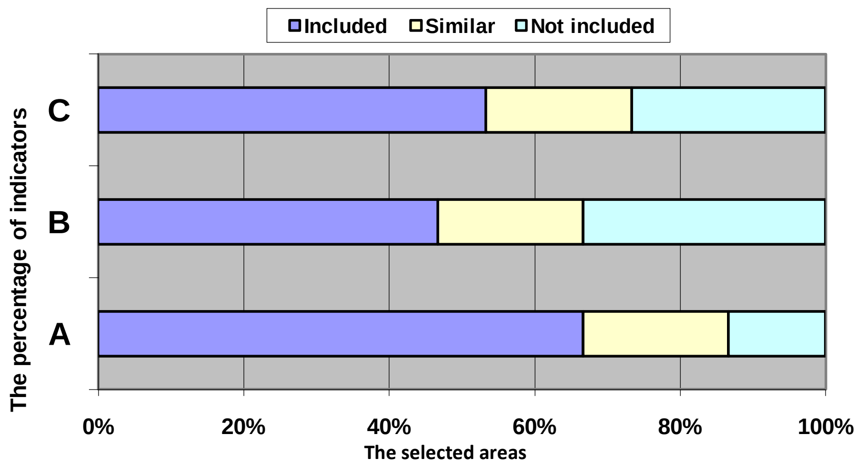

Figure 6.12: Compliance with the 15 indicators

Figure 6.12 shows that the highest percentage (out of a total of 15) of urban sustainability indicators is within area A, where 10 are included and 3 are viable (similar). As for the lowest percentage of urban sustainability indicators, they are within area B, where 7 are included and 3 are viable (similar). Therefore, area B is considered the least favourable area to apply urban sustainability indicators using HDMU. This area contains the lowest possible number of indicators due to high land prices and its long distance from the city centre. Area A is identified as the most suitable for high density mixed used schemes and is, therefore, used in the next stages of this study. This area contains the largest possible number of indicators because of its close proximity to the city centre and the provision of the largest possible number of services.

According to the indicator tests identified by the literature review in Amman, the study identified the suitable indicators for the city based on the measurements which met the threshold as shown in Table 6.21 below. In the context of Amman, 10 indicators were determined for the city from the 15 indicators identified from Al-Waer and Sibley (2006). These indicators constituted the first component of the framework according to DEA (2010;2006;2005;1998), Ndeke (2011) and Lehman (2010). The 10 indicators were further checked at the questionnaire phase.

Table 6.21: Suitable indicators for the city of Amman

Dimensions	Indicators
Social	Functionality, Usability and Aesthetic aspects
	Local people facilities
	Architectural considerations and cultural heritage
	Customers facilities and trends
Environmental	Energy and Natural Resources
	Materials used, Durability and Waste
	Sustainable Land use and Site selection
	Water and water conservation (W)
Economic	Economic performance
Governance	Public Communication

Additionally, the thesis used the ‘not achieved measurements' which did not meet the threshold for the indicators to identify the key constraints affecting the implementation of sustainable urban design principles using HDMU schemes in the Amman master plan, as shown in Table 6.22.

Table 6.22: Main constraints facing the implementation of the sustainable urban design principles in Amman

Indicators	Constraints
Social	The percentage of open space area compared to the city's area is low
	Indoor noise and acoustic noise in primary areas inside buildings
	Indoor air quality non monitoring inside buildings
	Shortage of internet facilities used as a way of online shopping
	The population income is inadequate for housing price or rent
Environmental	Difficulties in the management of water resources: inadequate of surface and ground water
	Absence of recycled materials in building construction
	Ineffective integration between land use, transport planning and other governance functions such as; ineffective infrastructure
	The percentage of open public green space compared to the city's area is low
	The percentage of waste treatment and disposal is low.
	Difficulties in moving around the city such as; traffic and congestion
	Absence of cycle lanes and cycle facilities
	Shortage of frequent fixed bus stops
Economic	The percentage of annual renewable energy consumption of total energy consumption is low
	Difficulties to create job and training opportunities for local community
Governance	Emergence of Local community resistance and negative media coverage for the master plan project, because of problems in communication between private sectors and local citizens and local government bodies.
	Difficulties in providing the skills and experience of professionals involved in delivering sustainable urban design.
	Unsuitability of the regulations and laws which govern land use

Table 6.22 extrapolates these constraints across the four dimensions for sustainable development: social, environmental, economic and governance. These constraints constitute the second component of the framework which was identified through the literature review by Pearce (2000) Pearce and Barbier (2000), DEA (2010;2006;2005;1998), Ndeke (2011), Lehman (2010) and Al Waer *et al.* (2014). These constraints were further checked at the questionnaire phase. Additionally, the next phase of this study using a questionnaire survey further explored a set of solutions to overcome these constraints using the solutions applied in the city of Curitiba, as identified in section 4.7.

In the questionnaire phase as part of the research, the questions focused on the issues which affect implementation such as suitable indicators, constraints and solutions to be used effectively as part of the framework for implementing SUDP using HDMU schemes in Amman. Starting from here, the study raised a set of key questions which it was judged would help to propose the implementation framework, as follows:

1. In your views, to what extent does each of the following affect the effective implementation of the sustainable urban design using high density mixed use schemes in Amman?

Table 6.23:Main constraints affecting the implementation of sustainable urban design principles using HDMU

No	Constraints	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Soc.1	Indoor noise and acoustic noise in primary areas inside buildings					
Soc.2	Indoor air quality non monitoring inside buildings					
Soc.3	Shortage of cultural facilities					
Soc.4	The population income is inadequate for housing price or rent					
Soc.5	The percentage of open space area compared to the city's area is low					
Env.1	Difficulties in the management of water resources: inadequate of surface and ground water					
Env.2	Absence of recycled materials in building construction					
Env.3	Ineffective integration between land use, transport planning and other governance functions such as; ineffective infrastructure					
Env.4	The percentage of open public green space compared to the city's area is low					
Env.5	The percentage of waste treatment and disposal is low.					
Env.6	Difficulties in moving around the city such as; traffic and congestion					
Env.7	Absence of cycle lanes and cycle facilities					
Env.8	Shortage of frequent fixed bus stops					
Eco.1	The percentage of annual renewable energy consumption of total energy consumption is low					
Eco.2	Difficulties to create job and training opportunities for local community					
Gov.1	Emergence of Local community resistance and negative media coverage for the master plan project, because of problems in communication between private sectors and local citizens and local government bodies.					
Gov.2	Difficulties in providing the skills and experience of professionals involved in delivering sustainable urban design.					
Gov.3	Unsuitability of the regulations and laws which govern land use					

2. In your view, please specify the appropriate solutions to overcome these constraints for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman? You can choose more than one choice.

Table 6.24: Main constraints and their solutions affecting the implementation of sustainable urban design principles using HDMU

Constraints	Proposed solutions
Soc.1 Indoor noise and acoustic noise in primary areas inside buildings	○ The use of sound absorbing materials inside the buildings
Soc.2 Indoor air quality non monitoring inside buildings	○ Integration of air conditioning to monitor air quality inside buildings, and performing regular maintenance of these devices
Soc.3 Shortage of cultural facilities	○ Commissioning of new cultural facilities
Soc.4 The population income is inadequate for housing price or rent	○ The establishment of finance programs in collaboration with lending institutions ○ Providing institutional support to encourage participation and partnership arrangements. ○ Promoting the use and maintenance of existing housing stock and the development of affordable rental housing
Soc.5 The percentage of open space area compared to the city's area is low	○ The work of expansion of open space areas for the city.
Env.1 Difficulties in the management of water resources: inadequate of surface and ground water	○ Ensuring a clean water supply for commercial, agricultural, industrial and urban uses ○ Prevention of the degradation of surface and ground water
Env.2 Absence of recycled materials in building construction	○ The use of recycled materials in new buildings, and the use of new building elements should be compatible with the urban context.
Env.3 Ineffective integration between land use, transport planning and other governance functions such as; ineffective infrastructure	○ Use of express bus lanes and the use of computerized area traffic control system. ○ Providing a free bus service painted green on weekends to parks ○ Keeping the public informed about environmental issues, using programs that encourage community responsibility for the parks. Local schools promote ecological principles
Env.4 The percentage of open public green space compared to the city's area is low	○ Expansion of park/green areas and reduced resource use
Env.5 The percentage of waste treatment and disposal is low.	○ Using solid waste management program that encourages citizens to separate organic from inorganic. Separating piped water from sewage lines
Env.6 Difficulties in moving around the city such as; traffic and congestion	○ The use of rapid bus transport system as a system of public transportation ○ Improvement of mass transit system and a restructuring of the roads ○ reducing the cost of mobility and promoting trade within the city

	○ Work to develop new ways to incorporate the city with the surrounding metropolitan area
Env.7 Absence of cycle lanes and cycle facilities	○ Plan the integrated transport network to install bike paths as new transportation alternatives
Env.8 Shortage of frequent fixed bus stops	○ Construction of many bus stops alongside transport routes
Eco.1 The percentage of annual renewable energy consumption of total energy consumption is low	○ Encourage the use of renewable energy within the designs for new buildings to reduce annual energy consumption
Eco.2 Difficulties to create job and training opportunities for local community	○ Using strategies to engage the private sector to provide a set of job and training opportunities for the local community.
Gov.1 Emergence of Local community resistance and negative media coverage for the master plan project, because of problems in communication between private sectors and local citizens and local government bodies.	○ Holding public debates that encourage the involvement of citizens and the private sector including architects, engineers, economists, sociologists, and public administrators ○ Founding the regional administration centres to identify similarities between regions and plan social programs for the periphery. Integrate the public into each social programs ○ Keeping the public informed about environmental issues, using programs encourage community responsibility for the parks, which provide aesthetic and recreational value
Gov.2 Difficulties in providing the skills and experience of professionals involved in delivering sustainable urban design.	The use of the skills and experiences available in the public institutions and private sector ○ The use of the outside experts to support this process
Gov.3 Unsuitability of the regulations and laws which govern land use	○ Land use laws should minimize transport demands, save energy, protect open and green spaces.

3. Through the emergence of the constraints previously, do you agree or disagree with that the ranking of the suitable urban sustainability indicators for the city of Amman, which can be implemented by this process is as follows?

1. Social
2. Environmental
3. Governance
4. Economic

Yes No

If you answered Yes in C3 above, please move to question C.5

4. If you answered No in C.3 above, please rank the following to be suitable indicators for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 6.25: The suitable sustainable urban design indicators for Amman

Ranking	Indicators	Your ranking
1	Social	
2	Environmental	
3	Governance	
4	Economic	

5. In your views, to what extent does each of the following are suitable indicators for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 6.26: Contextualised sustainable urban design indicators for Amman

Dimensions	Indicators	Highly agree	Agree	Neither agree nor disagree	Disagree	Highly disagree
Social	Functionality, usability and aesthetic aspects					
	Local people facilities					
	Architectural considerations and cultural heritage					
	Customers facilities and trends					
Environmental	Energy and natural resources					
	Materials used, durability and waste					
	Sustainable land use and site selection					
	Water and water conservation					
Economic	Economic performance					
Governance	Public communication					

Finally, this chapter developed the framework including its components which will be further explored in the next chapter as shown in Figure 6.13.

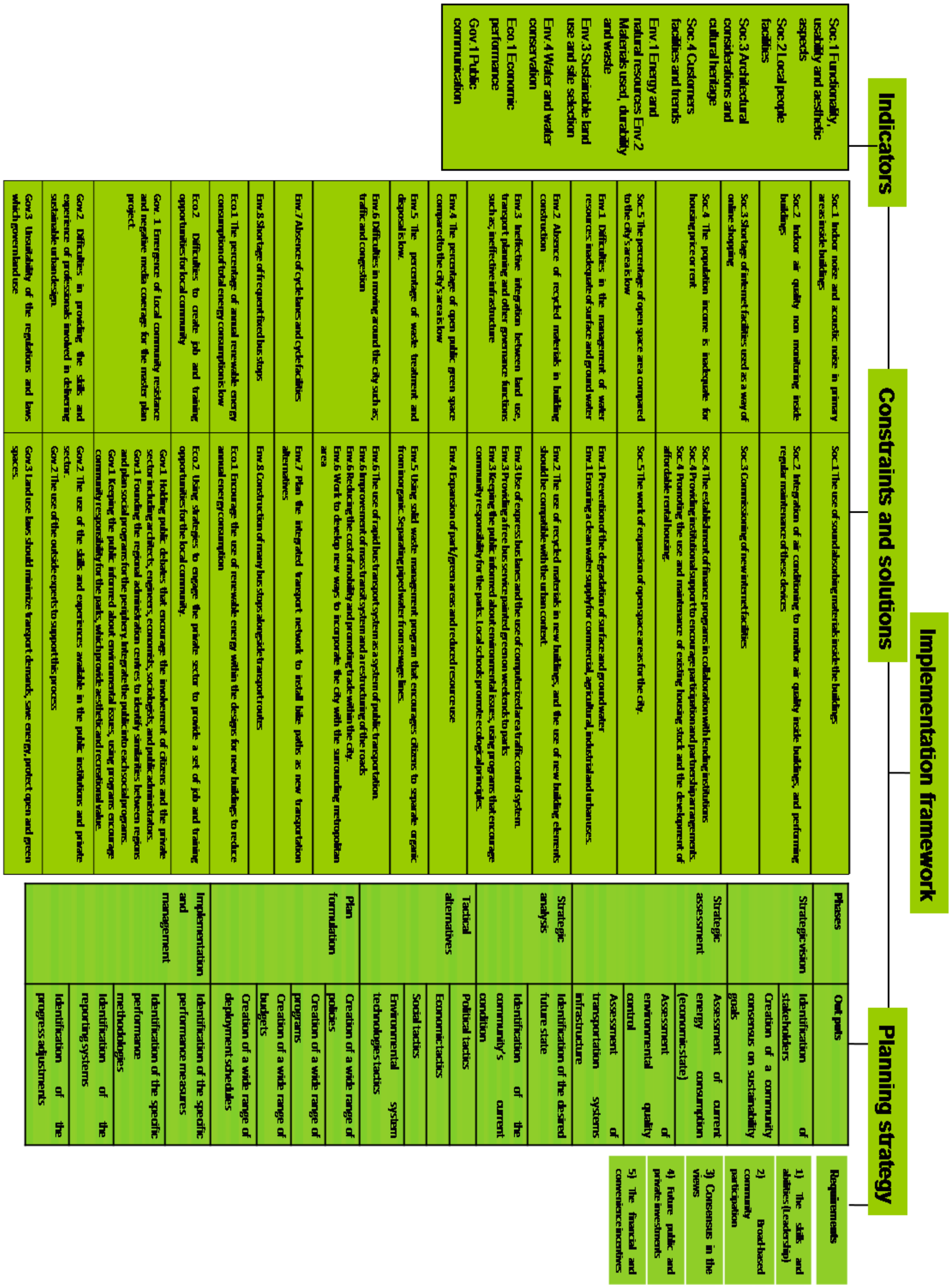

Figure 6.13: Implementation framework (Source: the Author)

6.5 Chapter Summary

This chapter found that the city of Amman has to a large extent succeeded in achieving environmental and social indicators thresholds within the selected case areas. These indicators have are being used to develop the infrastructure for the selected areas, using HDMU to serve the local community and investors. However, the city of Amman has failed in achieving economic targets within the selected areas. These targets had the lowest percentage of application because the city of Amman did not take these into account the indicator thresholds when designing HDMU schemes in the selected areas.

It was also found that the city of Amman started to implement these schemes within area A only as identified by the literature review in section 4.6. This was also partly because of existing services and available infrastructures in this area, and also the increasing demand for HDMU by investors in this central area. This also agrees with the main findings from testing the indicators in the three areas. These findings confirmed that area A is the best area to implement these schemes.

To summarise, it was found that area A complied with the highest percentage of urban sustainability indicators, when tested at the neighbourhood level. Its location close of the city centre also meant that it ranked highly on infrastructure. This helped to provide the largest possible number of services for HDMU. In addition, it had the highest percentage for every indicator. Therefore, Area A was considered to be the best area for the next stage of the study. Area B scored the lowest percentage of urban sustainability indicators applied at the neighbourhood level of the selected three areas. This is because of its location far from the city centre and high land prices. Therefore, it is considered the least favourable area to apply of urban sustainability indicators using HDMU.

Finally, this chapter identified part of the main components of the implementation framework represented in; (1) a set of the suitable indicators for the city of Amman through testing the indicators identified by the literature review; (2) a set of constraints which need to be addressed through finding their solutions and (3) a planning strategy, which constitute the other part of the main components of the implementation framework. These complexities will be addressed in detail in the next chapter through findings from the questionnaire survey and interviews for proposing the implementation framework.

Chapter 7

Proposing and evaluating the implementation framework: Findings from questionnaire survey and interviews

7.1 Introduction

This chapter presents the profile of participants in the survey. It discusses the findings from the questionnaire survey as a means of identifying the components constituting the implementation framework. The aim here is to further refine and contextualise the findings identified through the literature review and to test the indicator for the implementation of HDMU schemes in Amman. These questionnaire findings helped to further reinforce the set of solutions and the planning strategy identified from the literature review. The chapter also validates the suitable indicators and constraints previously identified when testing the indicators against the case study area in Amman.

The questionnaire used a wide range of architects and planners who were at the time working at the Greater Amman Municipality (GAM) as part of the Amman master plan team. This team is responsible for implementing HDMU schemes in the master plan according to SUDP. This provided the necessary information about the implementation of SUDP using HDMU schemes in Amman, and their views were used to formulate the implementation framework. The questions were derived from the literature review as discussed in section 3.4 and the findings from testing the indicators in Amman as discussed in section 6.4.

Additionally, this chapter discusses the findings from the interviews as a means of evaluating the components constituting the implementation framework. These interviews findings helped to further evaluate the suitable indicators, constraints, solutions and planning strategy for the implementation of SUDP using HDMU identified by the findings of the questionnaire survey. The questions used in these interviews were informed by the questionnaire findings. The chapter concludes with a framework for the implementation of sustainable urban design principles in context in Amman.

7.2 Survey respondents' profile

The profile of participants in the survey is presented in this section. As discussed in the methodology chapter, 120 architects and planners who were at the time working at the Greater Amman Municipality (GAM) as part of the master plan team were invited to participate in the survey. These professionals were selected using professional lists obtained from the Jordan Engineers Association (JEA) and Greater Amman Municipality (GAM) databases. The questionnaire was distributed to the professionals by hand. 100 responses were received back giving a response rate of 83.3%.

The survey questions can be found in Appendix 3 and the survey data in Appendix 4.

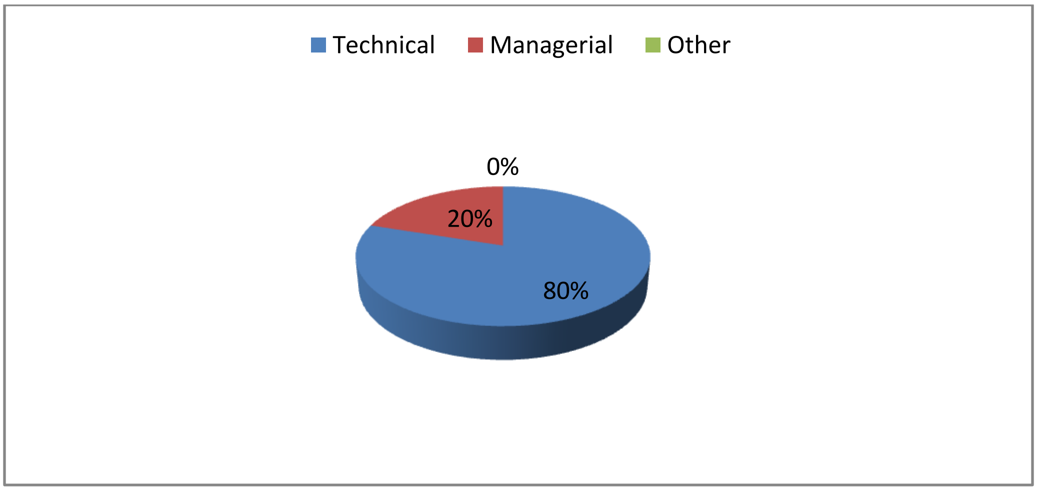

Figure 7.1: Role of professionals

Of the participating professionals, 80% worked in a technical role and 20% in a managerial role in the formulation of the master plan. Hence, the participants were involved, in some capacity, in the design and delivery of the master plan (Figure 7.1).

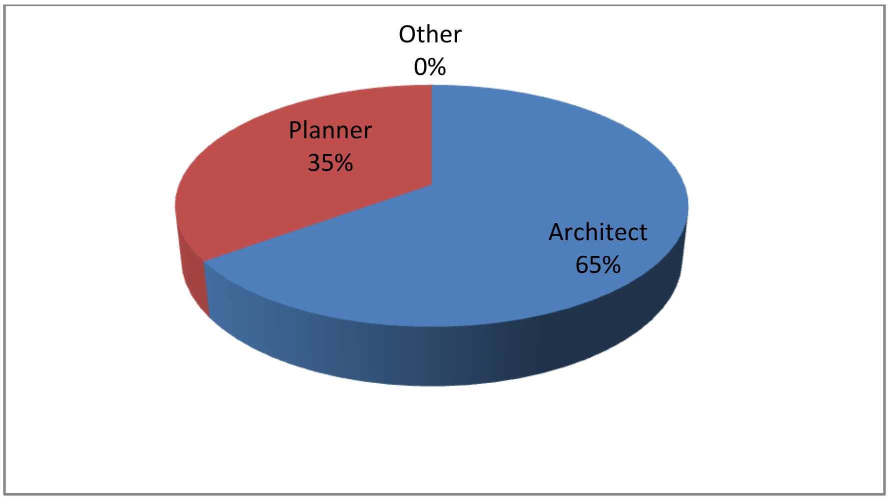

Figure 7.2: Professional background

Of the respondents, 65% were architects and 35% planners. The planners are responsible for creating the master plan while the architects are responsible for delivering the master plan (Fig 7.2). The architects were responsible for the design of the HDMU schemes and have the direct responsibility of implementing the sustainable urban design principles in the Amman master plan.

