

Land use and urban efficiency: towards more resilient cities

M. Richter
23374829

Dissertation submitted in fulfilment of the requirements for the degree *Magister Artium et Scientiae* in **Urban and Regional Planning** at the Potchefstroom Campus of the North-West University

Supervisor: Prof. J.E. Drewes
Co-supervisor: Mrs. M. van Aswegen

May 2017

ACKNOWLEDGEMENTS

This dissertation would not have been possible without the assistance, guidance and motivation of various people. I would like to show my gratitude with the following acknowledgements:

First, and most importantly, I want to thank my Heavenly Father for the strength, wisdom, ability and perseverance that He has provided to me.

My parents and my fiancé, for all the support, motivation and confidence you had in me.

Dr J.E. Drewes, my supervisor, for the valuable contact sessions that served as an important foundation to the study, as well as your help, willingness and inputs.

Mariske van Aswegen, my co-supervisor, for all your help, support, advice, time, willingness and trust in me. Without your guidance this dissertation would not have been possible.

Mari Richter

Urban and Regional Planning

North-West University; Potchefstroom Campus

ABSTRACT

This study aimed to provide a practical set of tools that may lead to improved urban resilience and efficiency. The goal of this set of tools is to improve and simplify the implementation of urban resilience and efficiency, and to enable cities to plan for shocks and to recover from them with faster and more effective adaption.

High rates of urbanization lead to a fragmented urban form with unequal access to jobs, amenities and public services. This, in turn, results in a number of problems, including inefficient infrastructure, long travel distances, poor service delivery, low quality spaces, disintegration and separation. The lack of efficient and adaptive layout and design, integrated land uses and sufficient planning at all levels of government have been identified as shortcomings that only exacerbate the consequences of urbanization. This study proposes a practical and policy-related set of tools for improved planning, promoting resilient layout and smart land use as a means to enable diverse settlements to respond to events such as intense levels of urbanisation.

Research was conducted on the different urban morphologies, the composition of land uses, design principles, mixed land uses and the existing literature on resilience. The findings reveal that urban resilience, urban efficiency and land uses are not sufficiently linked and that resilience is not an attainable state. It is rather a continuous quest.

The proposed set of tools could potentially improve urban resilience and efficiency. Tools include the ability of a daily urban system with all its constituent socio-ecological and socio-technical networks across temporal and spatial scales to maintain or rapidly return to their designated functions in the aftermath of a disturbance, to adapt to change, and to quickly transform systems that limit its current or future adaptive capacity.

This study is not focused on a specific study area, as it had in view the development of a generic set of tools. It incorporates national and international case studies that were utilized to determine the extent to which urban resilience and urban efficiency are implemented in terms of different types of land uses. The case studies include Barcelona, New Delhi and Durban. The three cities were studied in terms of their policy, legislation, physical form and land use composition. The lessons learnt from these case studies gave rise to the tools and policy proposals.

The empirical study revealed that current research, legislation and policies mainly focus on resilience in terms of natural disasters and shocks, with little emphasis on urban resilience, especially with regard to land use types and the impact on urban efficiency.

This study creates a number of opportunities and contributes potential solutions that could lead to improved and continuous implementation of urban resilience and efficiency. The possible solutions are based on a two-pronged approach and include both practical, policy and legislation-based proposals, which, if implemented effectively, could lead to improved urban resilience and urban efficiency.

Keywords:

Urban resilience; urban efficiency; land use; sustainability; densification.

OPSOMMING

Hierdie studie is onderneem om 'n stel praktiese riglyne daar te stel wat kan lei tot verbeterde stedelike veerkragtigheid en doeltreffendheid. Die doel van hierdie stel riglyne is om die implementering van stedelike veerkragtigheid en doeltreffendheid te verbeter en te vereenvoudig. Dit sal stede in staat stel om vir skokke te beplan en om met beter aanpasbaarheid daarvan te herstel.

Hoë verstedeliking lei tot 'n gefragmenteerde stedelike vorm met ongelyke toegang tot werk, geriewe en publieke dienste. Dit skep weer talle ander probleme, soos oneffektiewe infrastruktuur, lang reisafstande, swak dienslewering, lae-gehalte ruimtes, segregasie en verdeeldheid. Die gebrek aan 'n effektiewe en aanpasbare uitleg en ontwerp, geïntegreerde grondgebruik en voldoende beplanning op alle vlakke van die regering is geïdentifiseer as tekortkominge wat die impak van verstedeliking vererger. Hierdie studie stel 'n praktiese en beleidsverwante riglyne voor vir verbeterde beplanning, die bevordering van veerkragtige uitleg en effektiewe grondgebruik as 'n wyse om diverse nedersettings in staat te stel om beter te reageer op gebeure soos intensiewe vlakke van verstedeliking.

Navorsing is gedoen op die stedelike morfologie, die samestelling van grondgebruike, uitleg- en ontwerpbeginsels, gemengde grondgebruike en die bestaande literatuur oor veerkragtigheid. Die bevindinge het getoon dat stedelike veerkragtigheid, stedelike doeltreffendheid en grondgebruik samestelling nie voldoende verbind word nie en dat stedelike veerkragtigheid dus nie bereikbaar is nie, maar eerder gesien kan word 'n voortdurende soeke na hoër vlakke van veerkragtigheid.

Die voorgestelde stel riglyne kan potensieel stedelike veerkragtigheid en doeltreffendheid verbeter. Die konsep "stedelike veerkragtigheid" verwys in hierdie studie na die vermoë van die daaglikse stedelike sisteem en die sosio-ekologiese en sosio-tegniese netwerke om oor tyd en ruimteskale heen, vinnig terug te keer na hulle toegeskrewe funksies na 'n versteuring, om meer effektief by verandering aan te pas, en om meer doeltreffend die stedelike sisteem, wat huidige of toekomstige aanpassingskapasiteit beperk, te transformeer.

Hierdie studie is nie gefokus op 'n spesifieke studiegebied nie, aangesien dit gebaseer is op die ontwikkeling van 'n basiese stel riglyne. Dit sluit daarom plaaslike en internasionale gevallestudies in, wat gebruik is om die mate waartoe stedelike veerkragtigheid en stedelike effektiwiteit toegepas is, en geïmplementeer is met betrekking tot die samestelling van verskillende tipes grondgebruik. Die gevallestudies sluit Barcelona, Nieu-Delhi en Durban in. Die drie stede is bestudeer met spesifieke aandag aan beleid, wetgewing, morfologie en grondgebruiksamestelling. Die lesse wat by die drie stede geleer is, het bygedra tot die

ontwikkeling van riglyne en beleidsvoorstelle om die navorsingsvrae te beantwoord en navorsingsdoelwitte te bereik.

Sleutelwoorde:

Stedelike veerkragtigheid; stedelike effektiwiteit; grondgberuik; volhoubaarheid; densifisering.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	I
ABSTRACT.....	II
OPSOMMING.....	IV
CHAPTER 1: STUDY INTRODUCTION AND OVERVIEW.....	1
1.1 Research orientation	1
1.2 Problem statement and motivation	1
1.3 Primary research questions.....	1
1.4 Aims and objectives of this study	1
1.5 Basic hypothesis.....	2
1.6 Method of investigation.....	2
1.6.1 Literature study	2
1.6.2 Empirical study.....	2
1.7 Structure of the dissertation	3
1.8 Definitions.....	4
1.9 Abbreviations	5
CHAPTER 2: URBAN STRUCTURE AND LAND USE TYPES.....	8
2.1 Urban morphology	8
2.1.1 Concentric Zone Model	8
2.1.2 Sector Model	10
2.1.3 Multiple Nuclei Model	12
2.1.4 Modified Burgess Model.....	14
2.1.5 The twenty-first century model	15

2.1.6	Apartheid City Model	16
2.2	Land use planning	18
2.2.1	The origin and theoretical background of land use planning	18
2.2.2	Defining land use planning	18
2.2.3	The focus, objectives and importance of land use planning	19
2.2.4	The levels of land use planning	19
2.2.5	The components of land use planning	22
2.2.6	The stakeholders in land use planning	23
2.2.7	The steps in land use planning	26
2.3	Land use management	27
2.3.1	Defining land use management	27
2.3.2	The focus and objectives of land use management	27
2.3.3	The application of land use management	28
2.3.3.1	Densification	28
2.3.3.2	Zoning	28
2.3.3.3	Mixed land use	29
2.3.3.4	Corridor connection	29
2.3.3.5	Sense of community	30
2.3.3.6	Land use management policies	30
2.3.3.6.1	The purpose of land use management policies	30
2.3.3.6.2	The elements of land use management policies	30
2.3.3.6.3	Land uses within land use management schemes	31
2.4	Identified challenges	31

2.4.1	The challenges of land use management	31
2.4.2	Challenges in sustainable development.....	32
2.4.3	Challenges in liveable communities	34
2.5	Conclusion.....	34
CHAPTER 3: RESILIENCE IN SPATIAL PANNING.....		36
3.1	Introduction	36
3.2	Resilience defined.....	36
3.2.1	Defining resilience within spatial planning.....	39
3.2.1.1	Urban Systems.....	39
3.2.1.2	A comprehensive definition of urban resilience.....	42
3.3	Resilience and related terms	44
3.3.1	Resilience and sustainability	45
3.3.2	Resilience and smart cities	45
3.3.3	Resilience and Liveable cities	46
3.3.4	Resilience and Compact cities	47
3.4	Resilience in the built environment.....	48
3.4.1	Resilience, urban planning and urban structures.....	48
3.4.2	Resilience and complex systems	49
3.4.3	Towards resilient cities.....	50
3.4.3.1	The components within a city.....	50
3.4.3.2	The stressors and outcomes.....	51
3.4.3.3	The enhancers, suppressors and impact	52
3.4.3.4	The sets of interventions	53

3.5	Resilience and urban planning mechanisms	54
3.5.1	Resilience and revitalisation.....	54
3.5.1.1	CBD revitalization and urban retail marketing strategies	55
3.5.2	Land use types and resilience.....	57
3.5.3	Urban connectivity.....	58
3.5.4	Spatial planning principles	60
3.5.4.1	The best-practice city	60
3.5.4.2	Land use compilation for the best practice city	63
3.6	Conclusion.....	64
CHAPTER 4: RESILIENCE: POLICY AND LEGISLATION.....		66
4.1	International policies and legislation on resilience	66
4.1.1	The European Union Resilience Policy.....	66
4.1.1.1	Resilience Marker	68
4.1.1.2	Resilience Compendium	70
4.1.2	The United Nations Habitat	71
4.1.3	The Millennium Development Goals	72
4.1.4	The Sustainable Development Goals.....	74
4.1.5	New Urban Agenda.....	77
4.2	National policies, legislation and guidelines on resilience.....	78
4.2.1	National Policies.....	81
4.2.1.1	Local Agenda 21	81
4.2.1.2	Urban Development Framework	83
4.2.1.2.1	Urban Development Framework – 1997	83