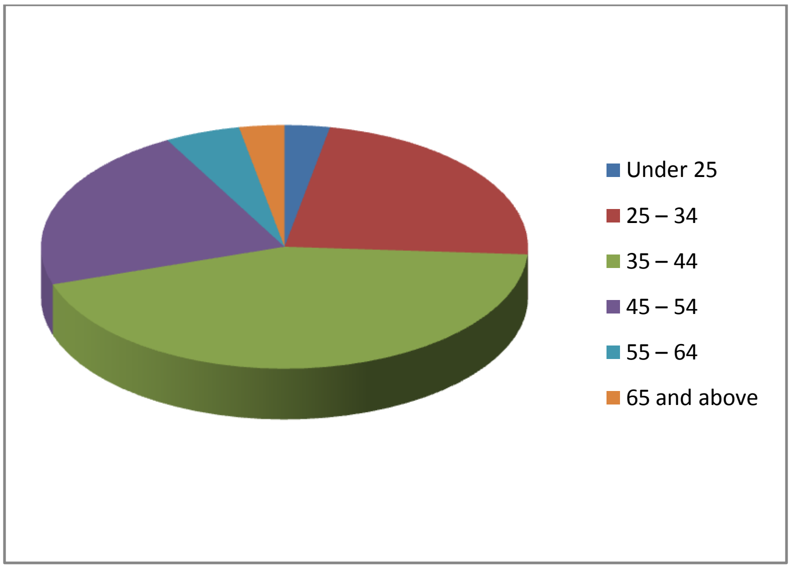

Figure 7.3: Professionals' age distribution

The age range of the respondents were: 3% under 25, 23% in the 25 – 34 bracket, 44% in the 35 – 44 bracket, 22% in the 45 – 54 bracket, 5% in the 55 – 64 bracket and 3% were aged 65 and above as shown in Figure 7.3. The majority of respondents were aged between 25 -54 years old thus representing a broad range of age and experience spanning 10 - 30 years. On the highest academic qualification of respondents: 75% hold a Bachelor degree, 15% Master's, 4% Doctorate and 6% Diploma. The majority of the respondents have also worked on the Greater Amman Municipality (GAM) master plan team for more than 5 years as shown in Figure 7.4; 4% less than one year, 8% less than three years, 14% less than five years and 74% more than five years.

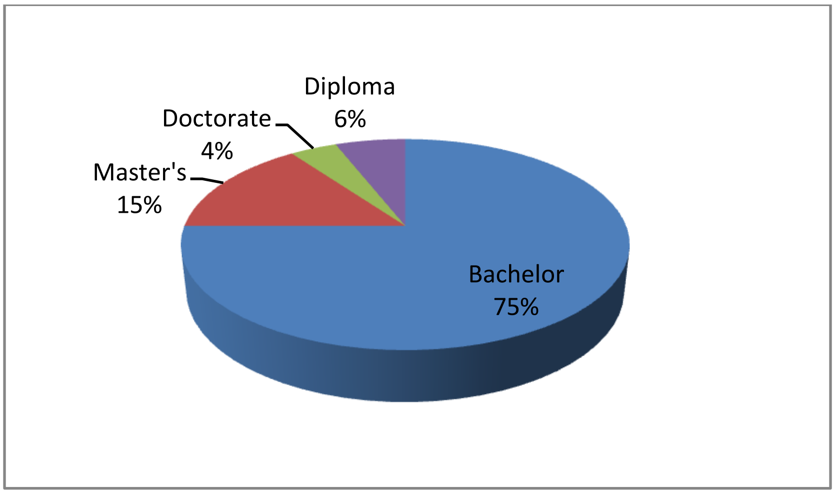

Figure 7.4: Respondents' highest educational qualification

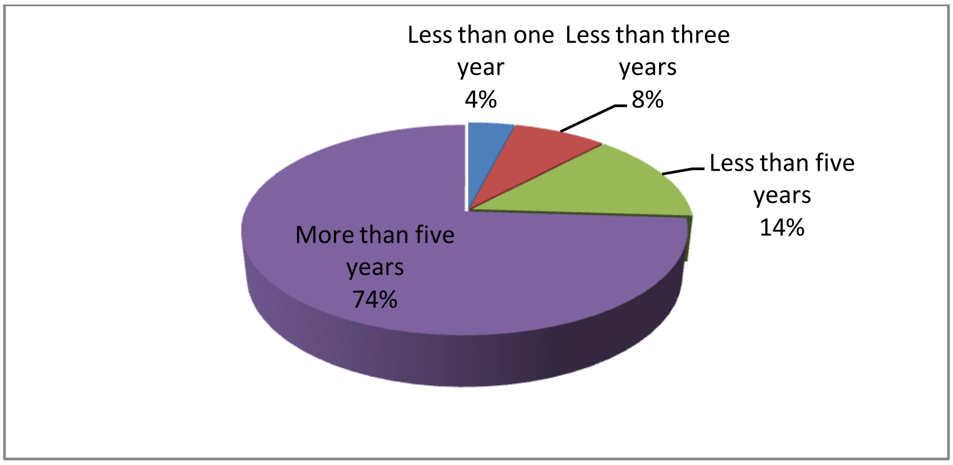

Figure 7.5: Respondents' years of experience

Figure 7.5 shows that the majority of the professionals had been working on the master plan for more than five years. Of the respondents that worked on the master plan, 24% were employed as external consultants.

7.3 Constraints to the implementation of HDMU schemes in Amman

This section was aimed at checking the constraints facing the implementation of high density mixed use HDMU in Amman, which were identified by testing the indicators in Amman. The findings, summarised in Table 7.1, show the most significant constraints that fall within the four dimensions: social, environmental, economic and governance. These are discussed in more detail in the following sub-sections:

Table 7.1: Main constraints affecting the implementation of the sustainable urban design principles using HDMU

Dimension	Constraints	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Soc.1	Indoor noise and acoustic noise in primary areas inside buildings	75%	23%	1%		1%
Soc.2	Indoor air quality non monitoring inside buildings	83%	13%	2%		2%
Soc.3	Shortage of internet facilities used as a way of online shopping	88%	9%			3%
Soc.4	The population income is inadequate for housing price or rent	70%	27%	2%		1%
Soc 5	The percentage of open space area compared to the city's area is low	86%	14%			
Env.1	Difficulties in the management of water resources: inadequate of surface and ground water	74%	23%			3%
Env.2	Absence of recycled materials in building construction	95%	3%	2%		
Env.3	Ineffective integration between land use, transport planning and other governance functions such as; ineffective infrastructure	91%	7%	2%		
Env.4	The percentage of open public green space compared to the city's area is low	83%	17%			
Env.5	The percentage of waste treatment and disposal is low.	1%	8%	27%	64%	
Env.6	Difficulties in moving around the city such as; traffic and congestion	92%	6%			2%
Env.7	Absence of cycle lanes and cycle facilities	98%	2%			
Env.8	Shortage of frequent fixed bus stops	82%	18%			
Eco.1	The percentage of annual renewable energy consumption of total energy consumption is low	89%	10%			1%
Eco.2	Difficulties to create job and training opportunities for local community	71%	26%			3%
Gov.1	Emergence of Local community resistance and negative media coverage for the master plan project, because of problems in communication between private sectors and local citizens and local government bodies.		3%	19%	75%	3%
Gov.2	Difficulties in providing the skills and experience of professionals involved in delivering sustainable urban design.	19%	76%	1%		4%
Gov.3	Unsuitability of the regulations and laws which govern land use	65%	31%	2%		2%

Soc: social, Env: environmental, Eco: economic, Gov: governance.

7.3.1 Social constraints

This section presents the findings regarding social constraints. 75% of respondents highly agree and 23% agree that noise and acoustic noise inside HDMU buildings are a constraint to its implementation in the case study areas. This means that 98% agree that it is a social constraint. 2% stated that this is not an issue. Hence, this constraint will need to be addressed in the implementation of any HDMU scheme to improve the internal buildings conditions.

88% highly agree and 9% agree that shortage of internet facilities used as a way of online shopping is a social constraint for the sustainable implementation of HDMU schemes in the Amman master plan. This means that 97% agree that it is one of the social constraints whilst 3% stated that it does not affect the process.

On the lack of monitoring of indoor air quality inside HDMU buildings, 83% highly agree and 13% agree that this is a social constraint. This means that 96% agree whilst 2% disagree that it is a social constraint. 2% also stated that this does not affect the process. Accordingly, the monitoring of indoor air quality is considered a social constraint that influences effective the implementation of the sustainable urban design in HDMU schemes in Amman.

70% highly agree and 27% agree that the income of the population is inadequate for the housing price and rent. This means that 97% agree affordability of housing is a social constraint for the sustainable implementation of HDMU schemes in the Amman master plan, whilst 2% disagree that it is a social constraint. 1% also stated that it does not affect the process. Hence, this constraint should be addressed by considering the affordability of the HDMU schemes after the implementation of the master plan. This will also ensure the owning or renting of housing in areas close to the place of work. Therefore, this is considered one of the most important social issues for sustainable urban design principles for achieving social justice within sustainable communities. Additionally, 86% highly agree and 14% agree that the percentage of open space area compared to the city's area is low. This means that 100% agree it is a social constraint for the sustainable implementation of HDMU schemes in the Amman master plan.

7.3.2 Environmental constraints

This section presents the environmental constraints identified by the survey respondents. On the difficulties with the management of water resources, 74% highly agree and 23% agree that there is inadequate surface and ground water. This means that 97% agree that it is one of the environmental constraints. 3% stated that this is not an issue. Hence, this constraint should be addressed in order to provide adequate water resources for the use of the population residing in HDMU schemes. It will also help to address the water consumption per capita through water conservation measures. The mismanagement of water resources leads to the weakening of infrastructure development for these areas, considered to be one of the most important mainstays for achieving the effective environmental design within the sustainable communities.

95% highly agree and 3% agree that the absence of recycled materials in building construction affects the environmental performance of the schemes. This means that 98% agree that this is one of the environmental constraints. 2% stated that it is not an issue. Hence, this constraint should be addressed bearing in mind the impact on construction costs. It will also help to ensure that the use of new building elements, including recycled materials is compatible with the surrounding urban context.

91% highly agree and 7% agree that the ineffective integration between land use, transport planning and other governance functions is an environmental constraint. This means that 98% agree, and only 2% disagree. Hence, this constraint should be addressed in order to provide an effective infrastructure that can be used by the population. Both land use and transport planning should be integrated effectively. This requires collaboration between all sectors responsible for achieving the compatibility of both elements. 83% highly agree and 17% agree that the percentage of open public green space compared to the city's area is low. This means that 100% agree that it is one of the environmental constraints. Hence, this constraint should be addressed in order to provide wide areas of the green spaces, and increase the opportunity for the population to use the spaces. This helps to progress towards sustainable communities.

Only 1% highly agrees and 8% agree that the percentage of waste treatment and disposal is low. This means that 9% agree that it is one of the environmental constraints. 64% disagree and 27 highly disagree. This means that 91% disagree that it is one of environmental constraints. Accordingly, this is not considered one of the environmental constraints which influence the effective implementation of the sustainable urban design, using high density mixed use schemes in Amman.

92% highly agree and 6% agree that difficulties in movement around the city such as traffic and congestion is an environmental constraint. This means that 98% agree, whilst 2% stated that this is not an issue. Therefore, this constraint should be addressed, in order to overcome the main problems related to transport systems with strategies such as discouraging the use of private cars in certain areas.

100% agree (98% highly agree) that the absence of cycle lanes and facilities is an environmental constraint. Therefore, this constraint needs to be addressed, because it will help to solve transportation problems such as traffic congestion. This solution will encourage the population to also use this sustainable alternative and affordable means of transportation. Again, 100% agree (82% highly agree) that the shortage of fixed bus stops is an environmental constraint. Therefore, this constraint needs to be addressed as it was noted that this shortage affects traffic for the master plan. Its resolution will encourage the use of public transport and reduce traffic congestion.

7.3.3 Economic constraints

The findings regarding economic constraints for the implementation of the master plan are as follows: 89% highly agree and 10% agree that the percentage of annual renewable energy consumption against total energy consumption in Amman is poor, and should be addressed in the implementation of HDMU schemes within the master plan. This means that 99% agree that it is one of the economic constraints. The increased use of renewable energy sources will alleviate energy shortages in the city of Amman. On an economic scale, this could increase access to affordable energy for the city's population.

71% highly agree and 26% agree that there are current difficulties in creating job and training opportunities for the local community. This means that 97% agree that it is one of the economic constraints. To address this, the city could explore strategies to engage the private sector to provide a job and training opportunities for the local community.

7.3.4 Governance constraints

The responses with regards to the governance constraints are presented here**.** Only 3% agree that the emergence of local community resistance and negative media coverage for the master plan project is a governance constraint. 19% disagree and 75% highly disagree that this is because of problems in communication between private sector, local citizens and local government bodies. This means that 94% disagree that it is one of governance constraints.

Therefore, local resistance and poor engagement with the public and private sector is not considered a governance constraint which influences the effective implementation of the sustainable urban design, using high density mixed use schemes in Amman.

19% highly agree and 76% agree that there are difficulties with professionals having the right skills, knowledge and expertise to deliver the sustainable urban design aspects of the master plan. This means that 95% agree that it is one of governance constraints, whilst only 1% disagree that it is one of governance constraints, and 4% state that this is not an issue. Therefore, this constraint should be addressed, because the delivery of the master plan requires a wide range of professionals with the right level of knowledge and skills.

65% highly agree and 31% agree that the regulations and laws governing land use are unsuitable for promoting sustainable urban design principles. This means that 96% agree and 2% disagree that this is a governance constraint, and also 2% stated that this is not an issue. Hence, this constraint needs to be addressed. The current regulations and laws are old (going back to 1968) and are unsuitable for the master plan developments that organise land use. The proposal of new regulations and laws can be compatible with the renewable sustainable urban design practices without affecting the master plan negatively.

In summary, this section confirmed most of the main constraints facing the implementation of HDMU schemes, which were identified by testing the indicators in the city of Amman. There are two exceptions: Firstly, that the percentage of waste treatment and disposal is low and, secondly, that the emergence of local community resistance and negative media coverage for the master plan project is because of problems with communication between the private sector, local citizens and local government bodies. These exceptions from the questionnaire findings are not consistent with what was identified from the findings from testing the indicators in Amman. Therefore, this was further explored at the interview phase of the study.

7.4 Opportunities for the implementation of HDMU schemes in Amman

This section of the survey aimed to identify opportunities and solutions to overcome the identified constraints to effective implementation of SUDP using HDMU schemes in Amman. This questionnaire used a set of solutions that were used for the implementation of HDMU schemes in the city of Curitiba, Brazil, as identified through the literature review by Globe Award (2013), Campbell (2012), Lerner (1994), IPPUC (2004), Lowry (2002), Campbell and Fuhr (2004), Fazzano et al. (2004), Rabinovitch and Leitmann (1996), McKibben (2005) and Rabinovitch (2008). A summary of survey findings is shown in Table 7.2. These are discussed in more detail in the following sub-sections.

Table 7.2: Main constraints and their solutions affecting the implementation of the sustainable urban design principles using HDMU

Constraints	Proposed solutions
Soc.1 Indoor noise and acoustic noise in primary areas inside buildings	○ The use of sound absorbing materials inside the buildings. **(98%)**
Soc.2 Indoor air quality non monitoring inside buildings	○ Integration of air conditioning to monitor air quality inside buildings, and performing regular maintenance of these devices. **(96%)**
Soc.3 Shortage of internet facilities used as a way of online shopping	○ Commissioning of new internet facilities. **(98%)**
Soc.4 The population income is inadequate for housing price or rent	○ The establishment of finance programs in collaboration with lending institutions. **(99%)** ○ Providing institutional support to encourage participation and partnership arrangements**(95%)** ○ Promoting the use and maintenance of existing housing stock and the development of affordable rental housing. **(1%)**
Soc.5 The percentage of open space area compared to the city's area is low	○ The work of expansion of open space areas for the city.**(100%)**
Env.1 Difficulties in the management of water resources: inadequate of surface and ground water	○ Ensuring a clean water supply for commercial, agricultural, industrial and urban uses. **(3%)** ○ Prevention of the degradation of surface and ground water. **(98%)**
Env.2 Absence of recycled materials in building construction	○ The use of recycled materials in new buildings, and the use of new building elements should be compatible with the urban context. **(99%)**
Env.3 Ineffective integration between land use, transport planning and other governance functions such as; ineffective infrastructure	○ Use of express bus lanes and the use of computerized area traffic control system. **(97%)** ○ Providing a free bus service painted green on weekends to parks. **(91%)**

	○ Keeping the public informed about environmental issues, using programs that encourage community responsibility for the parks. Local schools promote ecological principles. **(1%)**
Env.4 The percentage of open public green space compared to the city's area is low	○ Expansion of park/green areas and reduced resource use. **(100%)**
Env.5 The percentage of waste treatment and disposal is low.	○ Using solid waste management program that encourages citizens to separate organic from inorganic. Separating piped water from sewage lines. **(81%)**
Env.6 Difficulties in moving around the city such as; traffic and congestion	○ The use of rapid bus transport system as a system of public transportation. **(3%)** ○ Improvement of mass transit system and a restructuring of the roads. **(95%)** ○ Reducing the cost of mobility and promoting trade within the city. **(2%)** ○ Work to develop ways to incorporate the city with the surrounding metropolitan area. **(94%)**
Env.7 Absence of cycle lanes and cycle facilities	○ Plan the integrated transport network to install bike paths as new transportation alternatives
Env.8 Shortage of frequent fixed bus stops	○ Construction of many bus stops alongside transport routes. **(99%)**
Eco.1 The percentage of annual renewable energy consumption of total energy consumption is low	○ Encourage the use of renewable energy within the designs for new buildings to reduce annual energy consumption. **(97%)**
Eco.2 Difficulties to create job and training opportunities for local community	○ Using strategies to engage the private sector to provide a set of job and training opportunities for the local community.. **(98%)**
Gov.1 Emergence of Local community resistance and negative media coverage for the master plan project, because of problems in communication between private sectors and local citizens and local government bodies.	○ Holding public debates that encourage the involvement of citizens and the private sector including architects, engineers, economists, sociologists, and public administrators. **(98%)** ○ Founding the regional administration centres to identify similarities between

	regions and plan social programs for the periphery. Integrate the public into each social programs. **(97%)** ○ Keeping the public informed about environmental issues, using programs encourage community responsibility for the parks, which provide aesthetic and recreational value. **(1%)**
Gov.2 Difficulties in providing the skills and experience of professionals involved in delivering sustainable urban design.	○ The use of the skills and experiences available in the public institutions and private sector. **(100%)** ○ The use of the outside experts to support this process. **(2%)**
Gov.3 Unsuitability of the regulations and laws which govern land use	○ Land use laws should minimize transport demands, save energy, protect open and green spaces. **(99%)**

Soc: social, Env: environmental, Eco: economic, Gov: governance.

7.4.1 Social solutions

This section presents the social solutions identified by the survey respondents. On indoor noise and acoustic noise in primary areas inside buildings: 98% stated that the use of sound absorbing materials inside the buildings is the solution to overcome these constraints. It will help to minimise indoor noise and acoustic control in the primary areas inside the buildings improving indoor social conditions at the lowest costs.

96% stated that integration of air conditioning to monitor air quality inside buildings, and performing regular maintenance of these devices, is the solution to overcome non-monitoring of indoor air quality inside buildings. This solution will help to adjust indoor air quality to a higher level inside buildings creating indoor-appropriate social conditions. This can be achieved by using air conditioning devices and carrying out regular maintenance of them.

98% agreed that commissioning of new internet facilities is the solution for online shopping. Hence, the work to create new internet facilities in different areas will help develop shopping via internet access. This increased awareness for the population will, therefore, provide a social justice solution for sustainable communities.

99% stated that the establishment of finance programmes in collaboration with lending institutions, and also 95% stated that providing institutional support to encourage participation and partnership arrangements, are the appropriate solutions to overcome low income of the population against housing prices and rent. Hence, these solutions will try to provide adequate income for the population, enabling them to own or rent a house within the areas close to their work. This can increase employment opportunities for the local people, because there are few who live within walking distance of their place of work. This can all be achieved by cooperation with the private sector, professional associations, and Central Government to undertake research into creative housing typologies and alternative construction and insulation techniques, that reduce the cost of housing and support the provision of affordable housing. Additionally, 100% agreed with expansion of open spaces in the areas to increase their percentage against total open space area across the whole city.

7.4.2 Environmental solutions

The findings regarding environmental solutions for the implementation of the master plan are presented. On the difficulties with the management of water resources-inadequate surface and ground water, 98% stated that prevention of the degradation of surface and ground water is the appropriate solution allowing preservation of surface and ground water for the population uses. This will enhance the water consumption per capita by means of water conservation. This can be achieved by using storm water management through providing storm water facilities - treating storm water as a resource to be protected, managed, and utilised while recognizing its importance as a part of the ecosystem - and upgrading and extending water services. Necessary action should also be taken to limit use of potable water using high density mixed use (HDMU).

99% stated that the use of recycled materials in new buildings, and the use of new building elements compatible with the urban context, is an appropriate solution to the absence of recycled materials in building construction. Furthermore, use of recycled materials in building construction reduces construction costs. This should be implemented with conservation compatibility between buildings and the surrounding urban context in mind. To achieve this, there should be a specialist panel to monitor the construction process for the building in these areas.

On the ineffective integration between land use and transport planning, 97% agreed that use of express bus lanes and the use of a computerised area traffic control system would be a solution, and 91% stated that providing a free bus service painted green on weekends to parks would be an appropriate solution to overcome this constraint. These solutions separate the different modes of transport so that, for example, use of separate bus lanes will give the population more space for use of private vehicles without being influenced by the movement of public transport. Also it encourages the population to visit parks and green spaces. This will provide effective infrastructure for the population, and support the effective integration between land use and transport planning with collaboration between all sectors responsible for achieving the compatibility of both elements.

On the problem of the low proportion of open public green space compared to the city's total area, 100% stated that the expansion of park/green areas and reduced resource use would be appropriate solutions that will help protect these areas from any hindrance of progress towards sustainable communities. 81% favoured the employment of a solid waste management programme that encourages citizens to separate organic from inorganic. Separating piped water from sewage lines is the appropriate solution to increase the percentage of waste treatment and disposal. 19% stated that it is not a solution to overcome this constraint for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman.

On the difficulties of moving around the city (such as traffic and congestion), 95% supported improvement of a mass transit system and a restructuring of the roads, and 94% supported the development of new ways to incorporate the city within the surrounding metropolitan area, as appropriate solutions to overcome this constraint. Other solutions include discouraging private car access and improving infrastructure development of the transport system to encourage the population to use public transportation instead of their own cars, thus reducing traffic and congestion on the road and negative environmental impact.

98% indicated that an integrated transport network - which includes cycling paths as new transportation alternatives –would be an appropriate solution with 2% disagreeing. This solution, however, would help to mitigate transportation problems such as traffic congestion, and connect the open spaces, green areas, as well as the population's homes to their places of work. Making these different means available will encourage their use and will be inexpensive for the population.

99% favoured the construction of many bus stops alongside transport routes to resolve the shortage of frequent fixed bus stops, and also encourage the use of public transport to reduce traffic congestion which is a major master plan problem.

7.4.3 Economic solutions

The responses with regards to the economic solutions are presented here. 97% would encourage the use of renewable energy within the designs for new buildings to reduce annual energy consumption to increase its proportion against total energy consumption. This would also alleviate energy shortages in the city of Amman and, on an economic scale, increase access to affordable energy for the city's population.

On the difficulties of creating job and training opportunities for the local community, 98% thought that using strategies to engage the private sector to provide job and training opportunities for the local community would be a solution to overcome the constraint affecting implementation of the projects within the master plan.

7.4.4 Governance solutions

This section presents the findings regarding governance solutions. On the emergence of local community resistance and negative media coverage for the master plan project(as a result of communication problems between the private sector, local citizens and local government bodies) 98% agreed that holding public debates that encourage the involvement of citizens and the private sector including architects, engineers, economists, sociologists, and public administrators would work. In addition, 97% agreed that founding regional administration centres to identify similarities between regions and to plan social programmes for the periphery, and integrating the public into social programmes, are the appropriate solutions to these constraints for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman.

On the difficulties in providing the skills and experience of professionals involved in delivering sustainable urban design, 100% stated that the use of the skills and experiences available in public institutions and the private sector is the appropriate solution to this particular constraint in the delivery of the master plan which requires a wide range of professionals with the right level of knowledge and skills to provide technical and administrative support to this project, including an understanding of the relevant regulations relating to the master plan for the city of Amman.

99% stated that land use laws should minimise transport demands, save energy, and protect open and green spaces in order to be appropriate and effective in the regulation of land use. The current regulations and laws are outdated (1968) and incompatible with the master plan developments, so new ones need to be introduced. This can be achieved in consultation with all relevant stakeholders.

In summary, this section identified abroad variety of opportunities/solutions to overcome the identified constraints to the effective implementation of HDMU schemes.

7.5 Context-based sustainable urban design indicators for the city of Amman

This section ranked and checked the suitable urban sustainability indicators for the city of Amman identified by testing a longer list of indicators in Amman. From this, the premise was, that a series of recommendations for the implementation of the master plan could be derived.

The respondents were asked to rank the 4 main indicators, or dimensions, of sustainable urban design in the context of Amman(social, environmental, governance and economic) on a scale of 1-4. 97% prioritised them as follows: Social indicators ranked highest, followed by environmental indicators, governance indicators and lastly economic indicators. This agrees with the findings from testing the indicators within the three areas in the Amman master plan. The remaining 3% ranked the dimensions as follows: 1 - environmental, 2 - social, 3 - governance and lastly, 4 - economic. It is worth noting that all respondents agree on the order of the governance and economic indicators. Hence, these survey responses are similar to findings from testing the indicators and confirm that the ranking, represented as (1) social, (2) environmental, (3) governance, (4) economic, is suitable for the city of Amman.

Additionally, this section of the questionnaire aimed to identify to what extent each of the pre-defined indicators are applicable in the Amman context for implementation in HDMU schemes. The findings are summarised in Table 7.3.

Table 7.3: Contextualised sustainable urban design indicators for Amman

Dimensions	Indicators	Highly agree	Agree	Neither agree nor disagree	Disagree	Highly disagree
Social	Functionality, usability and aesthetic aspects	90%	10%			
	Local people facilities	86%	13%	1%		
	Architectural considerations and cultural heritage	85%	14%		1%	
	Customers facilities and trends	89%	8%		3%	
Environmental	Energy and natural resources	92%	8%			
	Materials used, durability and waste	77%	21%	2%		
	Sustainable land use and site selection	89%	11%			
	Water and water conservation	81%	17%	2%		
Economic	Economic performance	76%	22%	2%		
Governance	Public communication	91%	8%		1%	

Table 7.3 shows that all the shortlisted indicators were considered suitable for the Amman context. In this context, therefore, social indicators such as the functionality, usability and aesthetic aspects can be used to improve the efficiency of open space utilization for the local community, efficiency of local community movement and high aesthetic aspects for the buildings. Local people facilities indicators can also be used to provide public transport for local area, Facilities for local community and cyclist and pedestrian provision for the local area. In addition, architectural considerations and cultural heritage can be used to maximise the compatibility of the buildings with local heritage value, cultural heritage integration and compatibility of urban design with local heritage value. Customers facilities and trends can be used to maximise security inside the centre, use the internet as a way of online shopping, provide food courts distribution inside the buildings, use cinema complex effectively and provide play areas for children.

Environmental indicators, such as energy and natural resources can be used to improve the use of solar energy, use of daylight in the primary area, passive solar gain and cooling, and use of natural ventilation. As well as the materials used, durability and waste indicator can also be achieved by using non- toxic material, locally produced materials and, traditional and modern material. In addition, sustainable land use and site selection indicator can be used to provide a set of bus stops and stations, enhance green areas and the outdoor environment and for the collection and recycling of solid wastes. Moreover, water and water conservation indicator can be used to minimise water consumption per capita per year by sourcing water locally, minimising water prices and storing rainwater in the building for later re-use.

Economic indicators such as economic performance can be used to provide life cycle costs and high quality of maintenance which minimise operating and maintenance costs for the project.

Governance indicators such as public communication can be used to improve the connection between the local community and the private sector. The government can provide the framework and facilitate direct communications between different competent authorities, the private sector, and the local community, to hear their views and proposals for overcoming the main constraints facing the implementation of the sustainable urban design practices in the Amman master plan.

In summary, this section confirmed the ten suitable indicators for the implementation of HDMU schemes. These were identified by testing the indicators in the city of Amman. This section also ranked the suitable urban sustainability indicators for the city of Amman, which can be implemented by HDMU schemes. This ranking agrees with their ranking by testing-out of urban sustainability indicators in the context of Amman, therefore the survey responses increased the credibility of these findings.

7.6 The planning strategy

This section explores the planning strategy for the implementation of sustainable urban design principles using high density mixed use HDMU.

7.6.1 Planning strategy phases

To begin, it was important to identify the planning strategy phases that can be used for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman. These phases were determined and defined through the literature review by McGeough et al. (2004), Sanderson and Lepkowsky (2014). A breakdown of the phases as ratified and ranked by the survey respondents is as shown in Figure 7.6.

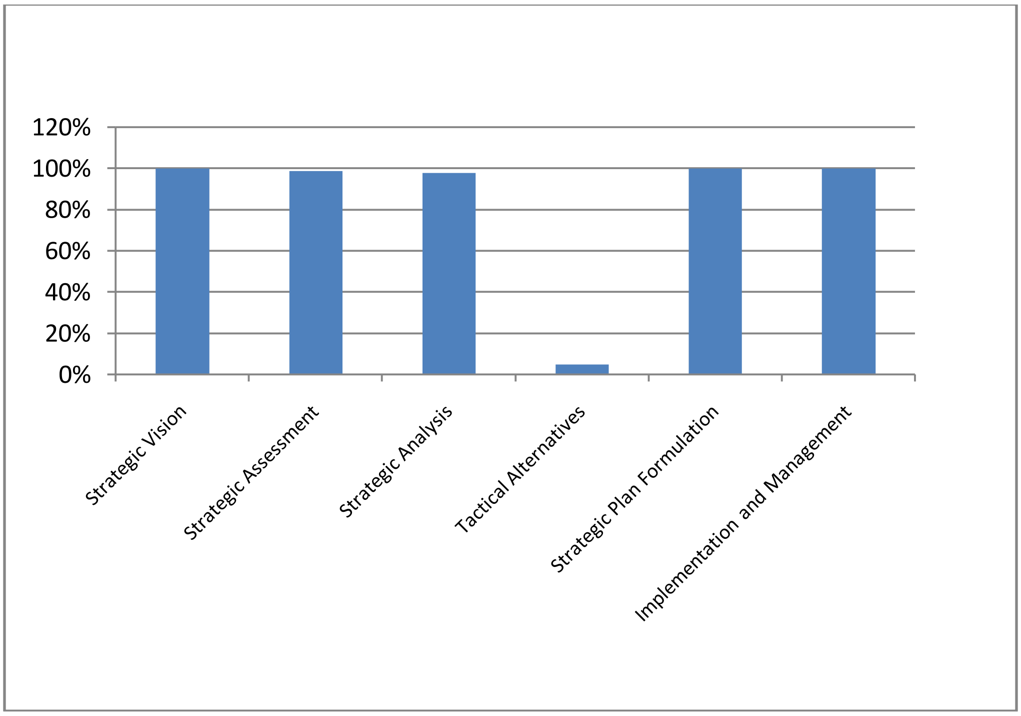

Figure 7.6: Planning strategy phases for the implementation of sustainable urban design principles using HDMU

It was found that 100% chose strategic vision, 99% strategic assessment, 98% strategic analysis, 100% strategic plan formulation, 100% implementation and management and 5% tactical alternatives. Accordingly, strategic vision, strategic assessment, strategic analysis, strategic plan formulation and implementation and management constitute the main planning strategy phases for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman. The tactical alternatives phase was excluded by the questionnaire findings, therefore, this does not agree with the findings which were identified through the literature review by McGeough et al. (2004), Sanderson and Lepkowsky (2014). However, the reason for its exclusion was further explored at the interview phase of the study.

7.6.2 The outputs of planning strategy phases

This section identified the extent to which each of the fore-mentioned outputs can be used for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman. The main findings are summarised in Table 7.4 and each phase is further enumerated in the following sub-sections.

Table 7.4: The main outputs for the planning strategy phases

Phases	Out puts	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Strategic vision	Identification of stakeholders	83%	15%			2%
	Creation of a community consensus on sustainability goals	80%	17%	2%		1%
Strategic assessment	Assessment of current energy consumption (economic state)	91%	8%			1%
	Assessment of environmental quality control	94%	4%			2%
	Assessment of transportation systems infrastructure	89%	8%	1%		2%
Strategic analysis	Identification of the desired future state	95%	2%	1%		2%
	Identification of the community's current condition	87%	7%	2%		4%
Tactical alternatives	Political tactics	14%	82%	2%		2%
	Economic tactics		2%	21%	76%	1%
	Social tactics			26%	72%	2%
	Environmental system technologies tactics		1%	14%	83%	2%
Strategic Plan formulation	Creation of a wide range of policies	91%	7%	1%		1%
	Creation of a wide range of programs	95%	5%			
	Creation of a wide range of budgets	88%	11%			1%
	Creation of a wide range of deployment schedules		1%	18%	78%	3%
Implementation and management	Identification of the specific performance measures	87%	11%			2%
	Identification of the specific performance methodologies	90%	10%			
	Identification of the reporting systems	76%	21%			3%
	Identification of the progress adjustments		1%	20%	78%	1%

7.6.2.1 Strategic vision

This section presents the outputs of the strategic vision phases identified by the survey respondents. 83% highly agree and 15% agree that the identification of the main stakeholders is one of the key outputs of the strategic vision to implement sustainable urban design in Amman. 80% highly agree and 17% agree that the creation of a community consensus on sustainability goals is equally important.

Therefore, this section identified that any strategic vision phase should include two outputs: identification of stakeholders and the creation of a community consensus on sustainability goals. This was compatible with what was identified in the literature review. Consequently, these outputs can provide a mainstay for the implementation of the scheme within the master plan, because the stakeholders will be a part of the process of achieving sustainability goals within their areas, which fall in the master plan.

7.6.2.2 Strategic assessment

The findings with regards to the outputs of the strategic assessment phase are presented here. On: 91% highly agree and 8% agree that the assessment of current energy consumption (economic state) is an important strategic assessment output. Equally, 94% highly agree and 4% agree that the assessment of environmental quality control is a key strategic assessment output. Similarly, 89% highly agree and 8% agree that the assessment of transportation systems infrastructure is an important part of strategic assessment.

Accordingly, this section identified that the strategic assessment phase should include three components: the assessment of current energy consumption (economic state), environmental quality control and transportation systems infrastructure. This was compatible with what was identified in the literature review. Consequently, the assessment of each of these outputs will help to build an effective planning strategy because they take into account the economic, environmental and social situation for the master plan of the city. This strategy can avoid economic, environmental and social gaps for this city, and this will help the city to implement this scheme according to its capabilities.

7.6.2.3 Strategic analysis

Here, the responses regarding the outputs of strategic analysis phase for the implementation of the master plan are presented. 95% highly agree and 2% agree that the identification of the desired future state is an important strategic analysis output. Also, 87% highly agree and 8% agree that the identification of the community's current condition is important. 5% stated that this is not an issue.

Accordingly, this section identified that the strategic analysis phase includes two outputs which should be applied for the strategic analysis for this project. These include: the identification of the desired future state and identification of the community's current condition. This was compatible with findings from the literature review. The analysis of each of these outputs will help to fill the gaps between the desired future state and the community's current condition, in order to define an effective planning strategy.

7.6.2.4 Tactical alternatives

This section presents the findings regarding the tactical alternatives phase. On political tactics: 14% highly agree and 82% agree that this is one of the tactical alternatives outputs. Also, 76% highly disagree and 21% disagree that economic tactics is one of tactical alternatives out puts. 72% highly disagree and 26% disagree that social tactics is important for tactical alternatives. 83% highly disagree and 14% disagree that environmental system technologies tactics is one of the tactical alternatives out puts.

Therefore, the tactical alternative phase includes one output which can be applied for this project: political tactics. This was not compatible with findings from the literature review. The questionnaire excluded three of the four outputs and this was further explored at the interview phase of the study.

7.6.2.5 Strategic plan formulation

This section presents the findings with regards to the strategic plan formulation phase through the responses identified by the survey respondents. 91% highly agree and 7% agree that the creation of a wide range of policies is one of the plan formulation out puts. 100% agree that the creation of a wide range of programmes is a plan formulation output. 99% agree that the creation of a wide range of budgets is a plan formulation output. 78% highly disagree and 18% disagree that the creation of a wide range of deployment schedules is important for plan formulation. Therefore, this section identified the strategic plan formulation phase to include three outputs: the creation of a wide range of policies, creation of a wide range of programmes and the creation of a wide range of budgets. These phases can constitute a framework composed of a broad variety of programmes, policies and budgets to ensure the implementation of this project in the master plan of the city. This was not compatible with findings from the literature review. The questionnaire findings also excluded the creation of a wide range of deployment schedules output as one of the main outputs for the strategic plan formulation phase.

7.6.2.6 Implementation and management

The findings on the implementation and management phase for the implementation of the master plan are presented here. 87% highly agree and 11% agree that the identification of the specific performance measures is an implementation and management output. A 100% agree that identification of the specific performance methodologies is an implementation and management output. 76% highly agree and 21% agree that the identification of the reporting systems is an implementation and management output. 78% highly disagree and 20% disagree (i.e. 98% disagree) that the identification of the progress adjustments is important for implementation and management.

Therefore, three criteria were identified for the implementation and management phase: identification of the specific performance measures, identification of the specific performance methodologies and identification of the reporting systems. Consequently, the identification of the performance measures and methodologies will help to implement and control the main project phases accurately. Moreover, the identification of the reporting systems will adjust the implementation of the project according to this identified system by using reports to describe and monitor the progress of this project. These outputs can ensure the implementation of this project in the master plan of the city. This finding was not consistent with findings from the literature review.

7.6.3 Planning strategy requirements

The survey findings identified the planning strategy requirements which were determined and defined through the findings of literature review by McGeough et al. (2004), Habitat ll in Istanbul, UN (1996), Ndeke (2011), DEA (2010), (2006), (2005), Sanderson and Lepkowsky (2014). This section identified the requirements which can be used for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman. A breakdown of the requirements as ratified and ranked by the survey respondents is as shown in Figure 7.7.

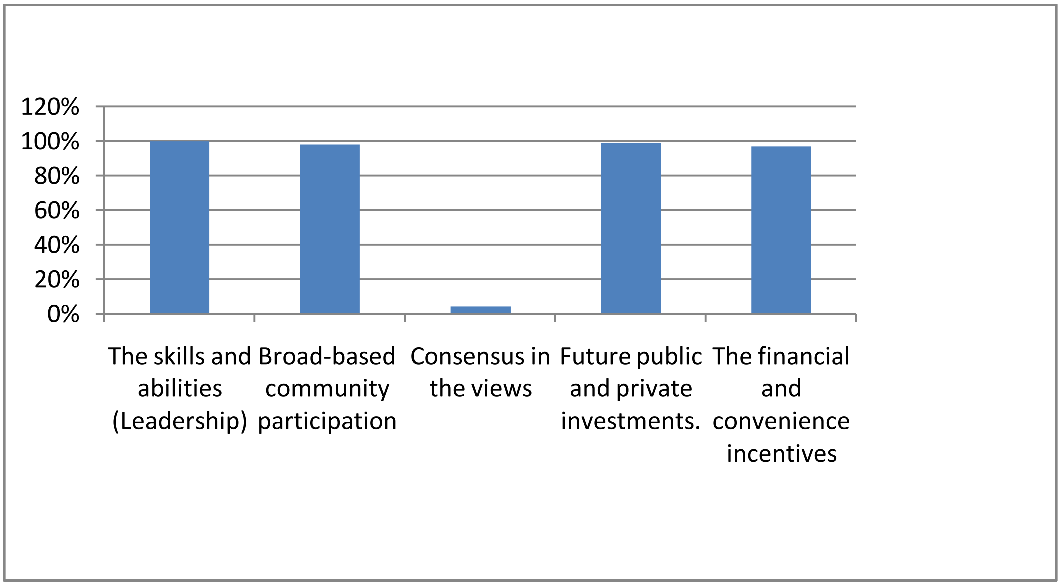

Figure 7.7: Planning strategy requirements for the implementation of sustainable urban design principles using HDMU

On planning strategy requirements, it was found that 100% chose competencies and skills (Leadership), 98% broad-based community participation, 99% future public and private investments, 97% financial and convenience incentives and 4% consensus of views (Figure 7.7). Therefore, skills and abilities (Leadership), broad-based community participation, future public and private investments and financial and convenience incentives constitute the main planning strategy requirements for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman. There was no consensus of views in the questionnaire findings. This was not consistent with findings from the literature review. However, the reason for its exclusion was further explored at the interview phase of the study.

The extent to which each of the planning strategy requirements influence the effective implementation of sustainable urban design using high density mixed use schemes was further explored as shown in Table 7.5.

Table 7.5: Main planning strategy requirements for the implementation of sustainable urban design

Requirements	Positive effect	No effect	Negative effect	Do not know
Competencies and skills (Leadership)	99%	1%		
Broad-based community participation	97%	2%		1%
Consensus of views	5%	81%	10%	4%
Future public and private investments.	98%	2%		
Financial and convenience incentives	97%	1%		2%

The key findings were that 99% confirmed that skills and abilities (Leadership) positively influence effective implementation of the sustainable urban design implementation process. 97%, 98% and 97%, respectively, agreed that broad-based community participation, future public and private investments, and financial and convenience incentives positively influence the effective implementation of sustainable urban design. There was no positive agreement on the need for consensus of views, therefore this confirms that this requirement was excluded originally from the main planning strategy requirements by the survey responses as shown in the section 7.6.3. In this context, the reason for its exclusion was further explored at the interview phase of the study.

7.6.3.1 Competencies and skills

The competencies and skills needed at each phase for the effective implementation of HDMU in Amman are as shown in Table 7.6.

Table 7.6: Competencies and skills for the implementation of sustainable urban design

Competencies and skills	Study of project	Preparation of plans	Design of plans	Implementation of project	Monitoring of project
Local community	95%	1%			96%
Private sector	99%	2%	2%	100%	
Public institutions	100%	100%	99%	1%	98%
Outside experts	98%	97%	99%		2%

These competencies and skills are distributed across the five phases identified through the literature review by McGeough et al. (2004), DEA (2010), (2006), (2005). On local community, 95% and 96% respectively agree that the study of project and monitoring of the project is important for the implementation of sustainable urban design. The study of project phase can present an opportunity to the local community to be involved in giving their views early and avoiding problems later on. As for the monitoring of project phase, this can offer an opportunity to the local community to know how the project can be implemented, therefore giving them the right to present an objection to the specialist panel responsible for the implementation of this project in the master plan.

The majority agree that the private sector is needed for both the study and implementation phases of a sustainable urban design project. The study of project phase can present an opportunity to the private sector to be involved in giving their views early in the first studies of the project avoiding possible problems at the implementation stage of this project. At that latter stage necessary provision of skills required enable the private sector to be involved in this project as investors. The majority also agree that public institutions are needed for each phase. 100% for study of project, 100% preparation of project, 99% design of plans and 98% monitoring of project. It was noted that public institutions can participate in most of the phases since they have the property rights for this project and are part of the governance institutions who are responsible for the main phases, and do not attract high financial costs. However, the implementation of project phase needs the skills and a high financial capacity which is not always available in public institutions.

The majority agree that outside experts are needed at each phase notably, 98% study of project, 97% preparation of project and 99% design of plans. These phases constitute the main nucleus of the project requiring external experiments. These experiments can be integrated with internal experiments to prove adequate studies for these phases starting from the study of project up to design of plans, to be implemented in the master plan.

Additionally, the extent to which each of the following can be used as competencies and skills for the effective implementation of HDMU schemes in Amman was identified (Table 7.7). The questionnaire findings agreed with findings from the literature review by Ndeke (2011), Habitat ll in Istanbul, UN (1996).

Table 7.7: Competencies and skills for the implementation of sustainable urban design

The competencies and skills	Highly agree	Agree	Neither agree nor disagree	Disagree	Highly disagree
Local community	84%	13%	2%	1%	
Private sector	91%	8%	1%		
Public institutions	98%	2%			
Outside experts	88%	9%	2%	1%	

7.6.3.2 Community participation

This section identified the extent to which community participation affects the planning strategy for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman (Table 7.8).

Table 7.8: Community participation for the implementation of sustainable urban design

Community participation	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Local citizens	81%	16%	1%		2%
Private sector	92%	7%			1%
Public institutions	97%	3%			

On local citizens, 97% agree that it influences community participation for effective strategy planning. 3% state that it is not an issue. 99% agree that private sector influences community participation for effective strategy planning. 1% state that it does not affect community participation. 100% agree that public institutions influence community participation for the effective strategy planning.

Accordingly, these groups can provide direct participation of different competent authorities within public institutions, the private sector, and the local community and take their proposals for the implementation of HDMU in the Amman master plan. Furthermore, the mainstays for this requirement can be provided within this context by public institutions, private sector and local community. Therefore, this helps to control the main problems which emerge during the implementation of this project through providing necessary support through collaboration with these different sectors. Hence, the survey responses were compatible with the findings identified through the literature review by Ndeke (2011), Habitat ll in Istanbul, UN (1996).

Additionally, it identified which of the following methods can be used to provide the technical and administrative support for the effective implementation of HDMU schemes in Amman as shown in Table 7.9.

Table 7.9: Community participation for the implementation of sustainable urban design

Community participation	Interviews	Focus group	Survey
Local citizens	1%	3%	98%
Private sector	2%	96%	99%
Public institutions	97%	96%	5%

On local citizen participation, 98% stated that the survey method can be used whilst other methods such as interviews and focus groups cannot due to effort and time required. 99% stated that the survey method, and 96% that the focus group method can be used for ensuring private sector participation for the effective implementation of HDMU schemes in Amman. On the public institutions participation, 97% chose interviews and 96% chose focus group as a method to ensure this participation for effective implementation. Hence, the survey responses agreed according to the context of Amman the main methods for the community participation identified through the literature review by McGeough et al. (2004), DEA (2010); (2005), Habitat ll in Istanbul, UN (1996).

7.6.3.3 Consensus of views

This section identified the third requirement of the main planning strategy requirements that were identified through the literature review by McGeough et al., (2004), Ndeke (2011), DEA (2010); (2006). The survey responses identified the extent to which consensus of views affects the planning strategy for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman (Table 7.10).