4.2.1.2.2	Urban Development Framework – 2009	86
4.2.1.2.3	Integrated Urban Development Framework - 2016	89
4.2.2	National Legislation	92
4.2.2.1	Spatial Land Use and Management Act	92
4.2.2.1.1	Development principles, norms and standards	93
4.2.3	National Guidelines	94
4.2.3.1	The CSIR Redbook	94
4.2.3.2	The CSIR Guidelines for the Provision of Social Facilities in South African Settlements	96
4.3	Application of policies and legislation	97
4.3.1	Policy Context	98
4.4	Conclusion	102
CHAPTER 5: EMPIRICAL STUDY		103
5.1	Introduction	103
5.2	Methodology	103
5.3	International Case Studies	104
5.3.1	Spain	104
5.3.1.1	Current Guidelines in Spain	105
5.3.1.2	Barcelona	106
Figure 34: Map of Catalonia		106
5.3.1.3	The origin of the paradigm shift towards sustainability and resilience	106
5.3.1.3.1	Sustainability	107
5.3.1.3.2	Resilience	108

5.3.1.4	Mechanisms for moving towards resilience	108
5.3.1.5	The application of urban land use planning	113
5.3.1.5.1	Catalan Territorial Masterplan	114
5.3.1.5.2	Territorial Partial Plans	115
5.3.1.5.3	Territorial Masterplans.....	115
5.3.1.5.4	Sector-Specific Territorial Plans	115
5.3.1.5.5	Urban Masterplans	115
5.3.1.5.6	The Municipal Urban Plan	116
5.3.1.5.7	22@Barcelona Plan	116
5.3.2	India	124
5.3.2.1	Current guidelines in India	124
5.3.2.2	New Delhi.....	126
5.3.2.3	The origin of the paradigm shift towards sustainability and resilience	127
5.3.2.3.1	Sustainability	127
5.3.2.3.2	Resilience.....	128
5.3.2.4	Mechanisms for moving towards Resilience	128
5.3.2.5	The application of urban land use planning	130
5.3.2.5.1	Delhi Urban Area-2021.....	130
5.3.2.5.2	Urban Design	131
5.3.2.5.3	Mixed use regulations	131
5.3.2.5.4	Land use plan.....	132
5.3.2.5.5	Development Code.....	132
5.4	South African Case Study	133

5.4.1	Durban	134
5.4.1.1	Spatial Planning Background	134
5.4.1.2	The origin of the paradigm shift towards sustainability and resilience	135
5.4.1.2.1	Sustainability	135
5.4.1.2.2	Resilience	136
5.4.1.3	Mechanisms for moving towards Resilience	138
5.4.1.4	The application of urban land use planning	140
5.5	Conclusion.....	145
CHAPTER 6: SYNTHESIS AND RECOMMENDATIONS		146
6.1	Introduction	146
6.2	Synthesis	146
6.2.1	Purpose	146
6.2.2	Background	147
6.2.3	Findings.....	147
6.3	Recommendations	158
6.3.1	Policy proposals	159
6.3.1.1	National Level	160
6.3.1.2	Provincial level	161
6.3.1.3	Municipal level.....	162
6.3.2	Implementation tools for resilience.....	165
6.3.2.1	Public Transport Zones	168
6.3.2.2	Infill Planning	170
6.3.2.3	Open Space systems and zones	172

6.3.2.4	Mixed land use	174
6.3.2.5	Densification.....	176
6.3.2.6	Urban Edge	178
6.4	Conclusion.....	182
	BIBLIOGRAPHY	184

LIST OF TABLES

Table 1: Definitions of urban resilience	37
Table 2: Fundamental questions related to urban resilience.....	44
Table 3: Strategies for resilience.....	49
Table 4: Revitalization strategies to enhance the CBD	55
Table 5: Lynch’s spatial planning principles for the best practice city	60
Table 6: Behrens and Watson’s spatial planning principles for the best practice city	61
Table 7: Lynch and Hack’s spatial planning principles for the best practice city	62
Table 8: Chapin’s spatial planning principles for the best practice city	63
Table 9: MDG: To ensure environmental sustainability.....	73
Table 10: Sustainable Development Goals	74
Table 11The CSIR’s guidelines for human settlements and planning design:	94
Table 12: Planning Principles of the European Union.....	105
Table 13: National Planning Principles of India.....	125
Table 14: The SDF spatial proposals	142
Table 15: The comparisons between resilience and related terms	150
Table 16: Relationship between concepts and principles	155

LIST OF FIGURES

Figure 1: The concentric theory of urban structure	9
Figure 2: Burgess's concentric zone model of urban land use, applied to Chicago	10
Figure 3: Hoyt's Sector model	11
Figure 4: The multiple nuclei theory	12
Figure 5: Kearsley's modified Burgess model of urban land use	14
Figure 6: White's model of the twenty- first century.....	15
Figure 7: The original Apartheid city model.....	17
Figure 8: Links between the three levels of planning	21
Figure 9: The explained local level land use planning.....	22
Figure 10: Stakeholders in land use planning	23
Figure 11: The ten steps of land use planning	25
Figure 12: Conflicts among sustainable development.....	33
Figure 13: Levels of an urban system	40
Figure 14: Simplified conceptual schematic of urban systems.....	41
Figure 15: The SMART model.....	46
Figure 16: A model towards resilient cities	50
Figure 17: Components and interactions within a city	51
Figure 18: Cities and stressors.....	52
Figure 19: Cities, stressors, enhancers and suppressors, impact.....	53
Figure 20: Measures that contribute to resilience	57
Figure 21: Corridor development model.....	58
Figure 22: Resilience Marker Criteria.....	69

Figure 23: Resilience marker key	69
Figure 24: Phases of the CRPP	72
Figure 25: Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable	76
Figure 26: Interlinked priorities of the NDP	79
Figure 27: NDP Principles for Spatial Development.....	80
Figure 28: IDP main goals.....	82
Figure 29: IUDF Strategic Goals	89
Figure 30: The spatial planning context and relationships in South Africa	98
Figure 31: Linking the SDF and the LUMS.....	100
Figure 32: Linkages between the SDF and LUMS	100
Figure 33: Differentiating the different scales of planning according to the relevant elements, policy contexts and legislative demarcations.....	101
Figure 34: Map of Catalonia	106
Figure 35: Barcelona key dates for sustainable development.....	107
Figure 36: The vulnerability of the city in terms of service delivery and its interconnections	109
Figure 37: Strategic components of the resilience applied to infrastructure.....	109
Figure 38: Resilience cycle	110
Figure 39: Resilience in Barcelona.....	112
Figure 40: The Catalan Planning System.....	114
Figure 41: Location and area of the 22@Barcelona Project	117
Figure 42: La Ronda del Litoral (coastal ring road)	117
Figure 43: The Tram.....	118
Figure 44: Bicing bicycle services	118

Figure 45: Subsector 9 and 9 (present).....	119
Figure 46: Subsector 8 and 9 (future)	120
Figure 47: Density rights and obligations	120
Figure 48: Llull- Pujades Ponent (past) & Figure 49: Llull- Pujades Ponent (past)	121
Figure 50: Can Framis (past) & Figure 51: Can Framis (present).....	122
Figure 52: 22@Barcelona projects aspects	123
Figure 53: The Planning System of India	124
Figure 54: Key Constitutes of India's Urban Future	125
Figure 55: Map of New Delhi.....	127
Figure 56: The ten essentials of the New Delhi Resilience Action Plan.....	129
Figure 57: Map of Durban	134
Figure 58: Durban's process towards developing a Preliminary Resilience Assessment	136
Figure 59: Durban's resilience journey for Phase 2	137
Figure 60: A summary of the resilience issues emerging for Durban.....	138
Figure 61: Innovative place making and its subsystems	139
Figure 62: Sustainable and ecological city	139
Figure 63: Spatial Vision and Principles informing eThekweni Municipal SDF	141
Figure 64: Land use principles and concepts.....	148
Figure 65: The gap between the levels of planning.....	149
Figure 66: SWOT Analysis of Barcelona.....	152
Figure 67: SWOT Analysis of New Delhi.....	153
Figure 68: SWOT Analysis of Durban	154
Figure 69: Section Division.....	158

Figure 70: Integrated levels of planning	159
Figure 71: Vertical and cross-sectoral integration and alignment	164
Figure 72: The current situation	167
Figure 73: Public Transport Zones	169
Figure 74: Infill Planning	171
Figure 75: Open Space Systems and Zones	173
Figure 76: Mixed land uses	175
Figure 77: Densification.....	177
Figure 78: Urban Edge	179

CHAPTER 1: STUDY INTRODUCTION AND OVERVIEW

1.1 Research orientation

This study was initiated to potentially provide a practical set of tools that will lead to improved urban resilience and efficiency. This will potentially improve and simplify the implementation of urban resilience and efficiency, and enable cities to plan for shocks and recover from them with faster and more effective adaption. Most of the available studies and research focus on resilience in terms of natural disasters and shocks, with little or no emphasis on urban resilience, especially pertaining to land use types. This study focuses on the numerous legislation documents and theories associated with land use planning, resilience and efficiency, and identifies key aspects for urban resilience and urban efficiency.

1.2 Problem statement and motivation

According to the World Bank (2015), the world's urbanisation level is drastically increasing and stands at a even higher 53% urbanization rate. Unfortunately, this assertion is clearly reflected in South Africa. Similarly, Turok (2012:21) reveals that urbanization leads to a fragmented urban form with unequal access to jobs, amenities and public services in South Africa. This in turn leads to a number of problems including inefficient infrastructure, long travel distances, poor service delivery, low quality spaces, disintegration and separation. The ineffective and inadapttable layout and design, non-integrated land uses and the insufficient forward planning at all levels and aspects results in the inability of some cities to effectively keep up with a high urbanization rate, therefore exacerbating the problems. By taking these various components into account and determining what causes one city to handle and absorb rapid urbanization better than others, a framework may be established which will lead to more resilient cities. This problem can potentially be addressed by early forward planning and promoting resilient layout and smart land use which will in turn enable settlements to respond to events such as intense levels of urbanisation.

1.3 Primary research questions

- What spatial components leads to improved urban resilience?
- What land use types support spatial resilience and efficiency?
- What tools can be applied to improve urban resilience and efficiency?

1.4 Aims and objectives of this study

- Explore the different spatial components influencing the capacity of a settlement to respond positively to rapid changes.

- Propose a multi-faceted approach that leads to urban resilience and efficiency through the implementation of mixed land uses and thus more resilient settlements.
- Create a tool for government to enhance resilience and efficiency and guide development through existing policy and legislation.

1.5 Basic hypothesis

The implementation of an appropriate land use and densification model will lead to more resilient and efficient cities.

1.6 Method of investigation

The following sections will elaborate on the method of investigation applied in both the literature study and empirical study.

1.6.1 Literature study

The literature study consists of several aspects which serve as the background, overview and definition of the several models, theories and terms explored in the study. The first part focuses on land use models to determine the different land uses in a city and the importance and role of each land use. This will lead to a better understanding of the concept of resilience and its essence within the planning realm (Desouza & Flanery, 2013). The different components of resilience will be presented with an emphasis on aspects such as economy, social, environment, services, design and land use and the contribution they make to resilience. The primary purpose is to analyse the existing definition of resilience and possibly add new concepts to the definition (Cartalis, 2014). Thereafter, the study proceeds to explain the mixing and composition of land uses and how it is applied nationally and internationally. Lastly, the impacts of urban sprawl, densification and different types of zoning on resilience will be discussed.