Table 7.10: Consensus in the views for the implementation of sustainable urban design

Consensus of views	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Local citizens	82%	14%	1%		3%
Private sector		1%	7%	89%	3%
Public institutions	94%	4%			2%

On local citizens, 96% agree that they influence consensus of views for effective strategy planning.1% disagree and 3% see that they do not influence consensus of views. 96% disagree that the private sector influences consensus of views for effective strategy planning. 1% agree that it does influence consensus of views, whilst 3% state that it does not. Accordingly, the private sector does not consider one of participating groups of consensus of views as influential in the effective implementation of the sustainable urban design, using high density mixed use schemes in Amman. 98% state that public institutions influence consensus of views for the effective strategy planning. 2% state that they do not.

Accordingly, this project requires both public institutions and local communities in order to reach a consensus of views. Work on the views of the different competent authorities within public institutions, and the local community, needs to ensure compatibility the two. This provides a means of controlling the main problems which emerge during the implementation of this project by providing necessary support through collaboration with these different sectors. Hence, the questionnaire findings specified that consensus of views can include both local citizens and public institutions within to the context of Amman. The questionnaire findings excluded the private sector which was identified through the findings of literature review by Ndeke (2011), DEA (2005), because there are difficulties in gaining consensus of views.

7.6.3.4 Investments

This section checked the fourth requirement of this strategy which was identified through the literature review by McGeough et al. (2004), DEA (2005). The survey findings identified the extent to which investments influence the planning strategy for the effective implementation of the sustainable urban design principles, using high density mixed use schemes in Amman as shown in Table 7.11.

Table 7.11: Investments for the implementation of sustainable urban design

Investments	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Public investments	91%	7%			2%
Private investments	97%	3%			1%

On public investments, 98% agree that this influences effective strategy planning. 2% state that it does not. 99% agree that private investments influence effective strategy planning. 1% state that it does not.

Accordingly, this project needs both these investments to provide the necessary support through collaboration with the different sectors. Hence, the survey responses were consistent with the findings identified through the literature review by Ndeke (2011), Habitat ll in Istanbul, UN (1996), DEA (2006); (2005).

7.6.3.5 Incentives

The questionnaire findings checked the last requirement of this strategy which was identified through the literature review by McGeough et al*.* (2004). This section identified the extent to which the methods can be used as main methods for using the incentives as a planning strategy requirement for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman as shown in Table 7.12.

Table 7.12: Incentives for the implementation of sustainable urban design

Incentives	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Individual incentives	91%	5%	1%		3%
Organizational incentives	80%	17%			3%

On individual incentives, 96% agree that they influence incentives for the effective strategy planning. 1% disagree that they do, whilst 3% state that it does not influence incentives. 97% agree that organisational incentives influence incentives for the effective strategy planning. 3% state that they do not.

Accordingly, this project needs both incentives for providing the necessary support through either individuals or organizations, which should be included and taken into account in the project plan. These can be presented as financial and convenience incentives. As these incentives encourage either individuals or organisations to be involved in this project, this provides an opportunity to get a broad variety of participants for achieving sustainable communities. Hence, the questionnaire findings were consistent with the findings identified through the literature review by DEA, (2005); McGeough et al*.,* (2004); Habitat ll in Istanbul, UN, (1996).

In summary, this section explored the planning strategy for the implementation of sustainable urban design principles using HDMU schemes in Amman. It specified the planning strategy phases which can be used by this process such as, strategic vision, strategic assessment, strategic analysis, strategic plan formulation and implementation and management. It also identified the main outputs which can be used for these phases. Moreover, It specified the planning strategy requirements needed at each phase for the effective implementation of this process, and how these requirements can be implemented throughout this process, requirements such as competencies and skills (Leadership), broad-based community participation, future public and private investments and financial and convenience incentives. These requirements could be achieved through providing the main elements to each of them.

7.7 Discussion of HDMU implementation framework findings

The section discusses the primary outcomes of this study as justification for the proposed HDMU implementation framework. It concludes by making a set of recommendations for the framework as well as strategies to promote its effective implementation in HDMU schemes in the city of Amman.

7.7.1 Findings influencing the development of the HDMU implementation framework

The study used the findings from testing the indicators in Amman and the questionnaire survey to make an HDMU implementation framework. This was achieved through using the components of this framework identified through the literature review findings by Pearce (2000) Pearce and Barbier (2000), DEA (2010;2006;2005;1998), Ndeke (2011), Lehman (2010) and Al Waer *et al.* (2014). These findings are summarized as follows:

1. **Findings of testing the indicators in the context of Amman**

From testing the indicators in the Amman master plan, the framework included ten suitable indicators for the city of Amman and a wide range of constraints totalling 18 constraints. These constraints were distributed across the four dimensions: five social constraints, eight environmental constraints, two economic constraints and three governance constraints.

2. **Findings of questionnaire survey**

From the questionnaire survey, the framework confirmed that all of the indicators identified by the testing model are suitable for the city of Amman. The survey responses confirmed 16 of the 18 constraints identified by testing the indicators, and it excluded 2 constraints. Also the survey responses provided a set of appropriate solutions to overcome the constraints. In addition, it identified a planning strategy including phases and requirements for the effective implementation of the framework.

7.7.2 An implementation framework for HDMU in SUD schemes

The framework consists of the three main components identified by the findings from the literature review: the suitable indicators, constraints and solutions/opportunities and a planning strategy for implementing this scheme in the context of Amman. The thesis examined these components to provide the guidelines that constitute the implementation framework and that can be used effectively in this context. The framework was created through testing the urban sustainability indicators in the context of Amman and thus informing the future development of the Amman Master Plan for its delivery according to sustainable urban design principles using HDMU schemes. The framework consists of the main findings. These findings were split into two parts: the first part includes two components of the main three components of this framework are; suitable indicators and constraints and solutions/opportunities for the city of Amman. The second part presents the third component of this framework, is the accompanying planning strategy comprising a set of phases and requirements for the effective implementation of HDMU schemes using sustainable urban design principles SUDP. Both are presented in the next section.

7.7.2.1 Indicators, constraints and solutions for the city of Amman

Indicators

- Soc.1 Functionality, usability and aesthetic aspects
- Soc.2 Local people facilities
- Soc.3 Architectural considerations and cultural heritage
- Soc.4 Customers facilities and trends
- Env.1 Energy and natural resources
- Env.2 Materials used, durability and waste
- Env.3 Sustainable land use and site selection
- Env.4 Water and water conservation
- Eco.1 Economic performance
- Gov.1 Public communication

Constraints	Proposed solutions
Soc.1 Indoor noise and acoustic noise in primary areas inside buildings	Soc.1 The use of sound absorbing materials inside the buildings
Soc.2 Indoor air quality non monitoring inside buildings	Soc.2 Integration of air conditioning to monitor air quality inside buildings, and performing regular maintenance of these devices
Soc.3 Shortage of internet facilities used as a way of online shopping	Soc.3 Commissioning of new internet facilities
Soc.4 The population income is inadequate for housing price or rent	Soc.4 The establishment of finance programs in collaboration with lending institutions Soc.4 Providing institutional support to encourage participation and partnership arrangements.
Soc.5 The percentage of open space area compared to the city's area is low	Soc.5 The work of expansion of open space areas for the city.
Env.1 Difficulties in the management of water resources: inadequate of surface and ground water	Env.1 Prevention of the degradation of surface and ground water
Env.2 Absence of recycled materials in building construction	Env.2 The use of recycled materials in new buildings, and the use of new building elements should be compatible with the urban context.
Env.3 Ineffective integration between land use, transport planning and other governance functions such as; ineffective infrastructure	Env.3 Use of express bus lanes and the use of computerized area traffic control system. Env.3 Providing a free bus service painted green on weekends to parks
Env.4 The percentage of open public green space compared to the city's area is low	Env.4 Expansion of park/green areas and reduced resource use
Env.5 Difficulties in moving around the city such as; traffic and congestion	Env.5 Improvement of mass transit system and a restructuring of the roads Env.5 Work to develop new ways to incorporate the city with the surrounding metropolitan area
Env.6 Absence of cycle lanes and cycle facilities	Env.6 Plan the integrated transport network to install bike paths as new transportation alternatives
Env.7 Shortage of frequent fixed bus stops	Env.7 Construction of many bus stops alongside transport routes
Eco.1 The percentage of annual renewable energy consumption of total energy consumption is low	Eco.1 Encourage the use of renewable energy within the designs for new buildings to reduce annual energy consumption
Eco.2 Difficulties to create job and training opportunities for local community	Eco.2 Using strategies to engage the private sector to provide a set of job and training opportunities for the local community.
Gov.1 Difficulties in providing the skills and experience of professionals involved in delivering sustainable urban design.	Gov.1 The use of the skills and experiences available in the public institutions and private sector
Gov.2 Unsuitability of the regulations and laws which govern land use	Gov.2 Land use laws should minimize transport demands, save energy, protect open and green spaces.

Figure 7.8: First part of the summary of main findings

The thesis checked the indicators which should be measured for the implementation of sustainable urban design principles using HDMU schemes by the questionnaire findings. It confirmed that the ten indicators that were identified by testing the indicators t in the Amman context are suitable indicators for the city of Amman, therefore the survey responses increased the credibility of the findings allowing these indicators to be implemented in the context of Amman.

Additionally, the thesis identified that the ranking of the suitable urban sustainability indicators for the city of Amman which can be implemented by this process is (1) social (2) environmental (3) governance (4) economic. This means that this ranking, which was identified by the survey responses, agrees with the ranking of indicators by the testing-out of urban sustainability indicators in this context of Amman. Hence, this ranking represents the priority for implementing these indicators in the Amman master plan. This then led to the question as to whether this priority for implementing these indicators lends itself to effective implementation of HDMU schemes in Amman, and if so, how? This was further explored at the interviews phase.

The thesis checked the main constraints facing the implementation of HDMU schemes via the questionnaire findings. The survey responses confirmed 16 constraints of the 18 constraints identified by the testing indicators, and it excluded two constraints the first of which is environmental representing the percentage of waste treatment and disposal, which is low. The second is a governance constraint relating to the emergence of Local community resistance and negative media coverage for the master plan project. The remaining 16 constraints identified were: 5 social, 7 environmental, 2 economic and 2 governance. This result does not agree with the findings from testing the indicators in Amman. However, the reason for the exclusions was further explored at the interview phase of the study. The thesis also specified a range of appropriate opportunities/solutions which help to overcome these constraints for the effective implementation of HDMU schemes. The findings excluded a set of solutions that were used in the city of Curitiba because they are not compatible with the context of Amman. Hence, this study further explored whether there might be conflicts in the implementation of the proposed solutions to overcome the main constraints at the interview phase of the study.

7.7.2.2 The planning strategy

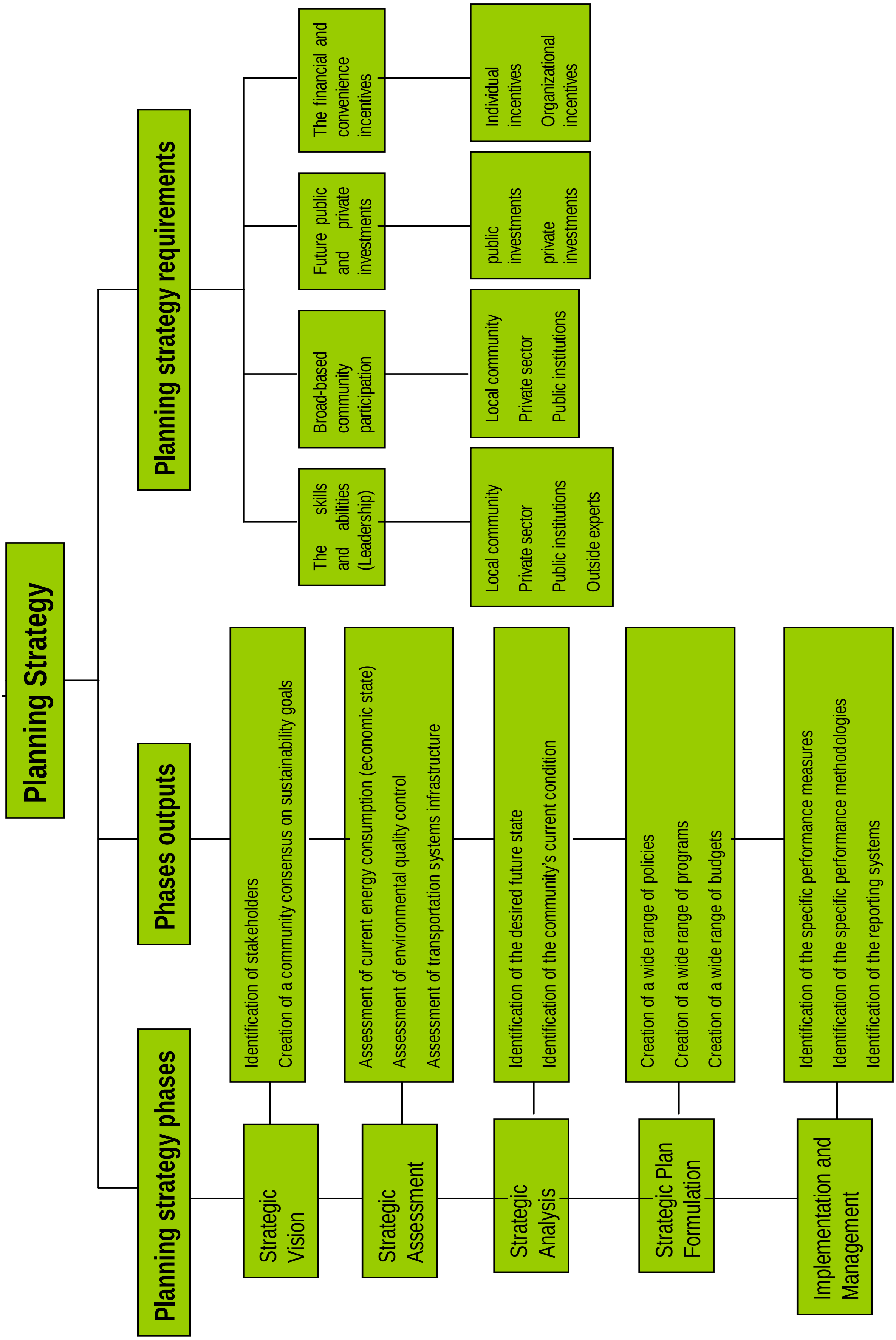

Figure 7.9: Second part of the summary of main findings

The thesis identified the main planning strategy phases which can be used for this process via survey responses. It also proposed a wide range of outputs at each phase. Firstly, 'strategic vision' includes the identification of stakeholders and creation of a community consensus on sustainability goals. This creates an opportunity to improve knowledge and practice in understanding these project goals by the local community. Hence, this provides a basis of assessment and analysis for the next phases of the planning strategy for the implementation of HDMU schemes. Secondly, 'strategic assessment' tries to assess both the economic state and environmental quality for the city, as well as transportation systems infrastructure. In this context, these outputs help to address the strategic assessment phase in terms of economic, social and environmental indicators for implementing sustainable urban design principles. Thirdly, 'strategic analysis' seeks to analyse the community's current conditions and identify the desired future state. This helps to formulate a strategic plan for this process. Fourthly, 'strategic plan formulation' seeks to create abroad variety of policies, programmes and budgets, which constitute a framework of the social, economic, environmental and governance dimensions for implementing this project. In this context, the strategic plan formulation phase should include a range of professionals for each indicator.

Lastly, 'implementation and management' phase which includes identification of the mechanism used throughout this project including performance methodologies and measures, and reporting systems which can be presented throughout this project. In this context, the thesis excluded the 'tactical alternative' phase for this strategy as a result of the questionnaire findings. This was not compatible with the findings of the literature review. However, the reason for its exclusion was further explored at the interview phase of the study.

In addition, this study further explored if there are any additional planning strategy phases according to the context of Amman at the interviews phase.

The study findings identified four requirements for the planning strategy. Firstly, the ‘competencies and skills (Leadership)’ needed at each phase of the project involving the local community, private sector, public institutions and outside experts. These competencies and skills have been distributed across the main project phases as follows: the local community can be involved in the study and monitoring of the project, the private sector can be involved at the study and implementation phase, public institutions at study, preparation, design and monitoring phase, and outside experts can be involved in the study, preparation and design phases of the project. The second identified requirement is broad-based community participation involving local citizens, the private sector and public institutions. It also identified the main methods that can be used to provide the technical and administrative support for community participation, such as surveys which can be used for ensuring local citizen participation, surveys and focus groups for ensuring private sector participation, and interviews and the focus group method for ensuring public institution participation. The third requirement identified is future public and private investments and their elements. Hence, this study highlighted a role for both public and private investment for the planning strategy in the next section (interviews).

Fourthly and lastly, the financial and convenience incentives, both individual and organisational, and their methods. This study further explored how these incentives can be presented at the planning strategy phases via interviews. In this context, the study excluded the ‘consensus of views’ requirement for the planning strategy following the survey responses. This result does not agree with the findings of the literature review as shown in section 3.4. The study explored why this requirement was excluded for this planning strategy at the next section (interviews phase). Moreover, this study further explored. At this phase, whether there were any additional planning strategy requirements relevant to the context of Amman.

At the interviews phase involving professionals as part of the research, the discussions focused on the issues that affect implementation such as suitable indicators, constraints, solutions and the planning strategy to be used effectively, which constitute the framework for sustainable urban design for implementing HDMU schemes in Amman. Starting from here, the study raised a set of key questions which it was judged would help to overcome these issues as follows:

1. Does the ranking for implementing the indicators give the opportunity for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman? And if so, then how?
2. The low percentage of waste treatment and disposal was one of the economic constraints which was then excluded by the questionnaire survey. Do you agree with this? And if so, why?
3. The emergence of local community resistance and negative media coverage for the master plan project was one of the governance constraints which was excluded by the questionnaire survey. Do you agree with this? And if so why?
4. Considering the current implementation of sustainable urban design principles, what conflicts where found in the implementation of the proposed solutions to overcome the main constraints?
5. The main planning strategy phases for sustainable urban design using HDMU are: strategic vision, strategic assessment, strategic plan formulation and implementation and management. Are there other phases that could be used within strategic planning for this project? What are they, and why?

6. A tactical alternative phase was one of the planning strategy phases that was excluded by the questionnaire survey. Do you agree with this exclusion? Why?
7. The main planning strategy requirements for sustainable urban design using HDMU are: competencies and skills (mainly leadership), broad-based community participation, future public and private investments and financial and convenience incentives. Do you believe that there are other requirements that could be used within the strategy planning for this project? What are these and why?
8. What role is there for both public and private investments in the planning strategy for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?
9. How can the financial and convenience incentives be presented at the strategy planning phases for the effective implementation of the sustainable urban design principles, using high density mixed use schemes in Amman?
10. 'Consensus of public views' was one of the planning strategy requirements that was excluded by the questionnaire survey. Do you agree with this exclusion? Why?

7.8 Evaluation of the HDMU implementation framework

This section presents the findings from evaluating the implementation framework using a set of interviews. This evaluation validates and helps to improve the confidence in the findings, thereby increasing the credibility of these findings of the thesis. This section of the study involved a group of professionals consisting of five architects and five planners. These professionals are sampled because they worked in implementing the master plan either within the Greater Amman Municipality, or the private sector as part of the master plan team. These professionals were identified using the classification of Jordan Engineers Association (JEA) and Greater Amman Municipality (GAM) based on professional manpower to determine main samples. To ensure balance for the master plan, the evaluation included the views of the two professional groups involved in the project. The planners are responsible for creating the master plan while the architects are responsible for its delivery.

The interviews were recorded and transcribed by the researcher over a period of 30 days. One-to-one interviews were generally of one hour duration in a setting chosen by the participants themselves in order to allow them to feel relaxed and at ease when talking to the researcher. The longest interview was 90 minutes and, on average, interviews were 67 minutes. Every participant signed a meeting information sheet and confidentiality form at the start of the interview. Field notes were made by the researcher before, during and after the interviews and these were kept with interview notes to enable the researcher to reflect on issues and which offered a clear audit trail. This validity of data through credibility was at the core of the research findings.

Table 7.13 gives an overview of the professionals (architects and planners) who are working at the Greater Amman Municipality (GAM) as part of the master plan team.