1.6.2 Empirical study

The empirical study will be performed using South Africa as the focal case study on both a qualitative and quantitative basis. The decision to use various settlements as case studies, rather than limit the study to one specific settlement, is informed by the uniformity in the land use and layout planning throughout South Africa as is guided by various policies, the most recent being SPLUMA (South Africa, 2013).

The qualitative empirical method utilized for this study is the Document Analysis Protocol (case study method). According to Guba and Lincoln (1981:21), document analysis is a form of qualitative research in which documents are interpreted by the researcher to give voice and

meaning around an assessment topic. Analysing documents incorporates coding content into themes similar to how focus group or interview transcripts are analysed.

The document analysis method used for this study is the content analysis method, as certain policies and documents were studied and evaluated to establish a standard at the end of this section. This includes an international case study of a developed and developing country respectively, which were compared to the national case study. This method is adapted to determine whether there is a gap in South African settlements regarding resilient forward planning pertaining specifically to densification and a mix of land uses. The study also includes an investigation of the different policies and legislation that are used nationally and internationally to control and manage land uses. Quantitative data will be gathered through fieldwork in the chosen settlements to use as a basis for comparison. Existing databases such as the census data will be utilized where necessary.

Furthermore, the empirical study will be supplemented with various datasets, including the CSIR Redbook (CSIR, 2000) and The CSIR Guidelines for the Provision of Social Facilities in South African Settlements (CSIR, 2012). This refers to a qualitative and quantitative study of the various aspects of land use.

1.7 Structure of the dissertation

The following is a summary of the structure and content of the remainder of the dissertation:

Chapter 1: Introduction

The introduction is a short introductory chapter which includes the problem statement and a short overview of each chapter and the methods that were applied in its compilation.

Chapter 2: Urban structure and land use types

Chapter Two provides a detailed explanation of the different urban morphologies, which will include Burgess' Concentric zone model, Hoyt's Sector models, Harris and Ullman's multiple-nuclei model, Kearsley's modified Burgess model, White's model of the twenty-first century city and the Apartheid City model. The concluding part of the chapter elaborates what land use management entails and how it is applied and managed, nationally and internationally.

Chapter 3: Resilience in Spatial Planning

In Chapter Three, the existing definitions of resilience, the origin of the term and how it may be applied in the planning environment are discussed. Resilience and its related terms are elaborated to establish the differences and similarities thereof. This chapter also includes the

different systems and planning mechanisms and serves as a basis by providing adequate background information on resilience, which will assist in combining a set of tools in Chapter 6.

Chapter 4: Resilience Policy and Legislation

In this chapter, the international and national policies and legislations on development planning and land uses will be studied with the aim of determining the aspects that are applicable to the management and integration of land uses. This will enable the researcher to determine how this legislation influences the resilience of urban areas and whether or not it is sufficient to make a significant contribution towards the resilience and efficiency of a city. It will also assist in determining the gaps and the learning of lessons which lead to urban resilience and efficiency. The first section focuses on international policies and documents which serve as a basis and potential best practice guidelines to the second section which focuses on national policies and legislation to measure South Africa's approach towards resilience in terms of land use types.

Chapter 5: Empirical Study

Case studies from both developing and developed countries will be analysed in this chapter to determine which tools and aspects are applied in the maintenance of the resilience of cities globally. The chapter aims to establish the integration and application of urban resilience through different types of land uses.

Chapter 6: Synthesis and Recommendations

This chapter delivers an integrated summary of the issues, the findings from the case studies and the theoretical underpinnings examined in the study. Recommendations will be made for the proposal of principles and tools to address resilience and efficiency in settlements, to adopt a multi-faceted approach that could be used by the local government to achieve more resilient and efficient land use planning through the implementation of mixed land uses and densification, and subsequently, more resilient South African settlements. This chapter encapsulates the essence of this study and potentially proffers valuable contribution to academics as well as a practical tool for implementation.

1.8 Definitions

The following are important definitions of applicable terminology that were used in this research:

Compact City	An urban area with clearly defined boundaries, in which the residential and commercial districts are relatively close together,
--------------	---

	forestalling the development of rural land and reducing the need to commute by car.
Corridor	A belt of land linking two other areas or following a road or river.
Densification	The act of becoming or making more dense; an increased use of space both horizontally and vertically.
Gentrification	The process of renovating and improving a house or district so that it conforms to middle-class taste.
Infill planning	Buildings constructed to occupy the space between existing structures.
Land use management	Land use management is a multidisciplinary science that integrates natural land systems with the built environment
Liveability	Liveability is the sum of factors that add up to a community's quality of life.
Node	A point in a network at which lines or pathways intersect or branch.
Resilience	The capacity to recover quickly from difficulties; elasticity.
Sustainability	Avoidance of depletion of natural resource in order to maintain an ecological balance.
Zoning	Designate a specific area for use or development as a particular zone in planning.

1.9 Abbreviations

The abbreviations used in this research:

CBD	Central Business District
CRPP	City Resilience Profiling Programme
DFID	Department for International Development

DRDLR	Department of Rural Development and Land Reform
ECHO	European Commission Humanitarian Aid
ECSC	European Coal and Steel Community
EEC	European Economic Community
EU	European Union
FAO	Food and Agriculture Organisation
GDS	Growth and Development Strategy
IDP	Integrated Development Framework
IFAD	International Fund for Agriculture Development
IUDF	Integrated Urban Development Framework
LUMS	Land Use and Management Act
MDG	Millennium Development Goals
MSA	Municipal Systems Act
MSDF	Municipal Spatial Development Framework
MTSF	Medium Term Strategic Framework
NDP	National Development Program
NEMA	National Environmental Management Act
NSDP	National Spatial Development Framework
PSDF	Provincial Spatial Development Framework
SDF	Spatial Development Framework
SDG	Sustainable Development Goals
SPLUMA	Spatial Land Use and Management Act

SZEA	Standard Zoning Enabling Act
TISU	Taula de Infraestructuras de Servers urbans
TPA	Territorial Policy ¹⁰
UDF	Urban Development Framework
UN	United Nations
WFP	World Food Programme
100RC	100 Resilient Cities

CHAPTER 2: URBAN STRUCTURE AND LAND USE TYPES

This chapter discusses the different land-use models, which include the Burgess' Concentric zone model, Hoyt's Sector models, Harris and Ullman's multiple-nuclei model, Kearsley's modified Burgess model, White's model of the twenty-first century city and the Apartheid City model. The importance and relevance of each of the land uses will be emphasized and determined. The second part of the chapter explains what land use planning and land use management entails and how it is applied and managed, nationally and internationally.

This chapter is essentially serves as a basis and provides sufficient background and information about land use types and all the relevant aspects discussed in this chapter, as land use types form the core aspects of this study. This chapter also serves as a basis in order to determine which land use types contribute to resilience and urban efficiency later in the study.

2.1 Urban morphology

Land use models describe activities of land consuming actors and their competition for land in an urban setting (Kazem Oryani *et al.*, 1996:1). These actors include households, firms and retail establishments, each with specific requirements for space and access to markets, jobs and schools (Kazem Oryani *et al.*, 1996:1).

Describing the spatial distribution of these activities at present and projecting future land uses are the main two aspect of these models and it considers interaction among these activities through the transportation network (Kazem Oryani *et al.*, 1996:1).

2.1.1 Concentric Zone Model

This model for urban social areas was devised by Burgess in 1923. Burgess(1930:157) states that this model is based on the concept of a series of concentric zones due to the development of a city that takes place outwards from its central area (Figure 1). This model is related to the bid- rent theory which states that different land users will compete for land close to the city centre (Alonso, 1964: 23). The theory refers to how the demand and price for real estate changes as the distance from the central business district CBD increases. This is based on the idea that retail establishments wish to maximize their profitability, so they are more willing to pay more for land close to the CBD and less for land further away from this area. Therefore, the theory states that the more accessible an area is, the more profitable it is.

Following the bid-rent theory, Burgess identified the concentric zones. The zones begin with the Central Business District (CBD). According to the American Planning Association (2006:405), the CBD serves as a downtown retail district that includes department stores and upscale shopping,

offices, clubs, banks, hotels, theatres, museums and organizational headquarters. The CBD has major transportation routes that connect to it, which makes it the most accessible part of the city (American Planning Association, 2006:405).

Burgess (1930:158) states that the CBD is surrounded by an area of transition where older private houses are either in process of being taken over for offices and light industry, or are being subdivided to form smaller dwelling units.

The zone of working-men's homes surrounded the transitional zone, with the older residential buildings in the city that are found here, but social groups are stable and largely consist of working-class families Burgess (1930:159). In most cities today, what was known as the zone of transition has become mixed use, consisting of expensive residential infill projects (American Planning Association, 2006:405).

According to Burgess (1930:160), the zone of improved residences are farther from the centre with newer spacious dwellings, occupied by middle-class groups. These areas would have an urban, rather than a suburban character, consisting of single-family dwellings, exclusive restricted districts, where no other uses are allowed (American Planning Association, 2006:405).

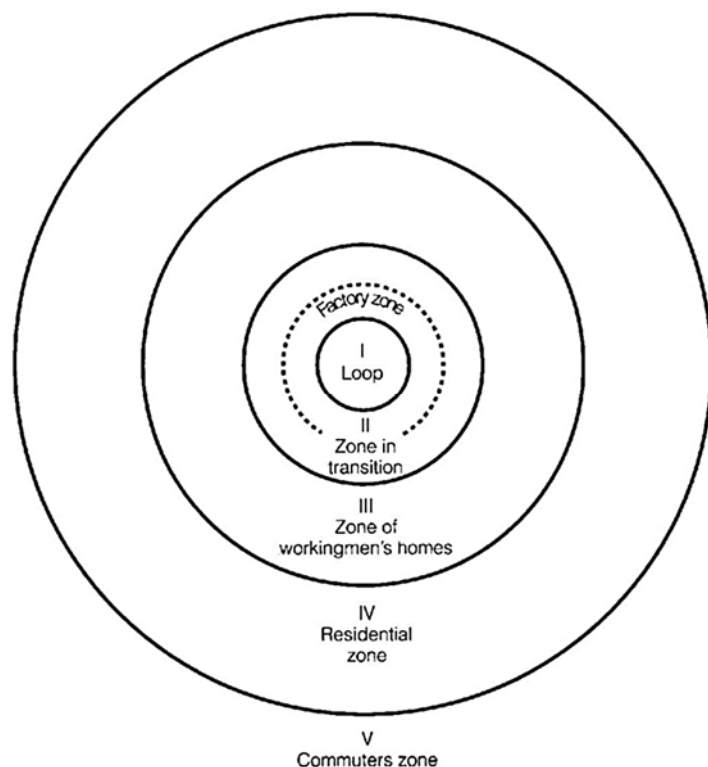


Figure 1: The concentric theory of urban structure

Source: Johnson (1972:170).

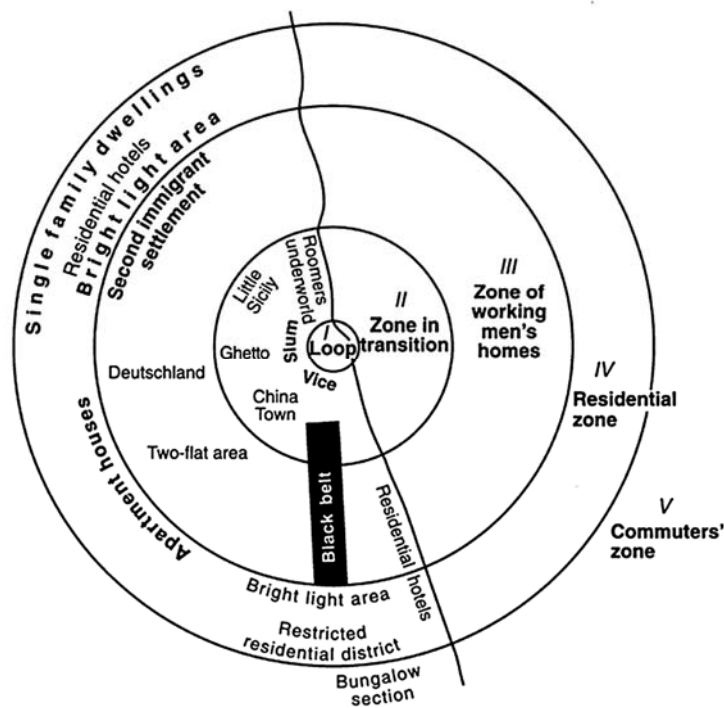


Figure 2: Burgess's concentric zone model of urban land use, applied to Chicago

Source: Pacione (2001:98).

Burgess (1930:160) further states that the commuters' zone was found beyond the continuous built-up area of the city, with the outer limit being about one hours' travel time from the city centre, where a considerable amount of the population in this zone was employed. Today, with its own developed economic base, the zone of commuters may be relatively independent of the central city and would be low-density residential suburbs or suburban areas (American Planning Association, 2006:405).

Criticisms by Qazi and Qazi (2006:167) state that the theory is over simplified and therefore, it is difficult to observe concentric zones in reality. According to Qazi and Qazi (2006:167), the theory is unhindered by physical environments, topographical variations might influence location of sites and the theory may have applied to cities before the introduction of motor transport. Rodrigue (1998:2) criticizes the model by stating that the theory is built on a lot of spatial differences in terms of ethnic, social and occupational status, while there were low occurrences of the functional differences in land use patterns. He argues that the concentric model assumed a spatial separation of place of residence and place of work, which was not generalized until the twentieth century.

2.1.2 Sector Model

Hoyt (1939:72) notes that the sector theory originated in 1939. Although M. R. Davie had similar views about the same time, the American land economist, Homer Hoyt, is frequently credited with

the sector model. Hoyt (1939:72) indicates that, once contrasts in land use had risen near the centre of a city, these differences were perpetuated as the city expanded. He also mentions that distinctive sectors of land use that were likely to grow out from the centre, often focused on major route ways (Figure 3). This assertion also has a linkage to Burgess's theory discussed in section 2.1.1.

According to Qazi and Qazi (2006:167), zones distort from circles to star shapes, with extensions taking place along major roads and railways due to people that tend to live in relation to time and distance (see bid rent theory section 2.1.1). The arrangement of routes radiating from the centre of the city conditions the patterns of land use creating a sectoral pattern of land and rental values, which in turn has an influence on land use (Qazi & Qazi, 2006:168).

This idea of a wedge-like expansion of urban areas is certainly an improvement on the earlier theory, due to more attention paid to the importance of the functionality of transport in the city (Hoyt, 1939:72). According to Hoyt (1939:72), the sector theory applies most appropriately to the development of residential areas, although the industrial sector also fits in this theory. Hoyt further notes that a high rent residential district is one sector of the city which will migrate outwards by the addition of new belts of houses along its outer area. The pattern of the building is concentric, because sectors of urban structure are not static but will expand outwards (Qazi & Qazi, 2006:168).

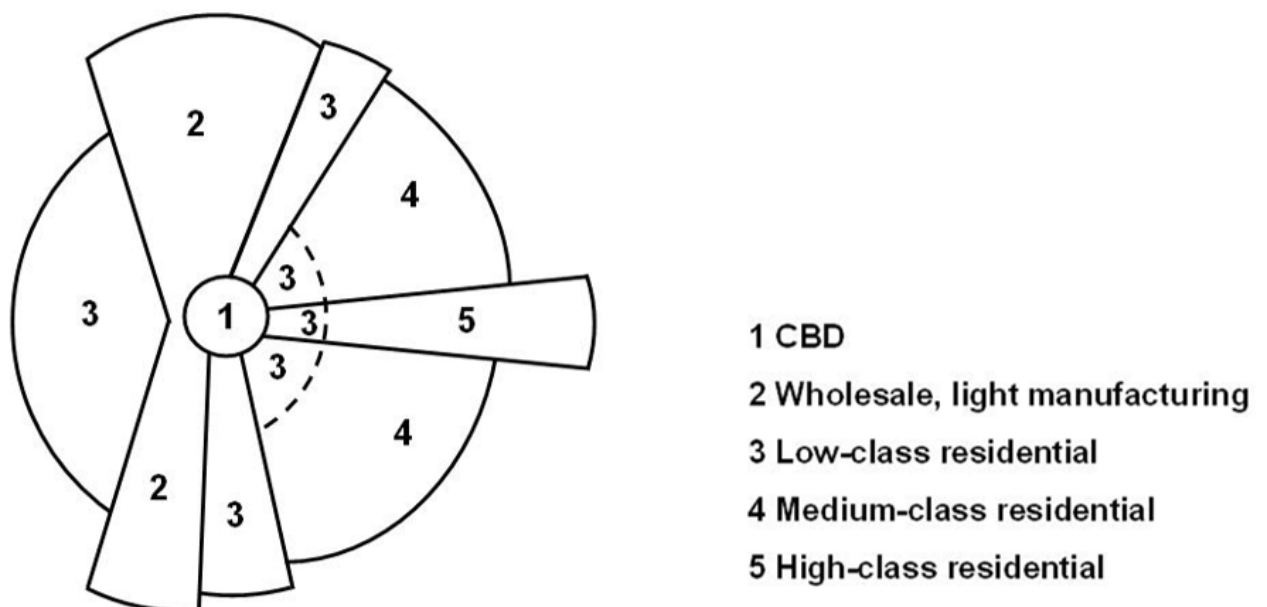


Figure 3: Hoyt's Sector model

Source: Pacione (2001:101).

The American Planning Association (2006:405) observes that Hoyt's theory about sectorial development is still relevant today. Although the sector itself may be subdivided into a series of nodes connected by a major arterial road, it is still found in many metropolitan areas that there is a favoured corridor that attracts expensive residences and prestigious office parks and shopping malls. The theory works to integrate modes of transportation within corridors, therefore, it is relevant to contemporary transportation planning and land-use relationships.

2.1.3 Multiple Nuclei Model

Johnson (1972:173) argues that the multi nuclei theory was advanced by two geographers, C.D Harris and E. Ullman, in 1945. Harris and Ullman (1945:13) suggest in this theory that cities have an essential cellular structure with distinctive types of land use that have developed around certain growth points within the urban area (Figure 4).

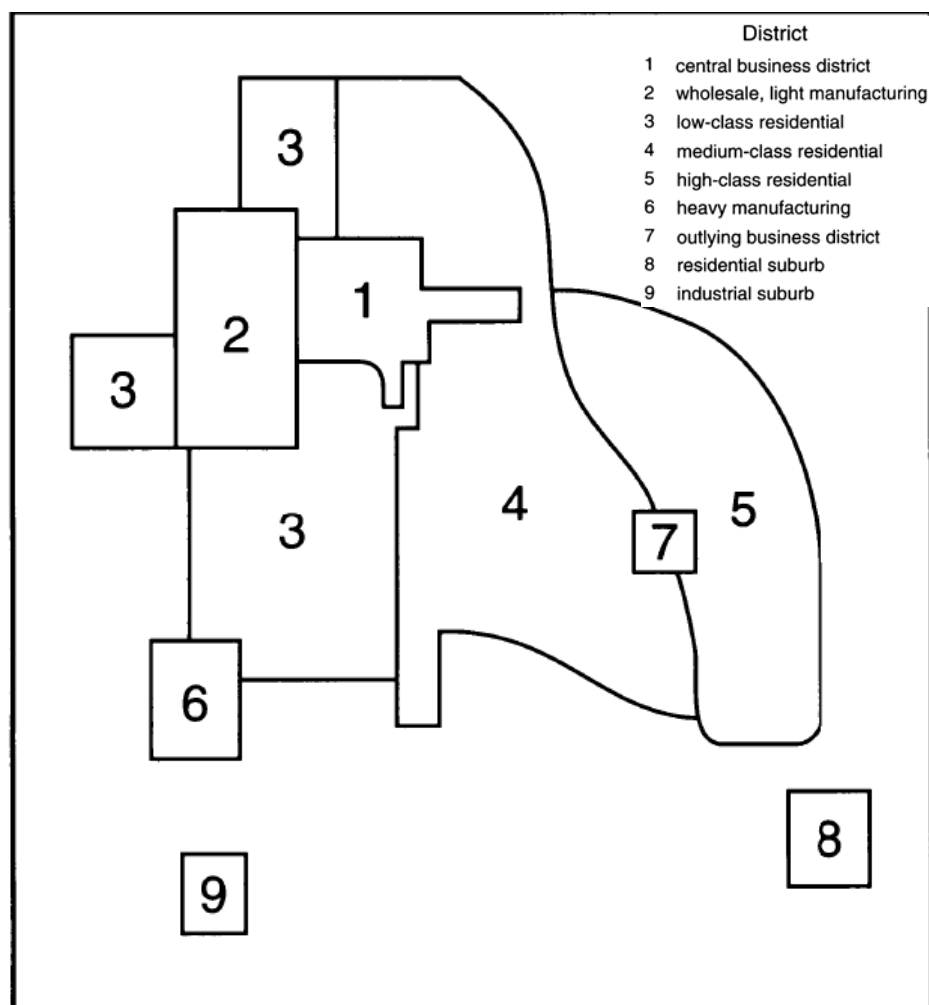


Figure 4: The multiple nuclei theory

Source: Pacione (2001:102).

The American Planning Association (2006:405) further states that the multiple nuclei theory describes a pattern of internal organization of a city where the land-use patterns are built around several discrete centres, rather than around a single centre. This may be the centres that have existed since the origins of the city, or were developed as the city's growth stimulated migration and specialization.

Harris and Ullman (1945:13) state that the grouping of specialist land uses around these nuclei has been encouraged by four factors, which have an influence on the distribution of human activities within a city in various ways.

Certain activities require specialized facilities. The position of the CBD as the location with the highest accessibility gives a clear illustration of this factor, or certain activities group together because they profit from cohesion, while other activities are detrimental to one another and are not normally in close juxtaposition (Harris & Ullman, 1945:13).

Furthermore, Harris and Ullman (1945:13) state that the multiple nuclei idea allows for the fact that the internal geography of cities owes much to the peculiarities of their individual sites, as well as to the operation of more general economic and social forces. The nature of the detailed site operates within a framework provided by social and economic factors.