Table 7.13: Sample of architects and planners for supporting evidence

No.	Name	Professional	Position	Experience
P.1	Tamam Mango	Planner	GAM	10 years
P.2	Rima Odeh	Planner	GAM	15 years
P.3	Hassan Alkaby	Planner	Engineering office	10 years
P.4	Dania Hamadna	Planner	GAM	6 years
P.5	Ihsanabustateah	Planner	Bearing Point company	5 years
A.1	NuhaQtaish	Architect	GAM	10 years
A.2	ShireenDa'ana	Architect	GAM	5 years
A.3	Hasan Kiswani	Architect	Engineering office	7 years
A.4	Lana Haddadin	Architect	GAM	5 years
A.5	Murad Kalalda	Architect	Engineering office	20 years

This section tried to fill the gaps in the framework for implementing sustainable urban design principles using HDMU schemes in Amman as identified previously. Therefore, these issues needed to be addressed to support the effective delivery of this framework. This was achieved through evaluating the main factors for this framework such as suitable indicators, constraints, opportunities/solutions and planning strategy as follow:

7.8.1 Indicators, constraints and solutions for the implementation of HDMU schemes in Amman

Interviewed architects and planners identified the ranking of indicators (identified by testing the indicators in Amman and by survey responses)thereby prioritising the implementation of the suitable indicators and increasing the effectiveness of the implementation of HDMU schemes in Amman. The feedback on this ranking which identifies the main proprieties to each indicator to overcome the main constraints facing the implementation of HDMU schemes in Amman is very useful, and is supported by some of the interviewees who state that:

> "Yes, the ranking of indicators can present an opportunity for effective implementation of high density mixed use schemes. This can be through identifying properties of each indicator to help to understand the main constraints and find appropriate solutions to overcome the key challenges facing this process." (A.5)

> "Yes, there should be feedback on the ranking of these indicators in order to work to fill the main gaps facing the implementation of high density mixed use schemes." (A.4)

> "Yes, this ranking of indicators can help to implement these indicators through using the feedback for the ranking. This works to fill the main gaps facing the implementation of this process. Hence, the application of this process gives an opportunity to implement the suitable indicators for the city of Amman." (P.2)

> "Yes, we should understand the main properties of each indicator to identify the main constraints and find appropriate solutions." (P.3)

The interviewees' responses confirmed that the low percentage of waste treatment and disposal is not one of the main environmental constraints. This is in agreement with what was identified by the questionnaire findings discussed above in section 7.3.2. Based on this, one conclusion arrived at is that the environmental constraint is not considered to be a major influence on the implementation of HDMU schemes in Amman. Additionally, work is underway to construct waste treatment and disposal plants with the technical assistance of an American company (MIMCo). Therefore, this will add further weight in the future to the argument that this constraint could be managed. This is supported by a group of interviewees who state that:

> "Yes, the city tries to create waste treatment and disposal plants without affecting the surrounding environment, using a set of private companies, such as Canadian or American." (A.1)

> "Yes, the city has tried to minimise the percentage of waste through constructing and developing a set of projects specifically for this process. This could be achieved using outside experts and specialist companies in this field." (A.4)

> "Yes, this constraint will not obstruct the implementation of sustainable urban design practices using high density mixed use schemes in Amman, because there is a waste treatment and disposal project underway in collaboration with an outside company, which will be responsible for the implementation of this project." (P.5)

> "Yes, the city is working in collaboration with an American company to overcome this constraint. Hence, this will not constitute a problem in achieving sustainable urban design practices for implementing high density mixed use schemes in the master plan." (P.2)

Interviewed architects and planners confirmed that the emergence of Local community resistance and negative media coverage for the master plan project is not a primary governance constraint. This agrees with what was identified by survey responses discussed above in section 7.3.4. Therefore, this was not considered as one of the governance constraints, because personal interests play a key role in decision-making for the local community but they constitute a low percentage of local community views. Therefore, these objections do not constitute a constraint in the implementation of this project, because the city can implement it according to a wide range of regulations and laws that organise the relationship between the local community and the city. These regulations help to implement this project without creating conflict with local community views, or affecting them negatively. This is supported by interviewees who state that:

> " Yes, the emergence of local community objection comes from personal interest which control local community views." (A.1)

> "Yes, the city has tried to implement these schemes using a broad variety of regulations and laws. These regulations and laws try to avoid conflict between community views and the city through achieving a balance between providing the local community demands and implementing the project without affecting the local community negatively." (A.5)

> "Yes, the city works to implement the project without affecting the local community negatively, according to a wide range of regulations and laws. This help to minimise local community objections motivated by personal interests, which control local community views." (P.4)

> "Yes, the emergence of local community objection comes from personal interest which control local community views. Therefore, the city has used a broad variety of regulations and laws for the implementation of these schemes, without affecting the local community." (P.2)

The interview findings were used as extra checks, and verified that there were no major conflicts in the implementation of the proposed solutions in the Amman master plan. This agrees with what was identified by the questionnaire findings discussed above in section 7.4. Moreover, consideration is given to implementation of these solutions in all areas within the Amman master plan equally, using the lessons learnt in the three areas. This is supported by interviewees who state that:

> "There are no conflicts; these solutions used in the three areas can be implemented in other areas within the Amman master plan. This can be achieved through taking advantage of the lessons used in these three selected areas in the master plan." (A.2)

> "There are no conflicts, but these solutions should be implemented within the master plan in all areas equally." (A.3)

> "There are no conflicts by implementing these solutions." (P.3; A.4;A.5)

7.8.2 Planning strategy phases and requirements

Interviewed architects and planners verified that there were no additional planning strategy phases for the implementation of HDMU schemes in Amman. This agrees with what was identified by the literature review as shown in section 3.4 and the questionnaire findings discussed above in section 7.6.1. Therefore, these planning strategy phases can be considered for the implementation of HDMU schemes in Amman. However, there should be confirmation that the monitoring phase should be included as a management element to control the implementation of this project. This is supported by interviewees who state that:

> "There are no other planning strategy phases. However, the implementation of these phases need monitoring by the competent authorities at each stage." (A.5)

> "There are no other planning strategy phases." (P.5; P.4; A.1; A.4)

> "There are no other planning strategy phases, provided that all of these phases are implemented as planned." (P.1)

> "There are no other planning strategy phases. But management should involve monitoring of the project. Hence, this gives an opportunity to implement the project phases according to effective planning strategy." (P.2)

> "There are other planning strategy phases. The monitoring of the implementation of this project can help to manage this project effectively during all phases." (A.2)

The interviewees responses confirmed that the tactical alternative phase is not one of the main planning strategy phases. This agrees with what was identified by the survey responses discussed above in section 7.6.1. Therefore, this phase is not considered one of the strategy phases affecting the implementation of HDMU schemes in Amman, because the strategic assessment phase is adequate for effective planning strategy provided that it is implemented effectively. However, if there is any defect in this phase then a tactical alternative phase can be usefully implemented in order to avoid the expected gaps and errors, which may happen through implementing the planning strategy. The strategic assessment phase can produce a wide range of alternatives and necessary precautions which can be used to correct these errors and fill these gaps as a result of implementing the planning strategy. This is supported by interviewees who state that:

> "Yes, the strategic assessment phase is adequate for effective planning strategy, provided that this phase is implemented effectively." (A.4)

> "Yes, there is no need for the use of the tactical alternative phase, so long as there is clear implementation of the strategic assessment phase with consideration given to a set of necessary precautions." (A.3)

> "Yes, the strategic assessment phase is adequate for effective implementation, but the tactical alternative phase can be used to avoid expected errors. The strategic assessment phase can fill these gaps and correct the errors, which may emerged as a result of implementing this strategy." (P.2)

> "Yes, the tactical alternative phase is not necessary if the strategic assessment phase is implemented effectively." (P.3)

Interviewed architects and planners verified that there are no additional planning strategy requirements for the implementation of HDMU schemes in Amman. This agrees with what was identified by the literature review as shown in section 3.4 and the survey responses discussed above in section 7.6.3. Therefore, these planning strategy requirements can be considered for the implementation of HDMU schemes in Amman. However, there should be confirmation that leadership must be effective and the broad-based community participation controlled throughout the implementation of the project. This is supported by a interviewees who state that:

> "There are no other planning strategy requirements, provided that leadership is effective throughout the implementation of the project." (A.2)

> "There are no other planning strategy requirements." (A.4; A.1; P.1)

> "There are no other planning strategy requirements. But the broad-based community participation should be controlled during the implementation of the project phases." (P.2)

> "There are no other planning strategy requirements. However, there should be monitoring of broad-based community participation." (P.3)

The interviews findings explored how private and public investments can be involved in the planning strategy for the effective implementation of HDMU schemes, which were identified by the literature review as shown in section 3.4 and the survey responses as discussed in section 7.6.3. This was identified through exploring the key role of both the private and public investments in the planning strategy for the effective implementation of the project. Private investments can play a key role more than public investments, because the construction of this project requires provision of adequate land area. Land prices are high requiring high financial capability for ownership which can only come from private investments, because of their high economic ability. As for the role of public investment this includes developing the infrastructure for these lands in collaboration with public institutions responsible for these sites. In addition, private investments need to be controlled throughout the implementation of the project to avoid promotion of personal interests by investors. Therefore, there should be monitoring of private investments by the public institutions responsible for the city, in order to control these investments. This is supported by interviewees who state that:

"Personal interests control private investments more than public interests during these projects. For this reason, this type of investment needs monitoring by the public institutions responsible for these sites." (A.1)

"Public investments do not have an ability to provide any type of financial capabilities. Public investments can help to develop the infrastructure for these sites, and this can be achieved in collaboration with public institutions responsible for these areas. As for private investments, these can provide any type of financial requirements though at high costs." (A.2)

"Private investment enables effective implementation of these principles more than other investments, because of its high financial capability to implement these projects. As for public investment, this cannot meet the financial costs required for these projects because they do not have the same level of financial capacity as the private investment." (A.5)

"This type of project creates a high economic cost of implementation. Private investment has the ability to buy significant land that is needed for implementing these projects at such a high cost." (P.3)

"Private investments motivated by personal interests more than public interests in these kinds of projects. Therefore, there should be monitoring of private investments by the public institutions responsible for the city. This will helps to adjust investment efficiency within these sites, and avoid the problem of personal interests relating these investments that do not take into account the city's interests." (P.4)

Interviewed architects and planners identified how the financial and convenience incentives can be presented by both private and public sector for the strategy planning phases, which were identified by the literature review as discussed in section 3.4, and the questionnaire findings as discussed in section 7.6.3. These incentives can be presented in two forms i.e. tax credits and facilities and discounts. These means can be offered as payments by instalments in order to be attractive to investors. This is supported by interviewees who state that:

"These incentives can be presented to private agencies for implementing these projects as discounts. As these incentives can be presented as tax credits to the investors, and this is encouraging them to implement projects such as these." (A.1)

"The city can present tax credits or discounts to these investments, and this is encouraging the investors to implement such projects." (A.3)

"The financial amounts which should be paid to ensure the implementation of the infrastructure for these sites can be offered as payments in instalments to facilitate implementing agencies, to be incentives to investors to overcome the financial constraints facing these projects." (P.2)

" The city can offer incentives that encourage different sectors to participate in implementing these projects on the ground." (P.4)

The interview findings confirmed that the consensus of public views requirement is not one of the main planning strategy requirements. This agrees with what was identified by the survey responses discussed above in section 7.6.3. Therefore, this requirement is not considered one of the strategy requirements affecting the implementation of HDMU schemes in Amman, because there is a wide-ranging difference of views. This difference relates to individual land ownership with the accompanying personal interest factor which inevitably affects the nature of the society-wide view of the master plan, because of the inability of the city to offer a broad variety of services to all areas of land equally. This can lead to disputes between landowners and the city undermining any possible consensus of views. This is supported by interviewees who state that:

> "Yes, because there are many issues that support personal interests which do not give an opportunity for consensus of views. For example, the city cannot present a wide range of services to all areas of land equally. Hence, this affects the nature of society's views relating the master plan." (P.2)

> "Yes, it is difficult getting consensus of public views, because there is a large difference in the views, and this difference relates to issues that play a key role in influencing these views." (A.4)

> "Yes, it is difficult to reach a consensus of public views for all categories within this process." (P.5; P.1; P.3; A.1)

Finally, this chapter developed the final HDMU implementation framework as shown in Figure 7.10.

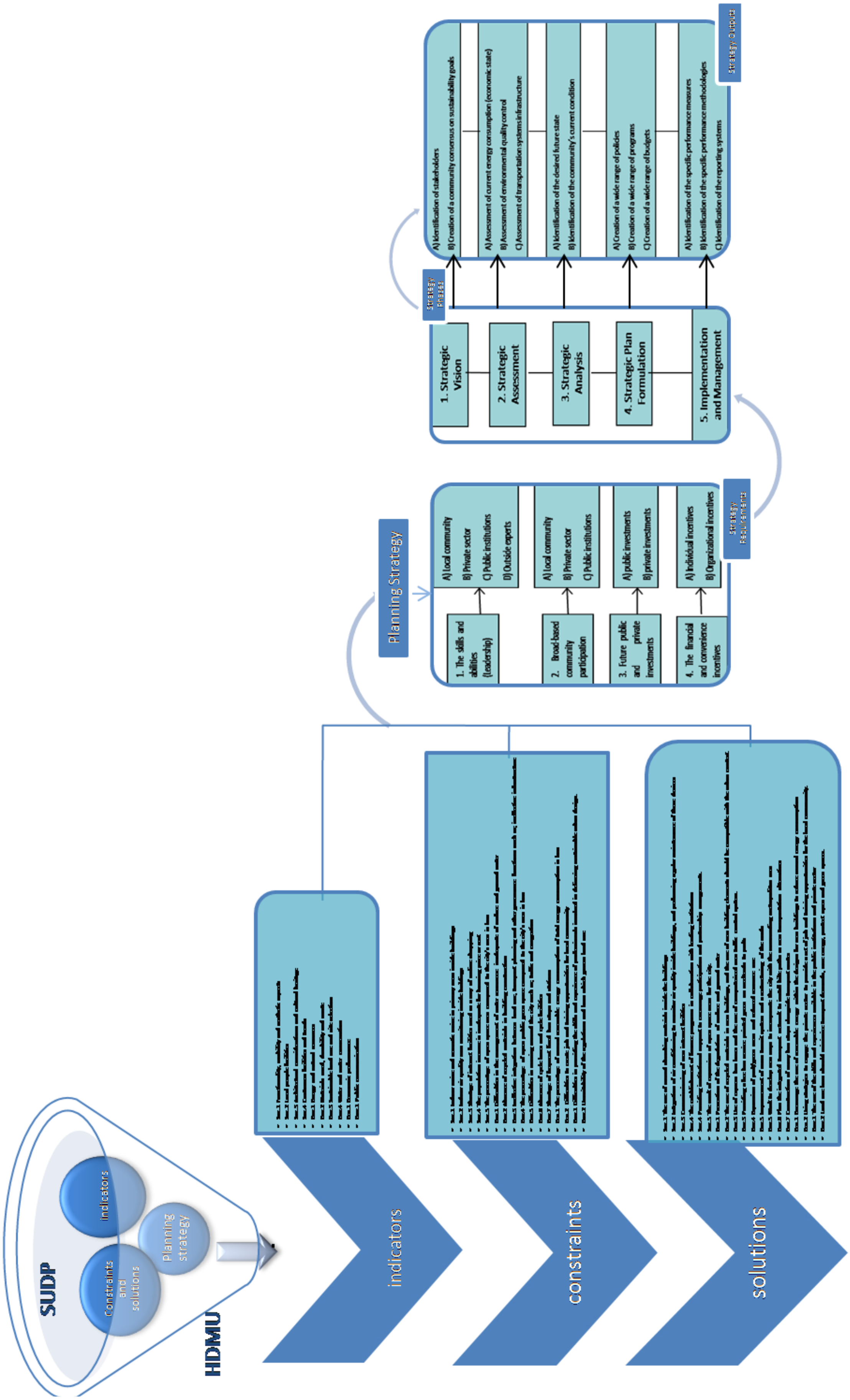

Figure 7.10: Implementation framework (Source: the Author)

7.9 Chapter Summary

This chapter discussed and evaluated the main findings which constitute the framework components through addressing the most important issues to fill the main gaps for the framework for implementing HDMU schemes in Amman. This improved confidence in the findings and increased their credibility. The next, and final, chapter presents a wide range of conclusions which constitute to a variety of recommendations relating to this framework, to be used effectively in the context of Amman.

Chapter 8

Conclusions and recommendation

8.1 Introduction

This chapter discusses the key findings of the thesis with respect to the role of sustainable urban design principles in delivering high density mixed use schemes in Jordan, Amman.

The research aim was to propose a framework consisting of a set of recommendations for providing guidelines for the implementation of sustainable urban design principles using HDMU schemes in the Amman context, and to inform the future development of the city's master plan. The purpose of this chapter is to synthesise the researcher's interpretations from the secondary data analysis, and the previous two analytical chapters, with the issues raised by the literature review in order to generate and confirm the findings. Amman was chosen as a case study because the researcher identified a clear need to undertake this kind of research in Amman which remains, in academic literature, a little studied city (Hanania, 2014).

The examination of the physical environment in Amman, and key factors within the case study, provided evidence that supported the literature review findings which showed that the nature of localities, and the physical environment, can influence the ability of agencies and city managers, through master planning, to incorporate higher density development into an existing urban area. The remainder of this chapter analyses the findings in the gaps in knowledge, and what this means when addressing the identified research problem which is: how can urban design principles and indicators help deliver high density mixed use and sustainable development in a city like Amman?

This chapter is divided into five sections. The first section explores the theoretical and practical contributions of the thesis. The second presents the main aim of the study which was outlined in the first chapter and is revisited to establish how the study has fulfilled the objectives of the thesis. The third includes a series of conclusions stemming from the research undertaken. The fourth provides a set of recommendations linked to the findings. The fifth offers a set of reflections on the research process, and outlines possible opportunities for future study within this field.

8.2 Key contributions of the thesis

8.2.1 Theoretical contribution

The thesis focused on two main existing theoretical concepts: sustainable urban design principles and high density mixed use. By investigating the implementation of HDMU schemes, the gap in the implementation framework was identified . At present, there are no clear guidelines for the implementation of HDMU schemes. Flaspohler et al. (2008) described implementation frameworks as major steps related to promoting implementation. It focuses on details in the specific procedures, strategies and practices that shape the implementation process to ensure quality implementation (Duncan *et al*., 2012).

A number of authors such as Pearce (2000), Pearce and Barbier (2000), and Al Waer et al (2014) propose frameworks for sustainable urban development. They affirm that such frameworks in the main need three key components to be used effectively: (1)provision of a broad variety of indicators using their measurements, (2) identification of the main constraints and solutions to overcome the challenges facing the implementation of sustainable urban design principles and, (3)formulation of a planning strategy to manage this process. This thesis examined these components constituting the implementation framework to provide the guidelines which can be used effectively in the context of Amman.

Starting from this point, the thesis raised the key question of how sustainable urban design principles can be implemented in HDMU schemes within the context of Amman. It then tried to propose a range of guidelines to fill this gap and which can be adopted in the implementation of sustainable urban design principles using HDMU. Accordingly, the contribution lies in proposing an implementation framework that consists of a series of multi-faceted recommendations providing guidelines for implementing SUDP in HDMU schemes. This was supported by from the literature and lessons learnt from Amman as shown in Figure 8.1.

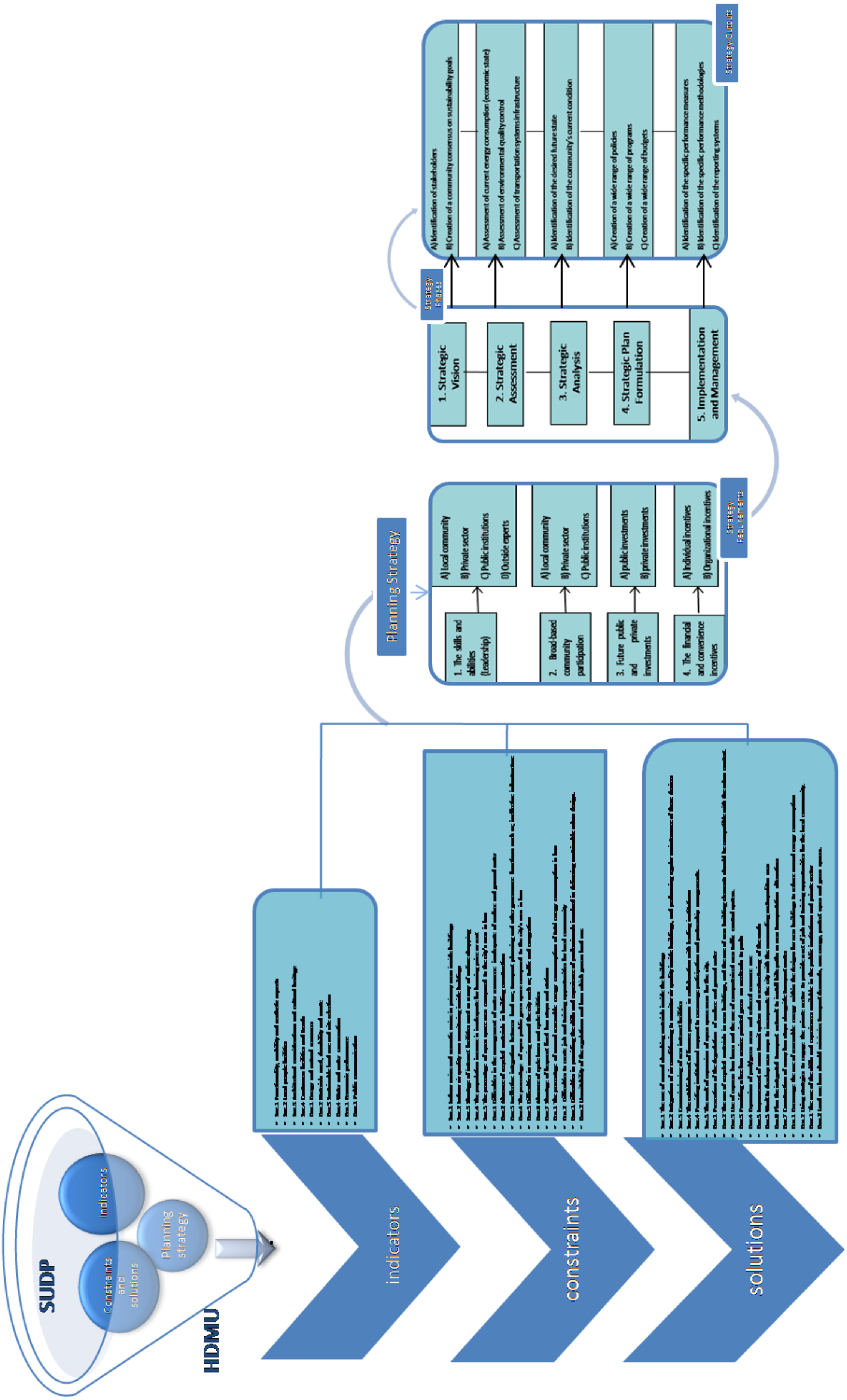

Figure 8.1: HDMU implementation framework for SUDP

Figure 8.1 provides an illustrative diagram of the framework including its components which constitute the guidelines for implementing this process.

By exploring the components contained within this framework, the thesis outlined how it could be used and adopted effectively. The thesis identified the suitable indicators for the city of Amman. Also it identified the main constraints and a broad variety of appropriate solutions to overcome the challenges facing the implementation of this process. In addition, it identified the main planning strategy including the phases and requirements. This provided a broad range of guidelines for implementing HDMU schemes in Amman.

8.2.2 Practical contribution

The thesis demonstrated how the implementation framework could be used effectively and successfully. Therefore, the contribution to knowledge was a series of multi-faceted practical recommendations. This knowledge addresses the gap in the delivery of the master plan for the city of Amman. An alternative set of suitable indicators for the city of Amman taking on board constraints, solutions and a planning strategy was developed. This framework allows the city of Amman to improve and inform the future development of the master plan by embedding a learning mechanism in the process.

At the urban scale, sustainable development lacks an urban development framework in most of the Middle Eastern cities that could stimulate a community change towards sustainable development (Elgendy, 2011b). The framework developed in the thesis could also be developed further in order to inform wider work that is being undertaken in the Middle Eastern region, in the growing cities of countries such as Qatar and the United Arab Emirates.

In 2008, the United Arab Emirates designed the first programme of its kind that is tailored to the Middle East region (Elgendy, 2011). The Estidama programme was developed by Abu Dhabi Urban Planning Council in 2010, in collaboration with a wide ranging group of national experts (Estidama, 2010a). It comprises the Pearl Community Rating System (PCRS) which consists of a set of indicators that are considered essential and fundamental to creating more sustainable communities (Estidama, 2010b; Elgendy, 2011a). It aims to create a balance between design guidance, and detailed requirements, for a project's potential performance in relation to the four pillars of Estidama: environmental, economic, cultural and social (Estidama, 2010a; Ayyoob and Akito, 2013b).

In Qatar, the Gulf Organisation for Research and Development institute (GORD) designed the Global Sustainability Assessment System (GSAS). In 2014, this was developed by GORD in collaboration with the University of Pennsylvania, United States (Ayyoob and Akito, 2013b). It aims to create a sustainable built environment through addressing the cultural, social and environmental needs of the region (GORD, 2014).