Similarly, the history of individual cities constitute an important factor shaping the form of urban development, this means that, this theory cannot produce a simple model of urban structure, immediately discernible in the form of every city (Harris & Ullman, 1945:13).

Johnson (1972:173) suggests that it is better to look at this approach more as a guide to thought about the structure of the city, rather than as a rigid generalisation about urban form.

2.1.4 Modified Burgess Model

Kearsley's model was an attempt to extend the Concentric model of urban structure to consider the contemporary dimensions of urbanisation as governmental interference changes, suburbanization, slum clearance, decentralization of economic activities and gentrification (Figure 5) occur. The modified model proceeds to manipulate various elements including the extension of the inner-city, expansion of low- density suburbs and minimisation of central and local government housing (Kearsley, 1983:12).

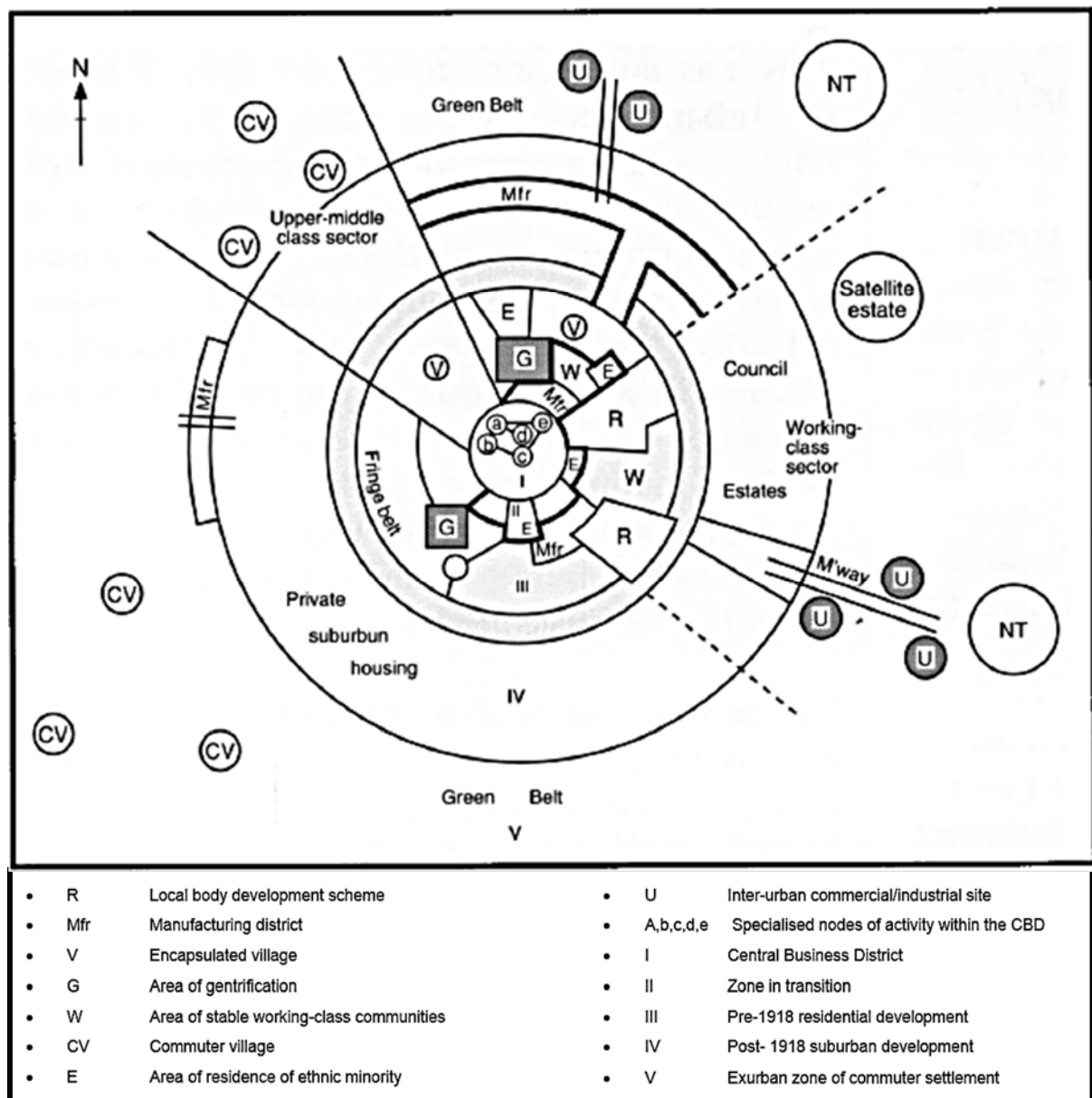


Figure 5: Kearsley's modified Burgess model of urban land use

Source: Pacione (2001:104).

The model is illustrated in Figure 5 and shows the new towns, council estates and satellite estates which he proposed would develop due to the influence of the above mentioned factors.

2.1.5 The twenty-first century model

White's twenty- first century model aims to include the new forces that have come to influence urban (White, 1987:327). This model reflects the social changes such as the emergence of a service economy, de- industrialization of the urban economy, the dominance of the automobile, suburban residential developments, smaller family sizes and greater influence by the government. White proposes a revision of the Burgess' concentric model that incorporates these forces in order to make it more applicable to the twenty-first century city.

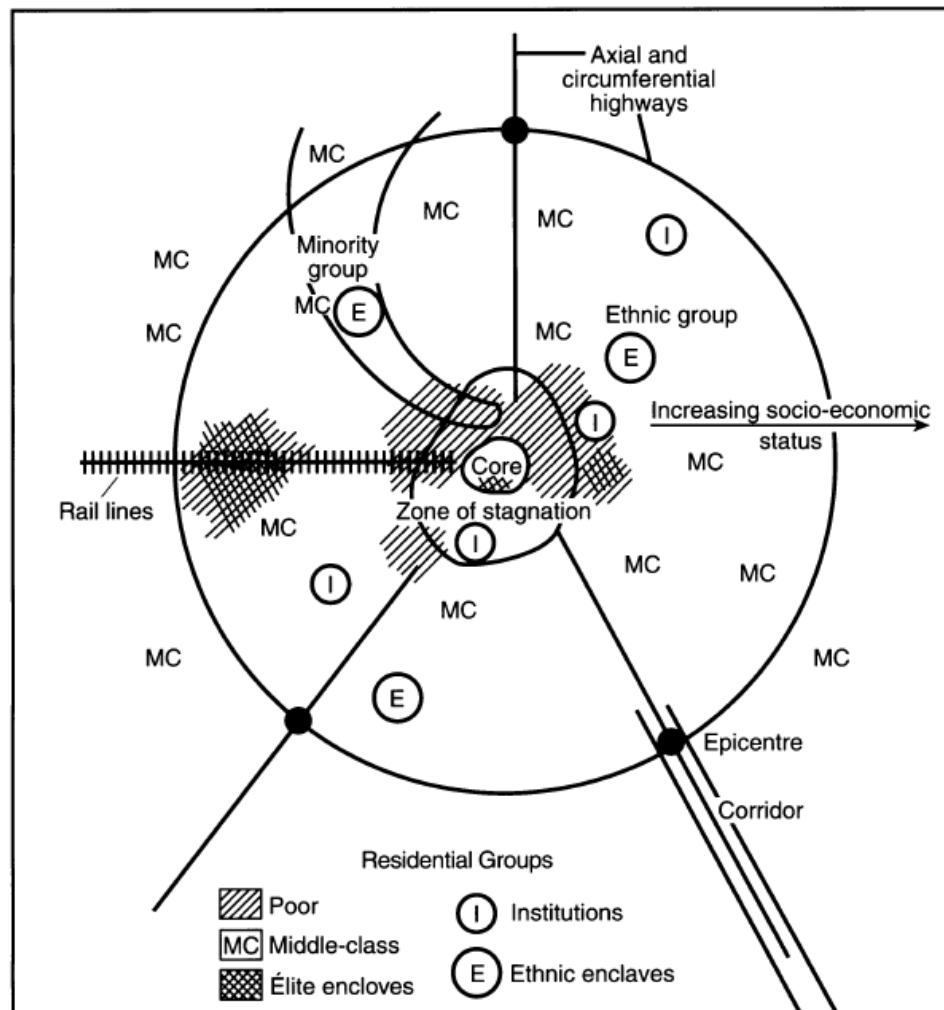


Figure 6: White's model of the twenty- first century

Source: Pacione (2001:105)

The model comprises of seven elements (White, 1987:327):

1. Core
2. Zone of stagnation
3. Pockets of poverty and minority
4. Elite enclaves
5. The diffused middle class

6. Industrial anchors and public-sector control
7. Epicentres and corridors.

The CBD remains the focus of the metropolis, but the functions may have changed over time. It still houses the major financial institutions, government buildings and corporate headquarters, but most retailing outfits have moved to the suburbs. White argues that the CBD expands vertically rather than extending outwards leading to the zone of stagnation. This zone has a lack of investment due to slum clearance, relocation of warehouses and transport activities and highway construction.

Industrial parks, research and developments centres, universities, business and office centres, hospitals and corporate headquarters can exert a large influence on patterns of land use. They can pressure a city to modify zoning, construct infrastructure and lower taxes. The epicentres and corridors is the emergence of peripheral epicentres and axial super-highway, providing a series of services to rival the CBD. This includes development corridors and intensive economic activity. Therefore, it is clear that the CBD remains the most essential part of the city and that all the major activities and services flows from this area.

White (1987:327) took patterns and traced them over time in order to show how racial segregation has declined modestly while socioeconomic segregation remains constant, and how population diffusion gradually affects neighbourhood composition. His assessment of the urban settlement system also illuminates the social forces that shape contemporary city life and the troubling policy issues that plague it.

2.1.6 Apartheid City Model

As a result of South Africa's history in terms of Apartheid and urban form, it is important to create a South African context to understand the background and origin of South African cities. It will also contribute to the background and basis of South African cities throughout the rest of the study. Therefore, the next section focuses on the discussion of the Apartheid city on a local level.

In 1981, Davies developed the Apartheid city model, which was preceded by his segregation model (Davies, 1981:59), and had strong resemblances to Hoyt's sector model. The Apartheid city was the result of the 1950 Group Areas Act, which sought to separate various racial groups in South Africa into distinct areas (Christopher, 1984:77). The South African cities are often regarded as a unique, defying contrast. A white minority were practicing the policies, while it led to racial discrimination and no freedom or independence to several races (Simon, 1989:191).

Simon (1989: 191) states that South Africa shares a colonial history of European conquest and is influenced by the early British 'native' policy which leads to segregation and became the model

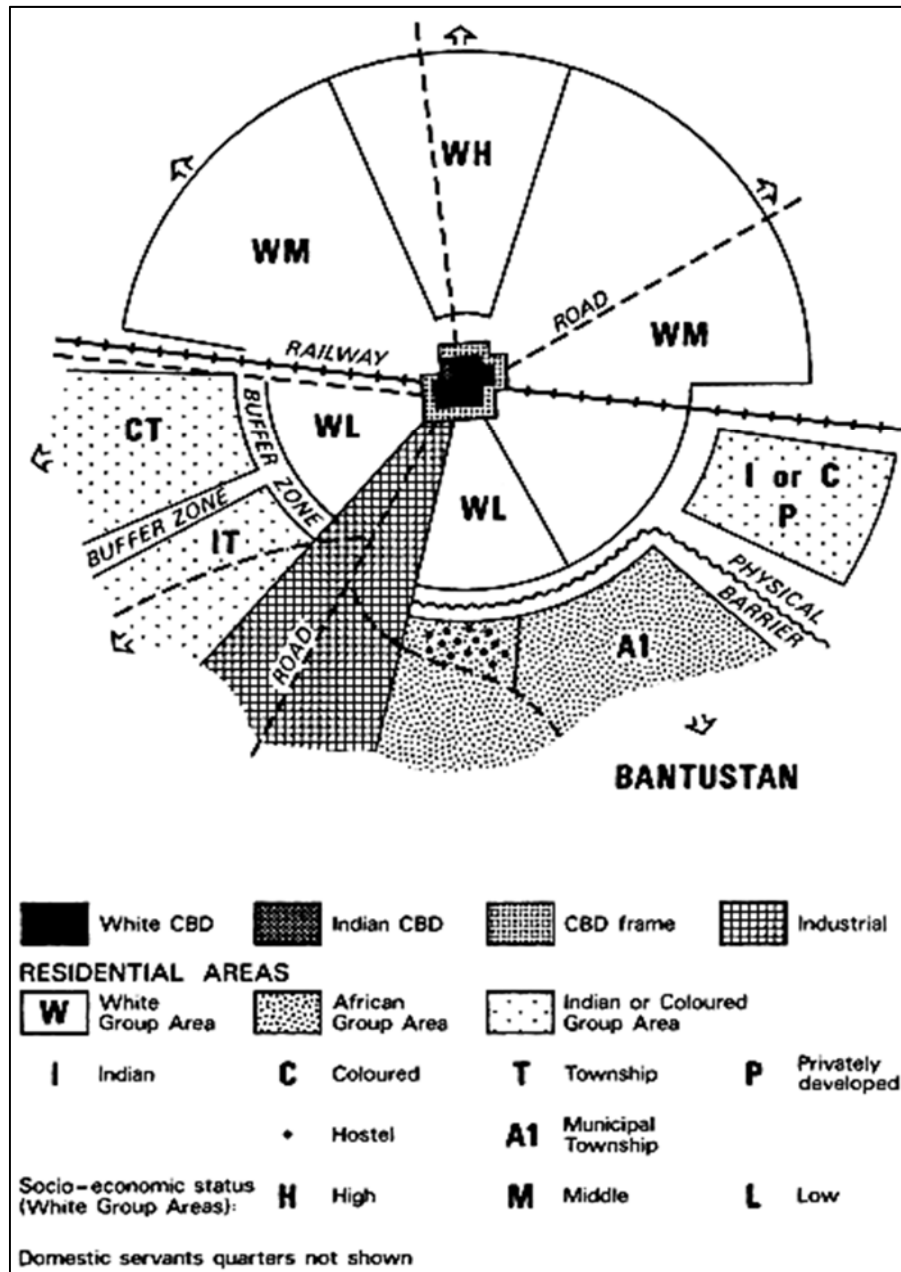


Figure 7: The original Apartheid city model

Source: Simon (1989:191).

for German and other British settlement colonies in Africa. Afrikaner nationalists adopted and systemized this inheritance of native reserves and urban segregation of Africans which resulted in the features of the Apartheid city.

In order to minimise interracial contact, the simplified urban structure with its racially exclusive and unequal residential areas, health, and education and recreation facilities was designed. Simon (1989:191) asserts that future growth occurs outwards from each segment to assure that the pattern remains preserved (Figure 7). This white dominated urban structure reflects and reinforces the social formation required by the domination, whereby overcrowded African townships were designed with the minimum cost. Simon (1989:191) further affirms that by 1985,

860 400 coloureds and Indians were relocated to inferior housing in overcrowded townships, while their former homes were given to whites at relatively low prices.

The overall spatial effect of the Apartheid city creation did not only led to racial segregation, it has also resulted in an increased separation between home and workplace. Simon (1989:191) observes that the immediate burden was borne tremendously by black labour, while both capital and land were mainly controlled by whites. The Apartheid city model proposed controlled outward growth toward the periphery of the city, in a similar manner as Hoyt.

2.2 Land use planning

The following section provides the background, definition and elements of land use planning.

2.2.1 The origin and theoretical background of land use planning

According to the American Planning Association (2006), the ambivalent nature of the term “planning” as it relates to land use is historically linked to the practice of zoning. Zoning in the United States started in the late 19th and early 20th centuries with the main purpose of protecting the interests of property owners. The practice was found to be constitutionally sound by the Supreme Court decision of *Village of Euclid* in 1926. Soon afterwards, the Standard State Zoning Enabling Act gave authority to the states to regulate land use however, the practice remains contentious till date. Chapin and Kaiser (1979:38) state that the theoretical underpinnings of land use planning are provided by two explanatory frameworks (Classical Theory and Transportation orientated theory) which originate from an agricultural concept advanced by Von Thunen in 1966. Other relevant works include Weber (1929), Losch (1954) and Isard (1975).

2.2.2 Defining land use planning

According to Young (1993:3), land use planning is the systematic assessment of land and water potential. He further states that land use planning is “the general term used for a branch of urban planning encompassing various disciplines which seek to order and regulate land use in an efficient and ethical way, thus preventing land-use conflicts”. Governments employ land use planning to manage the development of land within their jurisdictions. In line with this definition, Pace (2014:1) states that land use planning refers to the way the physical layout of communities are planned. He further argues that it is an essential component of long term resilience. Similarly, Nel (2011:2) suggests that for many planners, land-use management or development control as it was best known in the past is mainly associated with control. She argues that the new approach is to link spatial planning and development facilitation with development control to create a system of land-use management.

2.2.3 The focus, objectives and importance of land use planning

Land use planning includes both the built and natural environment by identifying areas for open space or preservation and shaping where development occurs (Pace, 2014:1). Chapin and Kaiser (1979:38) identify six objectives of land use planning:

1. Create safe and healthy environments
2. Convenience through land use and the relationship that each functional area bears
3. Efficiency and energy conservation
4. Create environmental quality
5. Social equity and social choice in terms of opportunity
6. Create a pleasant urban environment.

Young (1993:3) elaborates on this by providing the following objectives:

1. Estimating the needs (present and future) and systematically evaluating the land's ability to supply them;
2. Identifying and solving conflicts between the needs of individuals and those of the community, between competing uses, and between the needs of the present generation and those of future generations;
3. Seeking sustainable opportunities and choosing those that best meet identified needs;
4. Planning to achieve desired changes;
5. Achieve efficiency by combining different land uses with the areas that will provide the greatest benefits at the least cost;
6. Acceptability and equity so that land use could be socially acceptable;
7. Sustainable land use which meets the needs of the present while, at the same time, conserving resources for future generations.

From these objectives it is clear that land use planning focuses on planning for people, while acknowledging that land is not the same all over. Young (1993:3) states that land use planning focuses on determining what peoples needs, their knowledge and skills are, and how they can contribute to labour and capital. He states that it is also important to know that land cannot be moved, and different areas present different management problems and different opportunities. This is essential to create certainty and sustainable and orderly development.

2.2.4 The levels of land use planning

Land use planning can be enforced at three broad levels: national, district and local (Young, 1993:8). The methods of planning and types of planning policies differ at each level and different kinds of decisions are made at each level. However, he asserts that each level should have a

land-use strategy, policies that specify planning priorities, projects that address these priorities and operational planning to get the work done. The flow of information should be in both directions (Figure 8). The greater the interaction between the three levels of planning, the better. The three levels, as indicated in Figure 8, include National-, District-, and Local land use planning.

Young (1993:8) states that the national level is mostly concerned with the allocation of resources and not the actual allocation of different land uses. It rather tends to assist in prioritising the district level projects. The national level aims to serve as foundation for the following aspects:

- Land use policy
- National development plan and budget
- Coordination of sectoral agencies and stakeholders
- Legislation on land uses

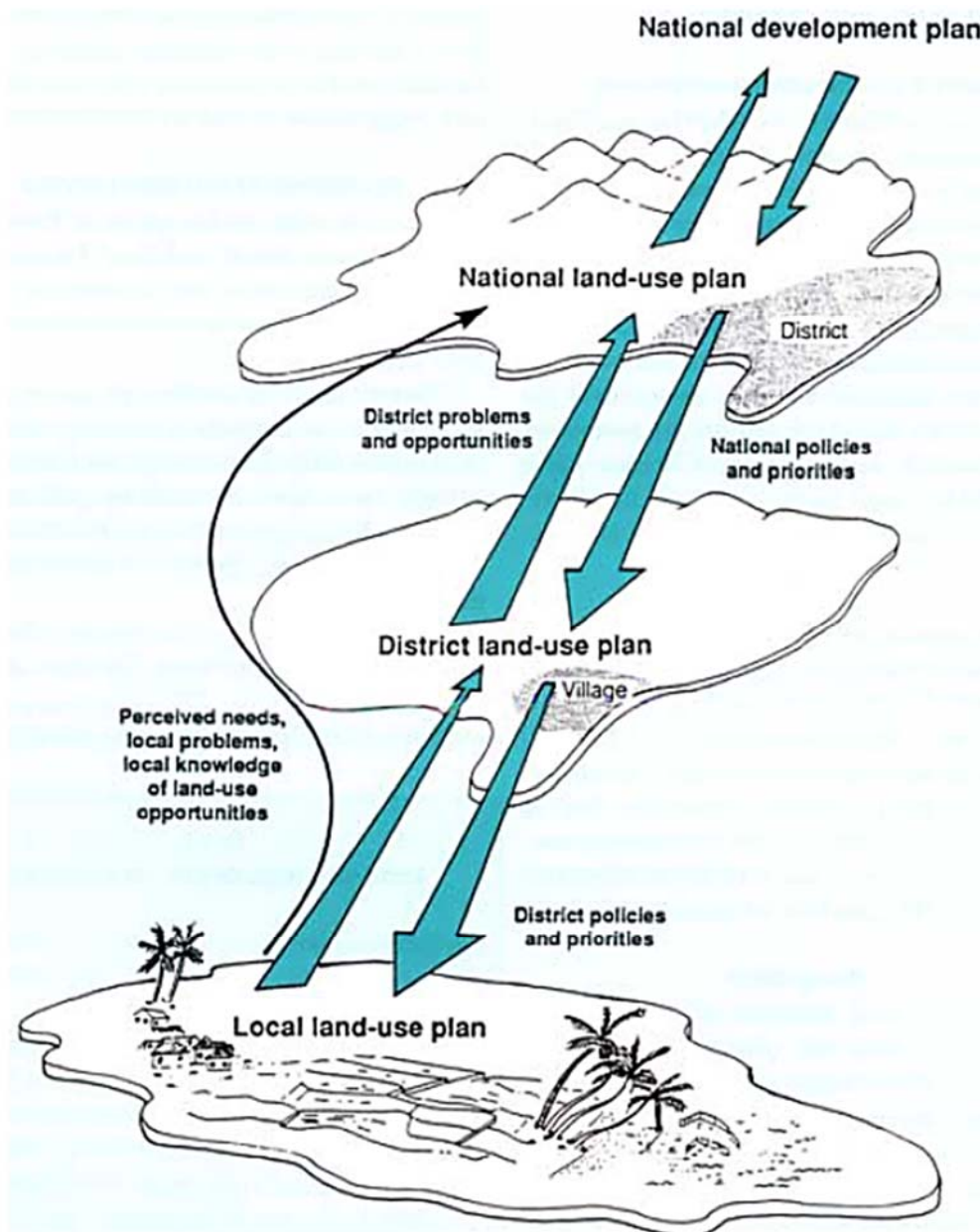


Figure 8: Links between the three levels of planning

Source: Young (1993:8).