The governments of the United Arab Emirates (UAE) and Qatar have engaged in commissioning sustainable design pilot projects in their respective countries with the goal of promoting sustainable development (Elgendy, 2012). The positive developments and the opportunities they present indicate that the tide is turning towards more sustainable development in the Middle East (Elgendy, 2010). Nevertheless, Elgendy (2011b) pointed out that the Middle Eastern cities have to overcome the challenges preventing progress towards achieving sustainable communities. The nature of the challenges faced by the region requires collaboration between professional bodies, governments, and the public (Elgendy, 2012).

Accordingly, the implementation framework developed by this thesis can be developed further in collaboration with these systems in order to inform wider work that is being undertaken in these cities in the Middle East. The methods developed in this thesis can be used in these cities to further inform their own development. This gives an opportunity to chart their own way to creating a sustainable future for its communities.

8.3 Revisiting the main aim and objectives of the thesis

This section revisits the main objectives of the thesis and pins down how the findings addressed these objectives in achieving the main aim of the thesis through what has been achieved, and what has not, as follows:

1. To identify and review urban sustainability indicators through a detailed literature review.

The thesis aimed to explore an implementation framework for the process of applying sustainable urban design principles using HDMU schemes to measure and monitor community progress towards sustainable development. Therefore, it identified the indicators that should be measured for implementing sustainable urban design principles in HDMU schemes, as part of the main components of this framework. It also identified a broad variety of indicators to help determine how successful the guideline policies are in the implementation and management of sustainable urban design principles, using high density mixed use. These indicators were examined by BREEAM Communities (2012), LEED ND (2009;2011), ESTIDAMA (2010), GORD/GSAS ND (2014) and Green Star (2012), the Council of the European Union Sustainable Development Strategy (2009), the United Nations Commission on Sustainable Development (CSD), International Urban Sustainability Indicators List (2007), SuBET Tool, Sustainability Checklist for Regional Shopping Centres (SCRSC)(2006),and other scientific papers and authors such as Serge Salat (2012).

This thesis chose the indicators which relate to sustainable urban design and high density mixed use, which were then applied to case studies in Amman, Jordan.

2. To identify a set of suitable indicators and constraints for the city of Amman through testing the indicators identified in the literature review.

The thesis tested the SCRSC model which includes a broad variety of urban sustainability indicators and measurements within three case study areas in Amman master plan. These areas provided an opportunity for testing the urban sustainability indicators to identify a set of suitable indicators and constraints for the city of Amman as part of the proposed framework. To achieve this, the thesis tested these indicators by using their defined measurements. Hence, the research compared the outcomes from the testing-out model in three study areas (A, B and C) in Amman. The research then identified a set of suitable indicators for the city of Amman, and highlighted the constraints to explore their solutions as part of the proposed framework.

3. To identify the solutions and the planning strategy for the implementation of sustainable urban design principles (SUDP) using HDMU.

The thesis used a questionnaire to identify the solutions and the planning strategy that can be used for implementing this scheme in Amman as part of the proposed framework. In this context, it used the successful solutions used in the city of Curitiba, Brazil, to help to explore the solutions to the constraints to overcome the challenges in implementing sustainable urban design principles using high density mixed use (HDMU) schemes. For the planning strategy, the questionnaire used questions derived from the literature review to identify this component of the framework.

In addition, the questionnaire checked the outcomes from testing the indicators identified by the literature review in Amman such as the suitable indicators and constraints for the city of Amman as part of the framework. Accordingly, the thesis has identified and checked these outcomes by the questionnaire survey. These outcomes constituted the main components of the HDMU implementation framework for sustainable urban design principles.

To achieve this, the thesis used the questionnaire survey on a wide range of professionals consisting of architects and planners in order to achieve balance. These professionals were working on the implementation of the master plan either within Greater Amman Municipality, or the private sector. The planners were selected because they are responsible for creating the master plan, while the architects are responsible for its delivery.

4. To propose the implementation framework through evaluating its components including the suitable indicators, constraints, solutions and planning strategy.

The thesis evaluated the implementation framework using the core research outcomes, which represent the proposed practical recommendations for providing guidelines for the implementation of sustainable urban design principles using HDMU in Amman. This was achieved by using a range of interviewees who were working to develop the master plan within the Greater Amman Municipality or the private sector, as well as outside experts. Hence, the thesis achieved the main aim of this research through proposing an implementation framework which includes a wide range of recommendations to inform the future development of the Amman master plan. This knowledge addresses the gap in the delivery of the master plan for the city of Amman according to sustainable urban design principles using HDMU, and provides guidelines to overcome the problems facing the Amman master plan.

8.4 Conclusions

The thesis enhanced the knowledge levels required for the implementation of sustainable urban design principles using high density mixed use. This was achieved by introducing an implementation framework focusing on the key components which constitute this framework. By exploring the underlying components that inform this framework, the thesis exposed how it can be used effectively and further fine-tuned to reflect place specific variables.

In the case of Amman, the thesis identified the main components of the HDMU implementation framework as shown in Figure 8.1 as follows:

8.4.1 Suitable indicators for implementing sustainable urban design principles using HDMU schemes

The thesis identified a broad variety of suitable indicators which help to determine how successful the guidelines are in the implementation and management of sustainable urban design principles using high density mixed use in the Amman context. These indicators are represented under four dimensions: social, environmental, economic and governance. For the social dimensions, there are four indicators: functionality, usability and aesthetic aspects, Local people facilities, architectural considerations and cultural heritage, and customers facilities and trends. As for the environmental dimensions, there are four indicators: energy and natural resources, materials used, durability and waste, sustainable land use, and site selection and water conservation. In addition, there is one economic indicator: economic performance, and one governance indicator: public communication.

The thesis also identified that the ranking of the suitable urban sustainability indicators for the city of Amman, which can be implemented by this process is: (1) social (2) environmental (3) governance (4) economic. Hence, this ranking represents the priority for implementing these indicators in the Amman master plan, enhancing the effective implementation of the sustainable urban design principles using HDMU schemes in Amman. Furthermore, the feedback from this ranking process has proven very useful since it identifies the main proprieties under each indicator to overcome key constraints, and fill the gaps in the implementation of this process.

In this context, the main thesis title prioritises the “high density mixed use” scheme. Therefore, the thesis used a set of indicators which are primarily concerned with the density issue and its measurements. Salat et al (2011a) identified a wide range of indicators related to density such as proportion of green areas per capita, proportion of agriculture lands, job density, rate of wastewater recycling, rate of renewable energy used, proportion of housing per capita, ease of private car access, proportion of pedestrian routes for population, proportion of cycle and cycle facilities, proportion of public transport systems and facilities, and proportion of recycled materials in the construction of the building (Salat et al., 2012; Bourdic and Salat, 2012). These measurements were considered within the selected indicators through the literature review and were tested within the Amman context.

8.4.2 The main constraints and a broad range of appropriate solutions

The thesis identified the main constraints and a broad range of appropriate solutions to overcome the challenges facing the implementation of this process. It identified five social, seven environmental, two economic and two governance constraints as clarified in Figure 8.1. Moreover, it specified a wide range of appropriate solutions which help to overcome these constraints to ensure effective implementation of this process. Hence, this study concluded that there are no conflicts in the implementation of the proposed solutions for overcoming the main constraints during the current implementation of the sustainable urban design principles. In addition, these solutions can be used in all areas within the Amman master plan equally, using the lessons learnt in the three areas.

In this context, this study excluded the emergence of local community resistance and negative media coverage for the master plan project as one of the governance constraints, because personal interests play a key role in decision-making for the local community, which constitute a low percentage for the local community views. Therefore, these objections do not constitute a constraint in the implementation of this project because it is guided by a wide range of regulations and laws, which organise the relationship between the local community and the city. These regulations help the implementation of this project by avoiding any conflict with local community views, and affecting them negatively. This study also excluded the low percentage of waste treatment and disposal as one of the economic constraints, because work is being done (by an American global company) to construct a set of waste treatment and disposal plants without any negative effect on the surrounding environment.

8.4.3 The main planning strategy: phases and requirements

The study explored the third component of the implementation framework, the planning strategy, for the implementation of these schemes in terms of phases and requirements. It identified the main planning strategy phases which can be used for this process, and a wide range of outputs for each phase which help to implement them. Firstly, 'strategic vision' includes identification of stakeholders and creation of a community consensus on sustainability goals. This provides an opportunity to improve the knowledge and practice to understand these project goals by the local community. This in turn provides a basis of assessment and analysis for the next phases. Secondly, 'strategic assessment' attempts to assess both the economic state and the environmental quality of the city, as well as assessment of transportation systems infrastructure. In this context, these outputs help to address this phase in terms of economic, social and environmental indicators for implementing sustainable urban design principles. Thirdly, 'strategic analysis' looks at the community's current conditions and identifies the desired future state. This helps to formulate a strategic plan for this process. Fourthly, 'strategic plan formulation' seeks to create abroad range of policies, programmes and budgets, which constitute a framework of social, economic, environmental and governance dimensions for implementing this project. This phase should include a range of professionals for each dimension. Lastly, 'implementation and management' phase which includes identification of the mechanism used throughout this project, including performance methodologies and measures and reporting systems which can be presented throughout this project. In this context, the study excluded the 'tactical alternative' phase for this strategy, because the strategic assessment phase is adequate for effective planning strategy, provided that this phase is implemented effectively. If, however, there is a defect in the use of this phase, the tactical alternative phase can be used in order to avoid the expected gaps and errors that could occur through implementing this strategy. This phase, therefore, introduces a wide range of alternatives and necessary precautions which can be used to correct these errors and fill these gaps to enable successful implementation of the planning strategy.

In addition, the study identified the main planning strategy requirements needed for this process. These requirements are: firstly, the competencies and skills (Leadership) needed at each phase of the project, which should involve the local community, private sector, public institutions and outside experts. These competencies and skills have been distributed across the main project phases, for example: the local community can be used in the study and monitoring phases of the project, the private sector can be used in the study and implementation phases of the project, public institutions in the study, preparation, design of plans and monitoring phases, and outside experts in the study, preparation and design of plans phases. Secondly, broad-based community participation which includes local citizens, the private sector and public institutions. it has identified the main methods which can be used to provide the technical and administrative support for community participation, such as: survey method for ensuring local citizen participation, survey and focus group methods for private sector participation, and interviews and focus groups for public institution participation. Thirdly, future public and private investment and their roles**.** This study identified that private investment can play a key role in the planning strategy more than public investment, because the construction of this project is dependent upon adequate areas of land. Since land cost is high, sufficient financial capacity for ownership is essential and this capacity can only be provided by private investors, because of their strong economic status. As for public investments, these would include developing the infrastructure for the land in collaboration with public institutions responsible for these sites. An important point is that private investments need to be controlled throughout the implementation of the project, to avoid the influence of personal interests of investors. Therefore, monitoring private investments should be conducted by public institutions responsible for the city, in order to gauge these investments.

The last requirement identified by the study is the financial and convenience incentives and their methods, which include individual and organisational incentives. This thesis examined how these incentives can be presented for the strategy planning phases. The financial and convenience incentives should be presented to both the private and public sector for the strategy planning phases in two forms: tax credits and facilities and discounts. These can be offered as payments by instalments in order to be attractive to investors. In this context, this study has excluded the ‘consensus of views’ requirement for this strategy, because there is a wide difference of views. This difference relates to individual land ownership with the accompanying personal interest factor which inevitably affects the nature of the society-wide view of the master plan, because of the inability of the city to offer a broad variety of services to all areas of land equally. This can lead to disputes between landowners and the city undermining any possible consensus of views.

8.5 Recommendations

The developed framework includes a series of practical recommendations that provide an opportunity to the city of Amman to inform the future development of the master plan as follows:

1. To develop the guidelines responsible for the Amman master plan according to the suitable indicators identified by this study as clarified in Figure 8.1. Moreover, to consider the ranking of these suitable indicators for the purpose of prioritising their implementation in the Amman master plan. This ranking provides useful feedback which identifies the main priorities for each indicator to overcome the constraints and fill the gaps in the implementation of the HDMU scheme. This will help to implement and manage sustainable urban design principles using high density mixed use in the Amman context.
2. To consider the main constraints that identified by this study as clarified in the Figure 8.1. These constraints can help to identify the main gaps that emerge through the implementation of the planning strategy of the sustainable urban design principles.
3. To use the proposed solutions identified by this study, and clarified in Figure 8.1,in order to fill the main gaps that emerge through the implementation of this scheme. These solutions provide a means to overcome the challenges of

effective implementation of the HDMU scheme. In addition, the implementation of these solutions can be used in all areas within the Amman master plan equally, using the lessons learnt in the three areas.

4. To apply the planning strategy identified by this study as clarified in the Figure 8.1 to achieve effective implementation of the HDMU scheme in the Amman master plan. In addition, to consider the main planning strategy phases and their outputs to be used for the HDMU scheme. For effective implementation of this process, the main planning strategy requirements are needed for this scheme.

8.6 Reflections

The decision to focus on a single case study was determined in order to understand the uniqueness and complexity of the individual case. Researchers such as Yin (2009) considered the limitations of the single case study strategy in that it could only reflect the uniqueness, or special conditions, that apply to the case study in question. Whilst recognising this, authors who support a single case study approach, such as Flyvbjerg (2006) and Tunnard and Wilson (2014), state that one can generalise on the basis of a single case. The force of example should not be underestimated but, rather, can be considered as supplementary to scientific development via generalisation (Bennett *et al.,* 2006; Tunnard and Wilson, 2014; Flyvbjerg, 2006). Formal generalisation should not be the main source of scientific progress (Giddens, 2014; Ragin and Becker 1992; Cutler, 2004; Thiem and Dusa, 2015; Tunnard and Wilson, 2014). Formal generalisation has often helped cut a path toward scientific innovation, but it only emphasises the limitations (Flyvbjerg, 2002). Also it is only one of many ways by which people gain and accumulate knowledge. That knowledge cannot be formally generalised does not mean that it cannot enter into the collective process of knowledge accumulation in a given field (Blaug, 2005; Basaiawmoit and Wanger, 2015;

Flyvbjerg, 2006). Ettlinger (2009) and Orchard-Webb (2012) argue that a single case study strategy can offer valuable insight into a "set of possibilities that may become scaled up". Therefore, the research undertaken in this thesis offers valuable insight into the relationship between sustainability, the physical environment, and locational elements that can in turn impact on the sustainability performance of a city, area or neighbourhood, all of which can be scaled up in the future.

Upon reflection, the researcher would have liked to expand this work into other cities similar to Amman in terms of urban form and development. The researcher believes that there are clear evidential benefits to conducting similar work elsewhere in order to further enhance the research findings. This would enhance the competency and suitability of the proposed framework through a fine-tuning process. Authors who support a multiple case study approach, such as Clandinin (2007), Denzin and Lincoln (2008), Brown (2008), Yin (2003,2009) and Stake (2005, 2008), believe that evidence from multiple case studies is often considered more compelling. This supports a triangulated research strategy used in this thesis thereby increasing construct validity, which enhances data credibility through searching converging findings from different sources (Corcoran *et al.,* 2004; Rolfe, 2006; Mertens, 2005; Yin, 2003; 2009; Stake ,2008).

Another limitation of the research/framework is the indicators identified during the data collection stage. This emerged with the limitation in quantitative (numeric) data collection as there were no actual figures for some issues like energy, maintenance and life cycle costs. In addition, there was a problem with the qualitative indicators which depend on the performance-based evaluation, depending on the subjective views (Gann *et al.,* 2003; Gann *et al.,* 2011; Suzuki *et al.,* 2013; Kelly *et al.,* 2015). Entrop and Dewulf (2011) state that this evaluation takes into account the difficulties of interpreting judgment data, therefore it relies on human (stakeholder) responses to evaluate project based on its design criteria and requirements. Therefore, this research used a set of interviews with a wide range of professionals who worked on the Amman master plan, therefore, aware of the quality of process of performance of these schemes. This gives an opportunity to evaluate the performance of these schemes based on its design criteria and requirements s in order to measure these indicators effectively.

Gann et al. (2011) state that it is necessary to use indicators of design that can be measured objectively, such as energy use and air quality which depend on the subjective views, preferences and experiences of the people asked. Since these indicators are qualitative, they need more integration to make the measurement less subjective and more reliable in addressing various sustainable community issues.

For the applicability of this framework in the Jordanian context more work needs to be done using the useful lessons learnt for Amman and contextualising with other Jordanian areas according to local conditions. Todd and Ruane (2011) Geissler and Grob (2010), Cole (2005), Tomalty et al. (2007) point out that local conditions which reflect the reality of a place are necessary in making more holistic models, systems and frameworks, thereby increasing applicability in different contexts. For the potential applicability of this framework in comparable contexts and scenarios, it needs a more significant work and integration to be carried out in those other contexts that contain HDMU including commercial and residential uses. In addition, the local conditions need to be considered in order to adapt this framework to these contexts.

The limitation of the framework in terms of practical application to the Amman context is that in order to develop effective relationships between sustainability, the physical environment, and locational elements concerted efforts are required with wide participation by the stakeholders groups, such as project managers, implementers and beneficiaries making the sustainability indicators fairly straight-forward. This agrees with Bell and Morse (2008) who pointed out that those stakeholder groups are needed to effect this outcome (see also Malito, 2014). The use of these indicators will then in turn impact on the sustainability performance of a city, area or neighbourhood (Dunham-Jones and Williamson, 2009; Balmori and Benoit, 2007; Daniel et al., 2008; Calkins, 2008).

The implications of this thesis for future research could be profound in identifying the importance of indicators in order to understand the sustainability performance of urban areas. The greatest benefit of measuring sustainability indicators is in helping decision-makers to be better informed about the impact of future development in line with an understanding of past experiences (Rowan, 2002; Ndeke, 2011; Al Waer and Sibley, 2006; Malito, 2014). The use of indicators also offers the opportunity to improve knowledge and practice in sustainability by providing a basis of analysis and decision-making (Cocca and Alberti, 2010; Brandon and Lombardi, 2011; Lombardi, 2011; Baslas, 2004; Scipioni et al., 2009; Ndeke, 2011). This helps according to identified actions which should or should not be taken in an attempt to make community or society sustainable. Therefore, measuring sustainability indicators can lead to better decisions and more effective actions by simplifying, clarifying and making aggregated information available to policy-makers, in order to help measure and calibrate progress towards sustainable development goals (Haapio and Viitaniemi, 2007; Moussiopoulos et al., 2010; Haapio, 2010; 2012). This can be used to assess inter-linkages between different aspects of sustainable development i.e. economic, social, environmental and governance. Conversely, the greatest limitation of the process of application and implementation of this framework is when there is no consensus of views by the stakeholders. This places a constraint on the implementation of this framework (Cocca and Alberti, 2010; Brandon and Lombardi, 2011; Deakin, 2009; Deakin et al., 2011; Lombardi and Cooper, 2009; Al Waer et al., 2014).

This research opens up many other possible research paths for future studies. Smith (2011) stated that the there are impacts of the application of sustainability indicators for the surrounding environment, and these impacts have to be explored. The application and implementation of the framework developed in the thesis will affect contemporary architecture in Amman and, therefore, pose a set of challenging and problematic issues concerning the application and implementation of this framework. This begs the question of how the implementation of these schemes will influence the master plan for the city of Amman, and this will need to be more fully explored as will need to more investigate the emerging relations between contemporary architecture and these schemes for the city. Amman could, therefore, benefit from the experience of other places, and this sharing of ideas is something that the researcher hopes will allow for greater synergies between indicators, development and the structures that allow and enable them to interact and influence each other.

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Appendix 1

Table 3.1: The UN Sustainable Development Indicators (Sources: CSD, UN, 2007a; Shen *et al*., 2011). Modified by the researcher

Measurements	***Indicators***	***Axis***
Percentage of city population with authorized electrical service Total electrical use per capita Number and duration of electrical interruptions per year per customer	Energy Access	social
Percentage of city population with potable water supply service Number of interruptions in water service	Water Access	
Percentage of children completing primary and secondary education Percentage of school aged children enrolled in schools (by gender) Student/teacher ratio	Education	
Mortality a) Under-five b) Mortality rate c) Life expectancy at birth d) Healthy life expectancy at birth Health care delivery a) Percent of population with access to primary health care facilities b) Contraceptive prevalence rate c) Immunization against infectious childhood diseases Nutritional status • Nutritional status of children Health status and risks a) Morbidity of major diseases such as HIV/AIDS,malaria, tuberculosis b) Prevalence of tobacco use c) Suicide rate	Health	
Number of homicides per 100,000 population Number of sworn police officers per 100,000 population Violent crime rate per 100,000 population	Safety	
Number of firefighters per 100,000 population Number of fire related deaths per 100,000 population Response time for fire department from initial call	Fire & Emergency Response	

Income poverty a) Proportion of population living below national poverty line b) Proportion of population below $1 a day Income inequality a) Ratio of share in national income of highest to lowest quintile	Poverty	
Km of transportation system per 100,000 population Annual number of public transit trips per capita Commercial Air Connectivity Average travel speed on primary thoroughfares during peak hours Transportation fatalities per 100,000 population Number of daily trips and time taken per capita by type of trip and by mode of transport Total average daily distance covered per capita by type of trip and by mode of transport Mode of transportation used by children to travel between home and school	Transportation	
Percentage of population living in hazard prone areas Human and economic loss due to natural disasters Disaster prevention and mitigation instruments	Natural hazards	
Durable structures Overcrowding Right to adequate housing Housing price and rent-to-income	Adequate housing	
Percentage of city population living in slums Area size of informal settlements as a percent of city area and population	Shelter	
Secure tenure Authorized housing Evictions	Security of tenure	
Housing finance	Access to credit	
Land price -to-income	Access to land	
Poor households	Promote social integration and support disadvantaged groups	

Number of cultural establishments per 100,000 population City expenditures on culture as a percentage of overall city budget	Culture	
Square meters of public recreation facility space per capita City expenditures on public recreation as a percentage of overall city budget	Recreation	
Citizens’ access to nearby public green areas and basic services	Availability of local public green areas and local services	
Population growth Planned settlements	Geographically balanced settlement	Environmenta l
Proportion of total water resources used Water use intensity by economic activity Presence of faecal coli forms in freshwater Biochemical oxygen demand in water bodies	Freshwater	
Percentage of city population served by wastewater collection Percentage of wastewater receiving no/primary/secondary/tertiary treatment	Wastewater	
Number of times the limit values for selected air pollutants are exceeded Existence and level of implementation of air quality management plan Emissions of greenhouse gases Consumption of ozone depleting substances	Quality of ambient air and atmosphere	
Share of population exposed to long-term high level of environmental noise Noise levels in selected areas Existence and level of implementation of a noise action plan	Noise pollution	
Artificial surfaces as a percentage of the total municipal area. Extent of derelict and contaminated land Number of inhabitants per Km2 Quota of new edification taking place on virgin area and quota taking place on derelict and contaminated land in % per year. Restoration of urban land a) Renovation, conversion of derelict buildings b) Redevelopment of derelict land for new urban uses c) Cleansing of contaminated land	Sustainable land use	

Protected areas as a percentage of total municipal area Land affected by desertification Area under organic farming Proportion of land area covered by forests		
Percentage of city population with regular solid waste collection Percentage of solid waste disposed to sanitary landfill/incinerated and burned openly/disposed to open dump/recycled/other Total solid waste generation per capita Generation of hazardous waste Waste treatment and disposal Management of radioactive waste	Waste generation and management	
Travel time Transport modes Energy intensity of transport	Effective and environmentally sound transportation systems	
Local environmental plans Latest approval date of Master Plan	Mechanisms to prepare and implement environmental plans	
Proportion of terrestrial area protected Management effectiveness of protected areas Area of selected key ecosystems Fragmentation of habitats Change in threat status of species Abundance of selected key species Abundance of invasive alien species	Biodiversity	
Material consumption Material intensity of the economy Domestic material consumption Annual energy consumption, total and by main user category Share of renewable energy sources in total energy use Intensity of energy use, total and by economic activity	Consumption and production patterns	Economic
Macroeconomic performance a) Gross domestic product (GDP) per capita b) Gross saving c) Investment share in GDP d) Adjusted net savings as percentage of gross	Economic development	

national income (GNI) e) Inflation rate Employment a) Employment-population ratio b) Vulnerable employment c) Labor productivity and unit labor costs d) Share of women in wage employment in the non-agricultural sector Information and communication technologies a) Internet users per 100 population b) Fixed telephone lines per 100 population c) Mobile cellular telephone subscribers per 100 population Research and development a) Gross domestic expenditure on Research and Development as a percent of GDP Tourism a) Tourism contribution to GDP		
Debt service ratio Tax collected as percentage of tax billed Own-source revenue as a percent of total revenues Capital spending as percentage of total expenditures	Finance	
Price of water Domestic water consumption per capita	Water	
Informal employment	Strengthen small and microenterprises	
Citizens participation Voters participation Civic associations	Participation and civic engagement	Governance
Transparency and accountability	Transparent, accountable and efficient governance	
Corruption Percentage of population having paid bribes	Government	
Share of public and private organizations adopting and using environmental and social management procedures	Sustainable management of the authorities and businesses	

Appendix 2

Title: the role of sustainable urban design principles in delivering high density mixed use schemes in Jordan

Section A (Introduction):

As a full-time PhD student at the University of Brighton, my research looks into sustainable urban design practices in Amman. You are invited to give your valuable opinion in the study called "the role of sustainable urban design and its impact on contemporary architecture in Jordan: The case of the Greater Amman Master Plan".