The district level mainly refers to the administrative districts and the land areas that are categorized between national and local levels (Young, 1993:9). This level also aims to solve conflicts between national and local levels, such conflicts include:

- The placement of new developments.
- The need for enhanced infrastructure.
- The development of management guidelines.

Local levels seem to be the easiest level to plan for the people. At this level initiated plans of the district level are implemented and the several responsible stakeholders are identified (Young,

1993:9). Chapin and Kaiser (1979:60) also affirms that there are three levels of land use management and collaborate even further on the local level by identifying four different divisions at this level (Figure 9).

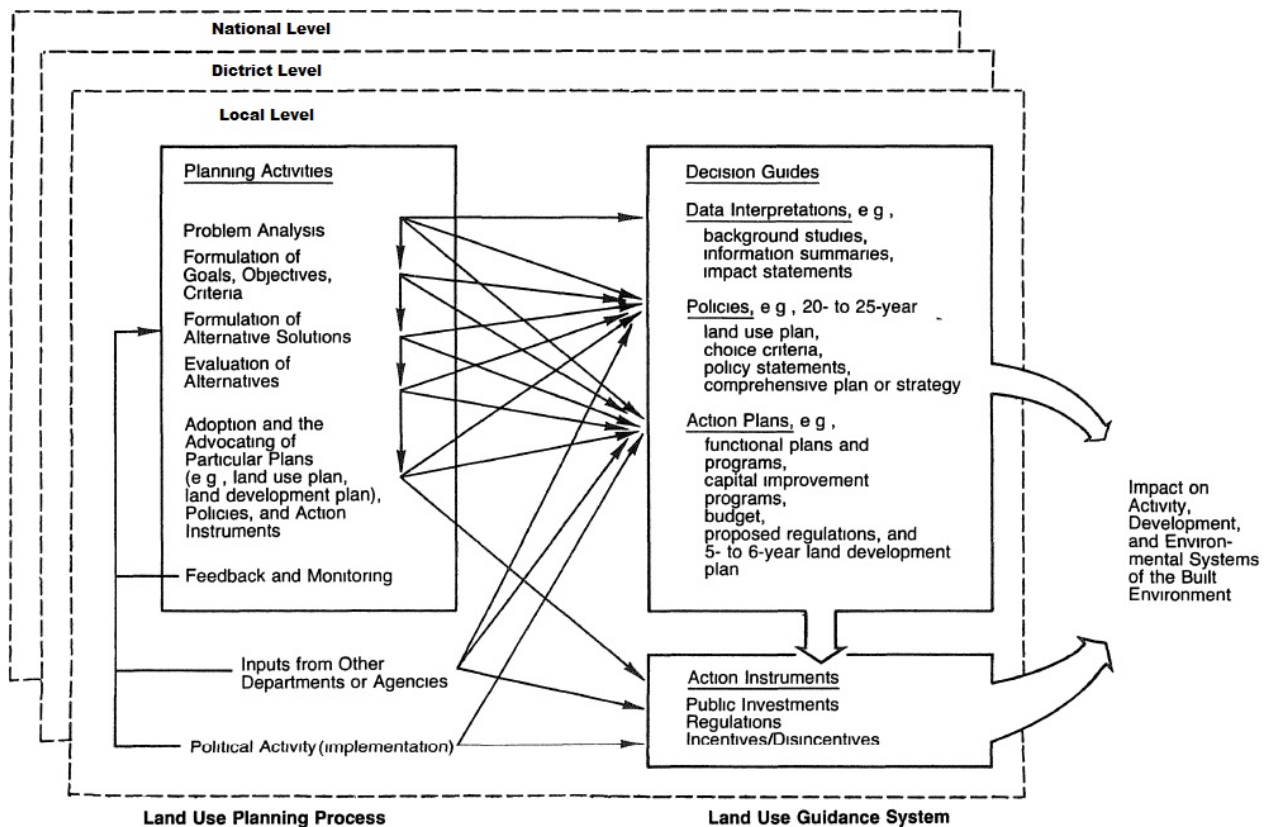


Figure 9: The explained local level land use planning

Source: Chapin and Kaiser (1979:60).

The four major divisions include:

- Land use planning activities: advance planning and action planning activities;
- Political system: agents and factors involved in the governmental process;
- Decision guides: policies, plans and proposed programs;
- Action instruments: regulations and public investments.

From this list, it is clear that there are different levels of land use planning. Therefore, it is important that each level aims to accomplish its goals and tasks to ensure that land use planning as a whole can be successfully maintained.

2.2.5 The components of land use planning

Pace (2014:1) asserts that land use planning often leads to land use regulation, which typically encompasses comprehensive planning, zoning and building codes, which can be seen as the three key components of land use planning. Amler *et al.* (1999:3) elaborate on the components

by stating that there are also a number of other components that control and influence land use. They state that this generally includes policies on taxes, credit and import/export, infrastructure as well as environmental and development policies. A comprehensive plan considers the social and environmental concerns of a community, along with the geography and economic development in an area and is a result of a public planning process that includes community involvement (Pace, 2014:1).

The concept of zoning was officially introduced in Prussia as a means of separating harmful industry from residential areas in the 19th century, although some form of zoning was in place prior to the industrial revolution (Ben-Joseph, 2005). This was an extensive form of zoning as not all industrial uses were separated from residential zones and some residential uses could be present within an industrial zone (Fischel, 2004:16). According to Mills (1989:1), zoning is a primary tool used by localities to control land use. The U.S Supreme Court ruled zoning as constitutional in 1926 and viewed zoning regulations as extensions of nuisance law, justified under the police powers of the state to prevent land uses that threatened the health, safety, morals and general welfare of the public.

2.2.6 The stakeholders in land use planning

Young (1993: 15) states that there are three main groups of people that are directly involved in the process of land use planning; (i) land users; (ii) decision makers and (iii) the planning team.

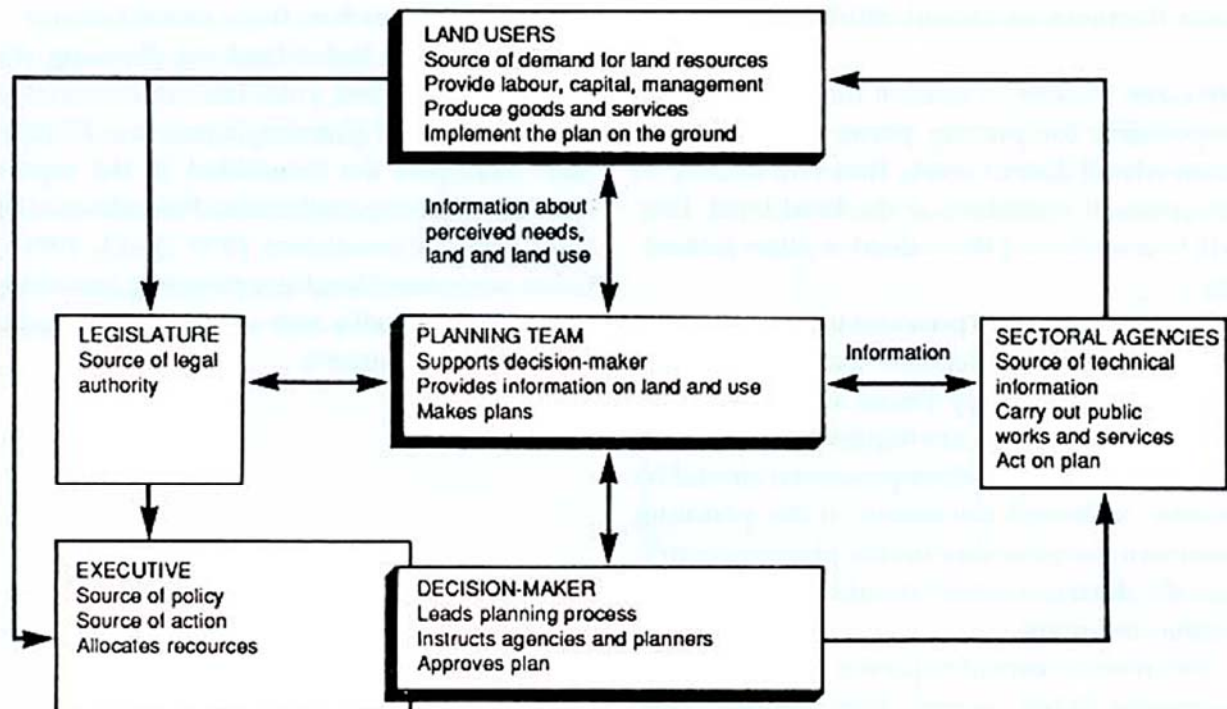


Figure 10: Stakeholders in land use planning

Source: Young (1993: 15).

- Land users are the people living in the planning area whose daily lives are affected by the land and the appropriate land uses. It is essential to involve all the land users of the specified area.
- Decision makers include those that are responsible for putting the plan into effect. These usually include government ministers and members from the council.
- The planning team involves a multi-disciplinary team of professionals which are an essential part land use planning, for they are responsible for the treatment of land use as a whole. This usually involves a land surveyor, a land evaluation specialist, an agronomist, an engineer, a town planner, an economist and a sociologist.

Therefore, it is pertinent for all parties involved in this process to be proactive. This will avoid many complications and discontent, and ensure that the land use planning process is successfully implemented.