This research aims to investigate through the use of urban sustainability indicators, how sustainable urban design principles can be implemented in high density mixed use schemes within the context of Amman, Jordan, for delivering its sustainability goals.

This research will use the high density mixed use mechanism (HDMU) to implement sustainable urban design principles in Amman. It is used as the most suitable mechanism to achieve sustainable urban principles in Amman, Jordan, because it accords with the topography, presents the successful solutions with the lowest cost of infrastructure for the areas and efficiently use the limited land supply.

My objective is to use the information from this research to investigate sustainable urban design practices as follow:

1. To identify and evaluate constraints, solutions and suitable indicators for the implementation of sustainable urban design principles in Amman.

2. To explore the planning strategy for the implementation of sustainable urban design practices.

Before you decide to participate, it is important for you to understand why the research is being done and what it will involve. Please take time to read the attached documents carefully, including the consent form and talk to others about the study if you wish. Your name and contact details have been passed on to me by the Greater Amman Municipality (GAM) as someone who was involved in the implementation of the master plan for the city of Amman.

This research will be presented within the school of Environment and Technology at the University of Brighton in the United Kingdom as part of my doctoral studies.

Section B (About you) :

Are you (Please tick one box only)?

B.1 How would you describe your role at Greater Amman Municipality (GAM)?

- Technical
- Managerial
- Other (Please specify)

B.2 Which of the following best describes your professional background?

- Architect
- Planner
- Other (Please specify)

B.3 What is your age category?

- Under 25
- 25 – 34
- 35 – 44
- 45 – 54
- 55 – 64
- 65 and above

B.4 What is your highest academic qualification?

- Bachelor
- Master's
- Doctorate
- Other (Please specify)

B.5 Year of completion of highest academic qualification is :

B.6 How long have you been employed by the Greater Amman Municipality (GAM) as part of the master plan team?

- Less than one year
- Less than three years
- Less than five years
- More than five years

B.7 Please tick this box if you were employed in this team by the Greater Amman Municipality (GAM) as an external consultant.

☐

Section C:

This section enables the researcher to test the first objective: To identify and evaluate constraints, solutions and suitable indicators for the implementation of sustainable urban design principles in Amman.

C.1 In your views, to what extent does each of the following affect the effective implementation of the sustainable urban design using high density mixed use schemes in Amman?

Table 1: Main constraints affecting the implementation of the sustainable urban design principles using HDMU

No	Constraints	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Soc.1	Indoor noise and acoustic noise in primary areas inside buildings					
Soc.2	Indoor air quality non monitoring inside buildings					
Soc.3	Shortage of cultural facilities					
Soc.4	The population income is inadequate for housing price or rent					
Soc.5	The percentage of open space area compared to the city's area is low					
Env.1	Difficulties in the management of water resources: inadequate of surface and ground water					
Env.2	Absence of recycled materials in building construction					
Env.3	Ineffective integration between land use, transport planning and other governance functions such as; ineffective infrastructure					
Env.4	The percentage of open public green space compared to the city's area is low					
Env.5	The percentage of waste treatment and disposal is low.					
Env.6	Difficulties in moving around the city such as; traffic and congestion					
Env.7	Absence of cycle lanes and cycle facilities					
Env.8	Shortage of frequent fixed bus stops					
Eco.1	The percentage of annual renewable energy consumption of total energy consumption is low					
Eco.2	Difficulties to create job and training opportunities for local community					
Gov.1	Emergence of Local community resistance and negative media coverage for the master plan project, because of problems in communication between private sectors and local citizens and local government bodies.					
Gov.2	Difficulties in providing the skills and experience of professionals involved in delivering sustainable urban design.					
Gov.3	Unsuitability of the regulations and laws which govern land use					

C.2In your view, please specify the appropriate solutions to overcome these constraints for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman? You can choose more than one choice.

Table 2: Main constraints and their solutions affecting the implementation of the sustainable urban design principles using HDMU

Constraints	Proposed solutions
Soc.1 Indoor noise and acoustic noise in primary areas inside buildings	○ The use of sound absorbing materials inside the buildings
Soc.2 Indoor air quality non monitoring inside buildings	○ Integration of air conditioning to monitor air quality inside buildings, and performing regular maintenance of these devices
Soc.3 Shortage of cultural facilities	○ Commissioning of new cultural facilities
Soc.4 The population income is inadequate for housing price or rent	○ The establishment of finance programs in collaboration with lending institutions ○ Providing institutional support to encourage participation and partnership arrangements. ○ Promoting the use and maintenance of existing housing stock and the development of affordable rental housing
Soc.5 The percentage of open space area compared to the city's area is low	○ The work of expansion of open space areas for the city.
Env.1 Difficulties in the management of water resources: inadequate of surface and ground water	○ Ensuring a clean water supply for commercial, agricultural, industrial and urban uses ○ Prevention of the degradation of surface and ground water
Env.2 Absence of recycled materials in building construction	○ The use of recycled materials in new buildings, and the use of new building elements should be compatible with the urban context.
Env.3 Ineffective integration between land use, transport planning and other governance functions such as; ineffective infrastructure	○ Use of express bus lanes and the use of computerized area traffic control system. ○ Providing a free bus service painted green on weekends to parks ○ Keeping the public informed about environmental issues, using programs that encourage community responsibility for the parks. Local schools promote ecological principles
Env.4 The percentage of open public green space compared to the city's area is low	○ Expansion of park/green areas and reduced resource use
Env.5 The percentage of waste treatment and disposal is low.	○ Using solid waste management program that encourages citizens to separate organic from inorganic. Separating piped water from sewage lines
Env.6 Difficulties in moving around the city such as; traffic and congestion	○ The use of rapid bus transport system as a system of public transportation ○ Improvement of mass transit system and a restructuring of the roads

	○ reducing the cost of mobility and promoting trade within the city ○ Work to develop new ways to incorporate the city with the surrounding metropolitan area
Env.7 Absence of cycle lanes and cycle facilities	○ Plan the integrated transport network to install bike paths as new transportation alternatives
Env.8 Shortage of frequent fixed bus stops	○ Construction of many bus stops alongside transport routes
Eco.1 The percentage of annual renewable energy consumption of total energy consumption is low	○ Encourage the use of renewable energy within the designs for new buildings to reduce annual energy consumption
Eco.2 Difficulties to create job and training opportunities for local community	○ Using strategies to engage the private sector to provide a set of job and training opportunities for the local community.
Gov.1 Emergence of Local community resistance and negative media coverage for the master plan project, because of problems in communication between private sectors and local citizens and local government bodies.	○ Holding public debates that encourage the involvement of citizens and the private sector including architects, engineers, economists, sociologists, and public administrators ○ Founding the regional administration centres to identify similarities between regions and plan social programs for the periphery. Integrate the public into each social programs ○ Keeping the public informed about environmental issues, using programs encourage community responsibility for the parks, which provide aesthetic and recreational value
Gov.2 Difficulties in providing the skills and experience of professionals involved in delivering sustainable urban design.	The use of the skills and experiences available in the public institutions and private sector ○ The use of the outside experts to support this process
Gov.3 Unsuitability of the regulations and laws which govern land use	○ Land use laws should minimize transport demands, save energy, protect open and green spaces.

C.3 Through the emergence of the constraints previously, do you agree or disagree with that the ranking of the suitable urban sustainability indicators for the city of Amman, which can be implemented by this process is as follows?

5. Social
6. Environmental
7. Governance
8. Economic

Yes No

If you answered <u>Yes</u> in C3 above, please move to question C.5

C.4 If you answered No in C.3 above, please rank the following to be suitable indicators for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 3: The suitable sustainable urban design indicators for Amman

Ranking	Indicators	Your ranking
1	Social	
2	Environmental	
3	Governance	
4	Economic	

C.5 In your views, to what extent does each of the following are suitable indicators for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 4: Contextualised sustainable urban design indicators for Amman

Dimensions	Indicators	Highly agree	Agree	Neither agree nor disagree	Disagree	Highly disagree
Social	Functionality, usability and aesthetic aspects					
	Local people facilities					
	Architectural considerations and cultural heritage					
	Customers facilities and trends					
Environmental	Energy and natural resources					
	Materials used, durability and waste					
	Sustainable land use and site selection					
	Water and water conservation					
Economic	Economic performance					
Governance	Public communication					

Section D:

This section enables the researcher to test the second objective: To explore the planning strategy for the implementation of sustainable urban design principles.

D.1In your view, please specify which of the planning strategy phases following can be used for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman? You can choose more than one choice.

- o Strategic Vision
- o Strategic Assessment
- o Strategic Analysis
- o Tactical Alternatives
- o Strategic Plan Formulation
- o Implementation and Management
- o Other (Please specify)

D.2In your opinion, to what extent does each of the outputs following can be used for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 5: The main outputs for the planning strategy phases

Phases	Out puts	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Strategic vision	Identification of stakeholders					
	Creation of a community consensus on sustainability goals					
Strategic assessment	Assessment of current energy consumption (economic state)					
	Assessment of environmental quality control					
	Assessment of transportation systems infrastructure					
Strategic analysis	Identification of the desired future state					
	Identification of the community's current condition					
Tactical alternatives	Political tactics					
	Economic tactics					
	Social tactics					
	Environmental system technologies tactics					
Plan formulation	Creation of a wide range of policies					

	Creation of a wide range of programs					
	Creation of a wide range of budgets					
	Creation of a wide range of deployment schedules					
Implementation and management	Identification of the specific performance measures					
	Identification of the specific performance methodologies					
	Identification of the reporting systems					
	Identification of the progress adjustments					

D.3In your view, please specify which of the planning strategy requirements following can be used for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman? You can choose more than one choice.

- The skills and abilities (Leadership)
- Broad-based community participation
- Consensus in the views
- Future public and private investments.
- The financial and convenience incentives
- Other (Please specify)

D.4 In your views, to what extent does each of the following affect the effective implementation of the sustainable urban design using high density mixed use schemes in Amman?

Table 6: Main planning strategy requirements for the implementation of sustainable urban design

Requirements	Positive effect	No effect	Negative effect	Do not know
Competencies and skills (Leadership)				
Broad-based community participation				
Consensus of views				
Future public and private investments.				
The financial and convenience incentives				

D.5In your view, please specify the competencies and skills needed to each phase for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 7: Competencies and skills for the implementation of sustainable urban design

Competencies and skills	Study of project	Preparation of plans	Design of plans	Implementation of project	Monitoring of project
Local community					
Private sector					
Public institutions					
Outside experts					

D.6 In your opinion, to what extent does each of the following can be used as competencies and skills for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 8: Competencies and skills for the implementation of sustainable urban design

Competencies and skills	Highly agree	Agree	Neither agree nor disagree	Disagree	Highly disagree
Local community					
Private sector					
Public institutions					
Outside experts					

D.7 In your opinion, to what extent does each of the following affect the planning strategy for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 9: Community participation for the implementation of sustainable urban design

Community participation	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Local citizens					
Private sector					
Public institutions					

D.8 In your view, please specify which of the methods following can be used to provide the technical and administrative support for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman? You can choose more than one choice.

Table 10: Community participation for the implementation of sustainable urban design

Community participation	Interviews	Focus group	Survey
Local citizens			
Private sector			
Public institutions			

D.9 In your opinion, to what extent does each of the following affect the planning strategy for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 11: Consensus of views for the implementation of sustainable urban design

Consensus of views	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Local citizens					
Private sector					
Public institutions					

D.10In your opinion, to what extent does each of the following affect the planning strategy for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 12: Investments for the implementation of sustainable urban design

Investments	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Public investments					
private investments					

D.11 In your opinion, to what extent does each of the following affect the planning strategy for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 13: Incentives for the implementation of sustainable urban design

Incentives	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Individual incentives					
Organizational incentives					

Section E (Additional data):

Thank you for completing this questionnaire. Please return the questionnaire directly to me or via email.

Optional information:
Name:
Address:
Postcode:
Telephone number:
Email:

Appendix 3

5.1 Introduction

This chapter will analysis the findings from the questionnaire survey as a means to explore key issues that relate to sustainable urban design practices, which are being undertaken in Amman, Jordan. This chapter aims to identify and evaluate the constraints, solutions, suitable urban sustainability indicators and planning strategies for the implementation of sustainable urban design principles in the Amman master plan within the selected areas (A, B, C), which represent with (A central parkway, B southern gateway, C northern gateway).

This questionnaire depends on the outcomes from testing the indicators in Amman within three case study areas as clarified in the fourth chapter. Therefore, this study will use this questionnaire to check the outcomes from comparative study areas such as; the suitable indicators, constraints and solutions for the implementation of sustainable urban design principles, using high density mixed use in Amman. In addition, the questionnaire will identify the planning strategy to mange this scheme in Amman. Hence, these factors will provide the guidelines which can be used effectively in the context of Amman. Therefore, this study will use a wide range of professionals consist of architects and planners. These professionals are sampled because they are worked in implementing the master plan either within Greater Amman Municipality or private sector. For ensuring achieving the balance for the master plan, the research will use two categories of professionals; architect and planners. The planners are responsible for creating the master plan while the architects are responsible for delivering the master plan.

The sections that follow look sequentially at the questions as they appear in the questionnaire and analysis the answers received picking up patterns and clues.

5.2 About the professionals (Architect and Planners)

This section introduces about the professionals (Architect and Planners) who are working at the Greater Amman Municipality (GAM) as part of the master plan team. These professionals are identified by using classification of Jordan Engineers Association (JEA) and Greater Amman Municipality (GAM) based on the professional manpower to determine main samples. The questionnaires have been distributed to the professionals by hand. The researcher distributed 120 questionnaires and he received 100 questionnaires, this means that the response percentage is (83.3%).

5.2.1 How would you describe your role at Greater Amman Municipality (GAM)?

Table 1; Role of professionals

The role	percentage	Number
Technical	80%	80
Managerial	20%	20
Other	0%	0

5.2.2 Which of the following best describes your professional background?

Table 2; Professionals background

professional background	percentage	Number
Architect	65%	65
Planner	35%	35
Other	0%	0

5.2.3 What is your age category?

Table 3; Professionals' age distribution

age category	percentage	Number
Under 25	3%	3
25 – 34	23%	23
35 – 44	44%	44
45 – 54	22%	22
55 – 64	5%	5
65 and above	3%	3

5.2.4 What is your highest academic qualification?

Table 4: Respondents' highest educational qualification

highest academic qualification	percentage	Number
Bachelor	75%	75
Master's	15%	15
Doctorate	4%	4
Diploma	6%	6

5.2.5 How long have you been employed by the Greater Amman Municipality (GAM) as part of the master plan team?

Table 5; Respondents' years of experience

Years	percentage	Number
Less than one year	4%	4
Less than three years	8%	8
Less than five years	14%	14
More than five years	74%	74

5.2.6 Please tick this box if you were employed in this team by the Greater Amman Municipality (GAM) as an external consultant.

It is noted that the professionals (architects and planners)' views on the employment in the team: 24% were employed as an external consultant.

5.3The constraints, solutions and suitable indicators for the Amman master plan

This section enables the researcher to test the first objective: To identify and evaluate constraints, solutions and suitable indicators for the implementation of sustainable urban design principles in Amman.

5.3.1 In your view, to what extent does each of the following affect the effective implementation of the sustainable urban design using high density mixed use schemes in Amman?

Table 6: Main constraints affecting the implementation of the sustainable urban design principles using HDMU

Dimension	Constraints	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Soc.1	Indoor noise and acoustic noise in primary areas inside buildings	75%	23%	1%		1%
Soc.2	Indoor air quality non monitoring inside buildings	83%	13%	2%		2%
Soc.3	Shortage of cultural facilities	88%	9%			3%
Soc.4	The population income is inadequate for housing price or rent	70%	27%	2%		1%
Soc.5	The percentage of open space area compared to the city's area is low	86%	14%			
Env.1	Difficulties in the management of water resources: inadequate of surface and ground water	74%	23%			3%
Env.2	Absence of recycled materials in building construction	95%	3%	2%		
Env.3	Ineffective integration between land use, transport planning and other governance functions such as; ineffective infrastructure	91%	7%	2%		
Env.4	The percentage of open public green space compared to the city's area is low	83%	17%			
Env.5	The percentage of waste treatment and disposal is low.	1%	8%	27%	64%	
Env.6	Difficulties in moving around the city such as; traffic and congestion	92%	6%			2%
Env.7	Absence of cycle lanes and cycle facilities	98%	2%			
Env.8	Shortage of frequent fixed bus stops	82%	18%			
Eco.1	The percentage of annual renewable energy consumption of total energy consumption is low	89%	10%			1%
Eco.2	Difficulties to create job and training	71%	26%			3%

	opportunities for local community					
Gov.1	Emergence of Local community resistance and negative media coverage for the master plan project, because of problems in communication between private sectors and local citizens and local government bodies.		3%	19%	75%	3%
Gov.2	Difficulties in providing the skills and experience of professionals involved in delivering sustainable urban design.	19%	76%	1%		4%
Gov.3	Unsuitability of the regulations and laws which govern land use	65%	31%	2%		2%

Soc: social, Env: environmental, Eco: economic, Gov: governance.

5.3.2In your view, please specify the appropriate solutions to overcome these constraints for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman? You can choose more than one choice.

Table 7: Main constraints and their solutions affecting the implementation of the sustainable urban design principles using HDMU

Constraints	**Proposed solutions**
Soc.1 Indoor noise and acoustic noise in primary areas inside buildings	○ The use of sound absorbing materials inside the buildings. **(98%)**
Soc.2 Indoor air quality non monitoring inside buildings	○ Integration of air conditioning to monitor air quality inside buildings, and performing regular maintenance of these devices. **(96%)**
Soc.3 Shortage of cultural facilities	○ Commissioning of new cultural facilities. **(98%)**
Soc.4 The population income is inadequate for housing price or rent	○ The establishment of finance programs in collaboration with lending institutions. **(99%)** ○ Providing institutional support to encourage participation and partnership arrangements**(95%)** ○ Promoting the use and maintenance of existing housing stock and the development of affordable rental housing. **(1%)**
Soc.5 The percentage of open space area compared to the city's area is low	○ The work of expansion of open space areas for the city. **(100%)**
Env.1 Difficulties in the management of water resources: inadequate of surface and ground water	○ Ensuring a clean water supply for commercial, agricultural, industrial and urban uses. **(3%)** ○ Prevention of the degradation of surface and groundwater. **(98%)**
Env.2 Absence of recycled materials in building construction	○ The use of recycled materials in new buildings, and the use of new building elements should be compatible with the urban context.**(99%)**
Env.3 Ineffective integration between land use, transport	○ Use of express bus lanes and the use of computerized area traffic control

planning and other governance functions such as; ineffective infrastructure	system. **(97%)** ○ Providing a free bus service painted green on weekends to parks. **(91%)** ○ Keeping the public informed about environmental issues, using programs that encourage community responsibility for the parks. Local schools promote ecological principles. **(1%)**
Env.4 The percentage of open public green space compared to the city's area is low	○ Expansion of park/green areas and reduced resource use. **(100%)**
Env.5 The percentage of waste treatment and disposal is low.	○ Using solid waste management program that encourages citizens to separate organic from inorganic. Separating piped water from sewage lines. **(81%)**
Env.6 Difficulties in moving around the city such as; traffic and congestion	○ The use of rapid bus transport system as a system of public transportation. **(3%)** ○ Improvement of mass transit system and a restructuring of the roads. **(95%)** ○ reducing the cost of mobility and promoting trade within the city. **(2%)** ○ Work to develop ways to incorporate the city with the surrounding metropolitan area. **(94%)**
Env.7 Absence of cycle lanes and cycle facilities	○ Plan the integrated transport network to install bike paths as new transportation alternatives
Env.8 Shortage of frequent fixed bus stops	○ Construction of many bus stops alongside transport routes. **(99%)**
Eco.1 The percentage of annual renewable energy consumption of total energy consumption is low	○ Encourage the use of renewable energy within the designs for new buildings to reduce annual energy consumption. **(97%)**
Eco.2 Difficulties to create job and training opportunities for local community	○ Using strategies to engage the private sector to provide a set of job and training opportunities for the local community. . **(98%)**
Gov.1 Emergence of Local community resistance and negative media coverage for the master plan project,	○ Holding public debates that encourage the involvement of citizens and the private sector including architects, engineers, economists, sociologists, and

because of problems in communication between private sectors and local citizens and local government bodies.	public administrators. **(98%)** ○ Founding the regional administration centres to identify similarities between regions and plan social programs for the periphery. Integrate the public into each social programs. **(97%)** ○ Keeping the public informed about environmental issues, using programs encourage community responsibility for the parks, which provide aesthetic and recreational value. **(1%)**
Gov.2 Difficulties in providing the skills and experience of professionals involved in delivering sustainable urban design.	○ The use of the skills and experiences available in the public institutions and private sector. **(100%)** ○ The use of the outside experts to support this process. **(2%)**
Gov.3 Unsuitability of the regulations and laws which govern land use	○ Land use laws should minimize transport demands, save energy, protect open and green spaces.**(99%)**

Soc: social, Env: environmental, Eco: economic, Gov: governance.

5.3.3 Through the emergence of the constraints previously, do you agree or disagree with that the ranking of the suitable urban sustainability indicators for the city of Amman, which can be implemented by this process is as follows?

9. Social
10. Environmental
11. Governance
12. Economic

It is noted that professionals (architects and planners)' view on the ranking of the suitable urban sustainability indicators: 97% agree that this ranking is the suitable ranking for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman.

5.3.4 If you answered No in C.3 above, please rank the following to be suitable indicators for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 8: The suitable sustainable urban design indicators for Amman

Ranking	Indicators	Your ranking
1	Social	2
2	Environmental	1
3	Governance	3
4	Economic	4

Table.8 notes It is noted that professionals (architects and planners)' view on the ranking of the suitable urban sustainability indicators as below: 3% choose (1) environmental indicators (2) social indicators (3) governance indicators (4) economic indicators as suitable ranking for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman.

***5.3*.5** In your views, to what extent does each of the following are suitable indicators for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 9: Contextualised sustainable urban design indicators for Amman

Dimensions	Indicators	Highly agree	Agree	Neither agree nor disagree	Disagree	Highly disagree
Social	Functionality, usability and aesthetic aspects	90%	10%			
	Local people facilities	86%	13%	1%		
	Architectural considerations and cultural heritage	85%	14%		1%	
	Customers facilities and trends	89%	8%		3%	
Environmental	Energy and natural resources	92%	8%			
	Materials used, durability and waste	77%	21%	2%		
	Sustainable land use and site selection	89%	11%			
	Water and water conservation	81%	17%	2%		
Economic	Economic performance	76%	22%	2%		
Governance	Public communication	91%	8%		1%	

5.4 The planning strategy

This section enables the researcher to test the second objective: To explore the planning strategy for the implementation of sustainable urban design principles.

5.4.1In your view, please specify which of the planning strategy phases following can be used for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman? You can choose more than one choice.

Table 10: The main outputs for the planning strategy phases

planning strategy phases	percentage
Strategic Vision	100%
Strategic Assessment	99%
Strategic Analysis	98%
Tactical Alternatives	5%
Strategic Plan Formulation	100%
Implementation and Management	100%

5.4.2In your opinion, to what extent does each of the outputs following can be used for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 11: The main outputs for the planning strategy phases

Phases	Out puts	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Strategic vision	Identification of stakeholders	83%	15%			2%
	Creation of a community consensus on sustainability goals	80%	17%	2%		1%
Strategic assessment	Assessment of current energy consumption (economic state)	91%	8%			1%
	Assessment of environmental quality control	94%	4%			2%
	Assessment of transportation systems infrastructure	89%	8%	1%		2%
Strategic analysis	Identification of the desired future state	95%	2%	1%		2%
	Identification of the community's current condition	87%	7%	2%		4%
Tactical alternatives	Political tactics	14%	82%	2%		2%
	Economic tactics		2%	21%	76%	1%
	Social tactics			26%	72%	2%
	Environmental system technologies tactics		1%	14%	83%	2%
Strategic Plan formulation	Creation of a wide range of policies	91%	7%	1%		1%
	Creation of a wide range of programs	95%	5%			
	Creation of a wide range of budgets	88%	11%			1%
	Creation of a wide range of deployment schedules		1%	18%	78%	3%
Implementation and management	Identification of the specific performance measures	87%	11%			2%
	Identification of the specific performance methodologies	90%	10%			
	Identification of the reporting systems	76%	21%			3%
	Identification of the progress adjustments		1%	20%	78%	1%

5.4.3In your view, please specify which of the planning strategy requirements following can be used for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman? You can choose more than one choice.

Table 12: Main planning strategy requirements for the implementation of sustainable urban design

planning strategy requirements	ratio
The skills and abilities (Leadership)	100%
Broad-based community participation	98%
Consensus of views	4%
Future public and private investments.	99%
The financial and convenience incentives	97%

***5.4*.4** In your views, to what extent does each of the following affect the effective implementation of the sustainable urban design using high density mixed use schemes in Amman?

Table 13: Main planning strategy requirements for the implementation of sustainable urban design

Requirements	Positive effect	No effect	Negative effect	Do not know
Competencies and skills (Leadership)	99%	1%		
Broad-based community participation	97%	2%		1%
Consensus of views	5%	81%	10%	4%
Future public and private investments.	98%	2%		
The financial and convenience incentives	97%	1%		2%

***5.4*.5**In your view, please specify the competencies and skills needed to each phase for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 14: Competencies and skills for the implementation of sustainable urban design

Competencies and skills	Study of project	Preparation of plans	Design of plans	Implementation of project	Monitoring of project
Local community	95%	1%			96%
Private sector	99%	2%	2%	100%	
Public institutions	100%	100%	99%	1%	98%
Outside experts	98%	97%	99%		2%

***5.4*.6** In your opinion, to what extent does each of the following can be used as competencies and skills for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 15: Competencies and skills for the implementation of sustainable urban design

Competencies and skills	Highly agree	Agree	Neither agree nor disagree	Disagree	Highly disagree
Local community	84%	13%	2%	1%	
Private sector	91%	8%	1%		
Public institutions	98%	2%			
Outside experts	88%	9%	2%	1%	

5.4.7 In your opinion, to what extent does each of the following affect the planning strategy for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 16: Community participation for the implementation of sustainable urban design

Community participation	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Local citizens	81%	16%	1%		2%
Private sector	92%	7%			1%
Public institutions	97%	3%			

5.4.8In your view, please specify which of the methods following can be used to provide the technical and administrative support for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman? You can choose more than one choice.

Table 17: Community participation for the implementation of sustainable urban design

Community participation	Interviews	Focus group	Survey
Local citizens	1%	3%	98%
Private sector	2%	96%	99%
Public institutions	97%	96%	5%

5.4.9 In your opinion, to what extent does each of the following affect the planning strategy for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 18: Consensus of views for the implementation of sustainable urban design

Consensus of views	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Local citizens	82%	14%	1%		3%
Private sector		1%	7%	89%	3%
Public institutions	94%	4%	1%		1%

***5.4*.10**In your opinion, to what extent does each of the following affect the planning strategy for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 19: Investments for the implementation of sustainable urban design

Investments	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
public investments	91%	7%			2%
private investments	97%	3%			1%

***5.4*.11 In your opinion, to what extent does each of the following affect the planning strategy for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?

Table 20: Incentives for the implementation of sustainable urban design

Incentives	Highly agree	Agree	Disagree	Highly disagree	No effectiveness
Individual incentives	91%	5%	1%		3%
Organizational incentives	80%	17%			3%

Appendix 4

Questions	Nuha Qtaish (Architect 1)	Shireen Da'ana (Architect 2)	Hasan Kiswani (Architect 3)	Lana Haddadin (Architect 4)
Objective 1; To evaluate constraints, solutions and planning strategies, which constitute a framework for the implementation of sustainable urban design principles in Amman.				
Does the ranking for implementing the indicators give the opportunity for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman? How?	I do not know	Yes, this ranking of indicators can help to implement these indicators through using the feedback for the ranking of these indicators, therefore this works to fill the main gaps facing implementing this process.	I do not know	Yes, there should be feedback on the ranking of these indicators in order to work to fill the main gaps facing the implementation of high density mixed use schemes.
"The percentage of waste treatment and disposal is low" is one of the economic constraints which have been excluded by the questionnaire survey. Do you agree with this exclusion? Why?	Yes, the city tries to create waste treatment and disposal plants without affecting the surrounding environment, using a set of private companies, such as Canadian or American .	Yes, the city tries to construct the project is under construction in collaboration with American company to overcome this constraint. Hence, this will not constitute a constraint for achieving sustainable urban design practices.	I do not know	Yes, the city has tried to minimise the percentage of waste through constructing and developing a set of projects specifically for this process. This could be achieved using outside experts and specialist companies in this field.
Emergence of Local community resistance and negative media coverage for the master plan project is one of the governance constraints which have been excluded by the questionnaire survey. Do you agree with this exclusion? Why?	Yes, because the emergence of the local community resistance is created from personal interest which control local community views.	Yes, because the emergence of the local community objection is created from personal interest which control local community views. Therefore, the city has used a broad variety of regulations and laws for the implementation of these schemes, without affecting the local community.	I do not know	I do not know
Considering the current implementation of the sustainable urban design principles, are there conflicts in the implementation of the proposed solutions to overcome the main constraints?	I do not know	There are no conflicts; these solutions used in the three areas can be implemented in other areas within the Amman master plan. This can be achieved through taking advantage of the lessons used in these three selected areas in the master plan.	There are not conflicts, but these solutions should be implemented within the master plan in all areas equally.	There are no conflicts by implementing these solutions.
The main planning strategy phases for sustainable urban design using HDMU are: strategic vision, strategic assessment, strategic plan formulation and implementation and management. Do you think that there are other phases can be used within the strategy planning for this project? What	There are no other planning strategy phases.	There are other planning strategy phases. The monitoring of the implementation of this project can help to manage this project effectively during all phases.	I do not know	There are no other planning strategy phases.

and why?				
Tactical alternative phase is one of the planning strategy phases which have been excluded by the questionnaire survey. Do you agree with this exclusion? Why?	I do not know	I do not know	Yes, there is no need for the use of the tactical alternative phase, so long as there is clear implementation of the strategic assessment phase with consideration given to a set of necessary precautions.	Yes, the strategic assessment phase is adequate for effective planning strategy, provided that this phase is implemented effectively.
The main planning strategy requirements for sustainable urban design using HDMU are: the skills and abilities (Leadership), broad-based community participation, future public and private investments and the financial and convenience incentives. Do you think that there are other requirements can be used within the strategy planning for this project? What and why?	There are no other planning strategy requirements.	There are no other planning strategy requirements, provided that leadership is effective throughout the implementation of the project.	I do not know	There are no other planning strategy requirements.
What is the role of both public and private investments in the planning strategy for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?	Personal interests control private investments more than public interests during these projects. For this reason, this type of investment needs monitoring by the public institutions responsible for these sites.	Public investments do not have an ability to provide any type of financial capabilities. Public investments can help to develop the infrastructure for these sites, and this can be achieved in collaboration with public institutions responsible for these areas. As for private investments, these can provide any type of financial requirements though at high costs.	I do not know	I do not know
How can the financial and convenience incentives be presented for the strategy planning phases for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?	These incentives can be presented to private agencies for implementing these projects as discounts. As these incentives can be presented as tax credits to the investors, and this is encouraging them to implement projects such as these.	I do not know	The city can present tax credits or discounts to these investments, and this is encouraging the investors to implement such projects.	I do not know
Consensus in the public views is one of the planning strategy requirements which have been excluded by the questionnaire survey. Do you agree with this exclusion? Why?	Yes, it is difficult to reach a consensus of public views for all categories within this process.	Yes, there are many issues which support personal interests, which may not help getting consensus of views.	I do not know	Yes, it is difficult getting consensus of public views, because there is a large difference in the views, and this difference relates to issues that play a key role in influencing these views.

Name	Nuha Qtaish	Shireen Da'ana	Hasan Kiswani	Lana Haddadin
Professional	Architect	Architect	Architect	Architect
Experiences	10 years	5 years	7 years	5 years

Questions	Tamam Mango (Planner 1)	Rima Odeh (Planner 2)	Hassan Alkaby (Planner 3)	Dania Hamadna (Planner 4
Objective 1; To evaluate constraints, solutions and planning strategies, which constitute a framework for the implementation of sustainable urban design principles in Amman.				
Does the ranking for implementing the indicators give the opportunity for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman? How?	Yes, there should be feedback on the ranking of these indicators in order to work to fill the main gaps facing the implementation of high density mixed use schemes.	Yes, this ranking of indicators can help to implement these indicators through using the feedback for the ranking of these indicators, therefore this works to fill the main gaps facing implementing this process. Hence, the application of this process gives an opportunity to implement the suitable indicators for the city of Amman.	Yes, we should understand the main properties of each indicator to identify the main constraints and find appropriate solutions.	I do not know
"The percentage of waste treatment and disposal is low" is one of the economic constraints which have been excluded by the questionnaire survey. Do you agree with this exclusion? Why?	I do not know	Yes, the city is working in collaboration with an American company to overcome this constraint. Hence, this will not constitute a problem in achieving sustainable urban design practices for implementing high density mixed use schemes in the master plan.	I do not know	Yes, because the city tries to create waste treatment and disposal plants without affecting surrounding environment.
Emergence of Local community resistance and negative media coverage for the master plan project is one of the governance constraints which have been excluded by the questionnaire survey. Do you agree with this exclusion? Why?	Yes, because the emergence of the local community resistance is created from personal interest which control local community views.	Yes, the emergence of local community objection comes from personal interest which control local community views. Therefore, the city has used a broad variety of regulations and laws for the implementation of these schemes, without affecting the local community.	I do not know	Yes, the city works to implement the project without affecting the local community negatively, according to a wide range of regulations and laws. This help to minimise local community objections motivated by personal interests, which control local community views.
Considering the current implementation of the sustainable urban design principles, are there conflicts in the implementation of the proposed solutions to overcome the main constraints?	I do not know	There are no conflicts by implementing these solutions.	There are no conflicts by implementing these solutions.	I do not know

The main planning strategy phases for sustainable urban design using HDMU are: strategic vision, strategic assessment, strategic plan formulation and implementation and management. Do you think that there are other phases can be used within the strategy planning for this project? What and why?	There are no other planning strategy phases, provided that all of these phases are implemented as planned.	There are no other planning strategy phases. But management should involve monitoring of the project. Hence, this gives an opportunity to implement the project phases according to effective planning strategy.	do not know	There are no other planning strategy phases.
Tactical alternative phase is one of the planning strategy phases which have been excluded by the questionnaire survey. Do you agree with this exclusion? Why?	I do not know	Yes, the strategic assessment phase is adequate for effective implementation, but the tactical alternative phase can be used to avoid expected errors. The strategic assessment phase can fill these gaps and correct the errors, which may emerged as a result of implementing this strategy.	Yes, the tactical alternative phase is not necessary if the strategic assessment phase is implemented effectively.	No, because the tactical alternative phase can be used to avoid the expected gaps and errors, which may happen through implementing this strategy**.**
The main planning strategy requirements for sustainable urban design using HDMU are: the skills and abilities (Leadership), broad-based community participation, future public and private investments and the financial and convenience incentives. Do you think that there are other requirements can be used within the strategy planning for this project? What and why?	There are no other planning strategy phases.	There are no other planning strategy requirements. But the broad-based community participation should be controlled during the implementation of the project phases.	There are no other planning strategy requirements. However, there should be monitoring of broad-based community participation.	I do not know
What is the role of both public and private investments in the planning strategy for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?	I do not know	I do not know	This type of project creates a high economic cost of implementation. Private investment has the ability to buy significant land that is needed for implementing these projects at such a high cost.	Private investments motivated by personal interests more than public interests in these kinds of projects. Therefore, there should be monitoring of private investments by the public institutions responsible for the city. This will helps to adjust investment efficiency within these sites, and avoid the problem of personal interests relating these investments that do not take into account the city's interests.
How can the financial and convenience incentives be presented for the strategy planning phases for the effective implementation of the	These incentives can be presented as facilities and discounts of both private and public sector for implementing these projects.	The financial amounts which should be paid to ensure the implementation of the infrastructure for these sites can be offered as	I do not know	The city can offer incentives that encourage different sectors to participate in implementing these projects on the ground.

sustainable urban design principles using high density mixed use schemes in Amman?		payments in instalments to facilitate implementing agencies, to be incentives to investors to overcome the financial constraints facing these projects.		
Consensus in the public views is one of the planning strategy requirements which have been excluded by the questionnaire survey. Do you agree with this exclusion? Why?	Yes, it is difficult to reach a consensus of public views for all categories within this process.	Yes, because there are many issues that support personal interests which do not give an opportunity for consensus of views. For example, the city cannot present a wide range of services to all areas of land equally. Hence, this affects the nature of society's views relating the master plan.	Yes, it is difficult to reach a consensus of public views for all categories within this process.	I do not know

Name	Tamam Mango	Rima Odeh	Hassan Alkaby	Dania Hamadna
Professional	Planner	Planner	Planner	Planner
Experiences	10 years	15 years	10 years	6 years

Questions	Ihsan stateah (Planner 5)	Murad Kalalda (Architect 5	Summary
Objective 1; To evaluate constraints, solutions and planning strategies, which constitute a framework for the implementation of sustainable urban design principles in Amman.			
Does the ranking for implementing the indicators give the opportunity for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman? How?	Yes, this ranking of indicators can help to implement these indicators through using the feedback for the ranking. This works to fill the main gaps facing the implementation of this process. Hence, the application of this process gives an opportunity to implement the suitable indicators for the city of Amman.	Yes, the ranking of indicators can present an opportunity for effective implementation of high density mixed use schemes. This can be through identifying properties of each indicator to help to understand the main constraints and find appropriate solutions to overcome the key challenges facing this process.	Yes, through identifying what are properties to each indicator help to knowledge the main constraints and find appropriate solutions to overcome the key challenge. Hence this can help to implement these indicators through using the feedback for the ranking of these indicators; in order to work to fill the main gaps facing implementing this process. The application of this process gives an opportunity to implement the suitable indicators for the city of Amman.
"The percentage of waste treatment and disposal is low" is one of the economic constraints which have been excluded by the questionnaire survey. Do you agree with this exclusion? Why?	Yes, this constraint will not obstruct the implementation of sustainable urban design practices using high density mixed use schemes in Amman, because there is a waste treatment and disposal project underway in collaboration with an outside company, which will be responsible for the implementation of this project.	I do not know.	Yes, because the city tries to create waste treatment and disposal plants without affecting surrounding environment. This project is under construction in collaboration with American company to overcome these constraints. Hence, this will not constitute a constraint for achieving sustainable urban design practices.

Emergence of Local community resistance and negative media coverage for the master plan project is one of the governance constraints which have been excluded by the questionnaire survey. Do you agree with this exclusion? Why?	I do not know	Yes, the city has tried to implement these schemes using a broad variety of regulations and laws. These regulations and laws try to avoid conflict between community views and the city through achieving a balance between providing the local community demands and implementing the project without affecting the local community negatively.	Yes, because the emergence of the local community objection is created from personal interest which control local community views. Therefore, the city should work to implement the project without affecting the local community negatively, according to a wide range of regulations and laws which organize the relationship between the local community and the city. These regulations and laws tries to avoid happening a conflict between the community views and the city through achieving a balance between providing the local community demands and implementing the project without affecting the local community negatively.
Considering the current implementation of the sustainable urban design principles, are there conflicts in the implementation of the proposed solutions to overcome the main constraints?	There are no conflicts, but these solutions should be implemented within the master plan in all areas equally.	There are no conflicts by implementing these solutions.	There are no conflicts, but these solutions should be implemented within the master plan in all areas equally. Hence, these solutions used in the three areas can be implemented in other areas within the Amman master plan, through taking advantage of the lessons used in these three areas.
The main planning strategy phases for sustainable urban design using HDMU are: strategic vision, strategic assessment, strategic plan formulation and implementation and management. Do you think that there are other phases can be used within the strategy planning for this project? What and why?	There are no other planning strategy phases.	There are no other planning strategy phases. However, the implementation of these phases need monitoring by the competent authorities at each stage.	There are no other planning strategy phases. But the management should be involved monitoring for the project. Hence, this gives an opportunity to implement the project phases according to effective planning strategy.
Tactical alternative phase is one of the planning strategy phases which have been excluded by the questionnaire survey. Do you agree with this exclusion? Why?	I do not know	Yes, the tactical alternative phase is not necessary if the strategic assessment phase is implemented effectively.	Yes, the strategic assessment phase is adequate for effective planning strategy, provided that this phase can be implemented effectively for this strategy. But if this phase can not be implemented effectively, the tactical alternative phase can be used to avoid the expected gaps and errors, which may happen through implementing this strategy. This phase can fill these gaps and correct the errors, which may be emerged as a result implementing this strategy. Therefore, the necessary precautions should be considered to fill that.
The main planning strategy requirements for sustainable urban design using HDMU are: the skills and abilities (Leadership), broad-based community participation, future public and private investments and the financial and convenience incentives . Do you think that there are other requirements can be used within the strategy planning for this	I do not know	There are no other planning strategy requirements, provided that leadership is effective throughout the implementation of the project.	There are no other planning strategy requirements, provided that leadership should be effective throughout the implementation of the project. Moreover, the broad-based community participation should be controlled during the implementation of the project phases.

project? What and why?			
What is the role of both public and private investments in the planning strategy for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?	Public investments cannot provide financial costs required for these projects because they do not have a financial capacity compared to the private investments. Private investments can support these projects in terms of financial costs more than other sectors.	Private investment enables effective implementation of these principles more than other investments, because of its high financial capability to implement these projects. As for public investment, this cannot meet the financial costs required for these projects because they do not have the same level of financial capacity as the private investment.	The private investments are which can be affected the effective implementation of these principles more than other investments, because of its high financial capability to implement these projects. These projects need a high economic cost for implementing them. Therefore, the private investments have a high ability to buy an adequate number of the lands although their high cost, which are needed for implementing these projects. As for the public investments do not have this ability. The public investments can help to develop the infrastructure for these sites in collaboration with public institutions responsible for these sites. Moreover, the private investments describes with a personal interests more than public interests during these projects. Therefore, there should be monitoring for the private investments by the public institutions responsible for the city. This will helps to adjust these investments efficiency within these sites, and avoid achieving personal interests relating these investments without taking into account city interests.
How can the financial and convenience incentives be presented for the strategy planning phases for the effective implementation of the sustainable urban design principles using high density mixed use schemes in Amman?	I do not know	The city can present tax credits or discounts to the investors to implement their projects.	These incentives can be presented as facilities and discounts of both private and public sector for implementing these projects. For examples, the financial amounts which should be paid to ensure the implementation of the infrastructure for these sites can be offered as payments in instalments to facilitate to implementing agencies, to be incentives to investors to overcome the financial constraints facing these projects. Moreover, the city can present tax credits or discounts to these investments, and this is encouraging the investors to implement the projects.
Consensus in the public views is one of the planning strategy requirements which have been excluded by the questionnaire survey. Do you agree with this exclusion? Why?	Yes, it is difficult to reach a consensus of public views for all categories within this process.	I do not know	Yes, it is difficult getting consensus in the public views, because there is a large difference in the views, this difference refers to a set of the reasons which plays a key role in formation these views.. It is the most important reasons is individual land ownership, which gives an opportunity to support personal interests. Hence, this ownership do not gives an opportunity for consensus in the views, because the city can not present a wide range of services to all lands equally. Hence, this affects nature of society views relating the master plan.

Name	Ihsan abu stateah	Murad Kalalda
Professional	Planner	Architect
Experiences	5 years	20 years

Rami Al-Shawabkeh

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The University of Brighton

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