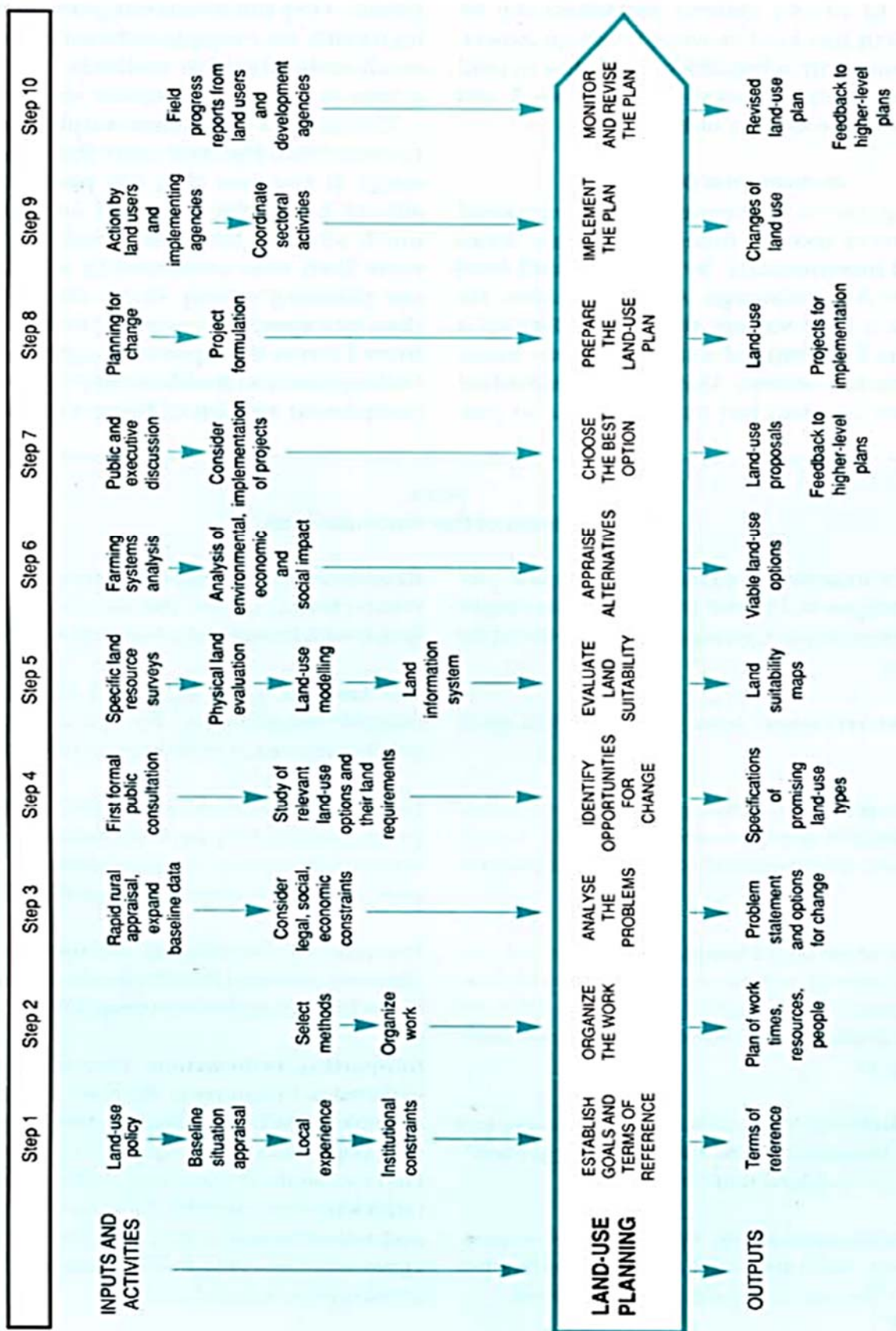


Figure 11: The ten steps of land use planning

Source: Young (1993:17)

2.2.7 The steps in land use planning

Although each land use plan is different and there is no specific process or recipe that is more valid than the other, it is important to have a framework to work from and use as a basis. One of such frameworks has been developed by Young (1993:17) and consists of ten steps (Figure 11).

Step one which includes the establishment of the goals and term of reference, states that in order to have proper terms and conditions, it is essential to include the required land use policy, a baseline situation appraisal, the local experience and the institutional constraints that appear.

Step two focuses more on the practical aspects such as working times, the resources needed as well as the people that will participate in this process. Therefore, various options and methods should be considered in order to select the most effective methods and organize and divide the work accordingly.

Step three emphasises the importance of baseline data and constraints that will influence the problem statement and options for change, it is therefore important that accurate data is used and that the constraints are studied in depth so that one could achieve a proper problem statement which is an essential part of this process.

During the fourth step, it is important to consult the public and combine the findings with the relevant land use types and its requirements. This would lead to effective specifications of promising land use types.

Step five elaborates on the aspects needed in order to construct proper land suitability maps. These aspects include specific land resource surveys, physical land evaluations, land use modelling and land information systems.

Step six indicates that it is necessary to complete effective analysis of the different impacts. Effective and accurate analysis leads to viable land use options.

In step seven, the importance of public discussion is emphasised again. During this step the goal is to achieve adequate land use proposals and to provide feedback to higher levels in order to maintain integration and implementation of national, provincial and municipal principles and objectives.

Step eight continues with the necessary aspects that would lead to implementation. During this step, it is important to remember that constant change is an aspect that is always part of land use planning, and therefore one should plan for change and develop the implementation projects accordingly.

Step nine includes the actual implementation and the actions by land users and implementing agencies. This, together with the coordination of the sectoral activities is essential in order to identify the changes of land uses.

The final step is often neglected. The monitoring and revision of the plan is an important part that will contribute to the success of the plan.

In the implementation of these ten steps, it is always important to keep in mind that each situation is unique. Attention should be given to specific economic, physical and social aspects.

2.3 Land use management

The following section elaborates land use management in terms of the definition, objectives and the implementation of land use management principles.

2.3.1 Defining land use management

Land-use management is a multidisciplinary science that integrates natural land systems with the built environment (Anon, 2015:5). It concerns the allocation of the landscape and its natural resources to appropriate uses for the purposes of providing food and shelter, ensuring adequate social and economic life-support systems, and protecting public health and safety, while preserving and sustaining the affected environment and natural resources for future generations. Land-use managers assess, evaluate, analyse, and study geospatial data in setting public policy and proposing land-use controls that mitigate environmental impacts caused by development. The collaboration of multiple stakeholders and a high level of communication are necessary components in land-use management.

Amler *et al.* (1999:4) define land use management as the operational processes of implementing land policies in comprehensive and sustainable ways. They mention that it is the system of regulations and legal requirements that apply to land in order to achieve desirable and harmonious development of the built environment.

The regulation of land use deals with a number of economic, social and environmental issues. Siek (2002:46) states that land use regulation is mostly concerned with the process of determining whether and how to use land and to determine the consequences of those choices. Therefore, she suggests that it is important to examine ways in which communities can combine and utilize land use planning and zoning in such a way that it minimizes the problems.

2.3.2 The focus and objectives of land use management

Lewis (2005:869) states that the main objectives of land use management include:

- Orderly development, e.g. putting land uses in the right place
- Development and management that is accountable and inclusive
- Sustainable development
- Transparent city management and development
- Protect land assets and resources
- Provide efficient and planned services
- Improved co-ordination between Land Use Planning and transportation planning
- Sufficient utilization of existing infrastructure.

2.3.3 The application of land use management

The following section focuses on the different aspects which facilitate the application of land use management in practice.

2.3.3.1 Densification

Densification is discussed extensively in planning literature as a possible way to achieve compact cities, combat sprawl and create urban sustainability (Daneshpour & Shakibamanesh, 2011:110; Gordon & Richardson, 1997:97).

Densification refers to dense and proximate development patterns which consists of a variety of building patterns, depending on the context considered. Brunner and Cozens (2013:236) suggest that densification in suburbs means enlarging existing buildings or establishing new ones (also referred to as infill development). Williams (2000:32) also states that densification can either be achieved by establishing new buildings in areas not built-up previously, in built-up areas previously having other purposes, or in areas with lower-density buildings which are replaced by high-rise buildings. Densification is also termed consolidation when referring to the compaction of inner city and peripheral areas (Bunker *et al.*, 2002:149). Therefore, depending on the context, densification can mean different building forms and processes. The approach aims to counteract negative effects of urban sprawl in terms of ineffective land-use and related environmental problems through densification and compact building.

2.3.3.2 Zoning

The authority to zone and plan is delegated to municipalities by the state through zoning enabling acts, which require that it should be procedural in nature and that it should address how zoning is adopted and administered (Siek, 2002:48). Most of these acts were originated from the SZEa.

Traditionally zoning only consistsof dividing the municipality into zoning districts. Each zone or district is limited to the labelled and permitted uses, with the permitted accessory uses and temporary uses listed in the zoning ordinance (Siek, 2002:48).

Dowall and Clark (1997:16) suggest that zoning measures are one of the most commonly used planning tools. They state that land zoning provides landowners with information on how their land can be optimized and where to situate buildings. to improve the different uses. Zoning regulates the use of land in residential, industrial, commercial, agricultural or other land-use areas and is used to control population density, urban sprawl, traffic, and other urban problems.

Drescher (2015:2) argues that mixed zoning is important especially in clustered developments where residential areas and working sites are planned as one entity. In many developing countries, the impromptu squatter settlements around the outskirts of cities, where small-scale industries, housing and agriculture are located in close proximity to each other, are also mixed zoning models.

2.3.3.3 Mixed land use

Thrall (2002:2) defines mixed-use development as a type of urban development that blends residential, cultural, commercial, institutional, or industrial uses, where those functions are functionally and physically integrated, and that allows pedestrian connections. He explains that mixed-use development can take the form of a single building, a city block, or entire neighbourhoods.

Du Plessis (2015: 218) asserts that the concept of mixed land use types in the South African context, has remained prominent on the spatial planning agenda since the early 1990s, and was most profoundly influenced by the seminal work of Dewar and Uytenbogaardt (1991) in which they argue that ‘the multifunctional use of space and facilities is not only desirable: it is economically essential (Dewar & Uytenbogaardt, 1991:59). They also identify the integration of urban activities and land use types as one of five central conceptual changes required for the transition of South African cities onto a more positive urban developmental path.

2.3.3.4 Corridor connection

Economic or development corridors are defined by Brunner (2014:29) as integrated networks of infrastructure within a geographical area designed to stimulate economic development and it may be developed within a country or between two or more countries. Similarly, Octaviano (2014: 2) affirms that development corridors may be created to link manufacturing hubs, areas with high supply and demand, and manufacturers of value-added goods and often feature integrated infrastructure, such as highways, railroads and ports, and may link cities or countries.

Bowland and Otto (2012: 3) are of the opinion that development corridors lead to economic integration and economic opportunities improving the wealth of the surrounding regions.

2.3.3.5 Sense of community

McMahon (2012:2) defines a sense of community is a unique collection of qualities and characteristics – visual, cultural, social, and environmental – that provide meaning to a location. Sense of place is what makes one city or town different from another, but sense of community is also what makes our physical surroundings worth caring about (McMahon, 2012:2).

Deitrick and Ellis (2004:428) suggest that aspects such as street connectivity, mixed land use, and accessible destinations along with moderate to higher levels of residential density, public gathering places and quality parks and open space all lead to an improved sense of community. The Sustainable Cities Institute (2012) states that a strong sense of community is a vital principle for sustainable land use management.

2.3.3.6 Land use management policies

2.3.3.6.1 The purpose of land use management policies

Land use management policies must give effect to and be constant with the municipal spatial development framework. It should also determine the development and use of land within the municipal area to which it relates in order to promote (Deutsche Gesellschaft für Internationale Zusammenarbeit, 2012:30; Amler *et al.* 1999:16):

- economic growth;
- social inclusion;
- efficient land development; and
- minimal impact on public health, the environment and natural resources.

2.3.3.6.2 The elements of land use management policies

A land use scheme must include (Deutsche Gesellschaft für Internationale Zusammenarbeit, 2012:50):

- scheme regulations setting out the procedures and conditions relating to the use and development of land in any zone;
- a map indicating the zoning of the municipal area into land use zones; and
- a register of all amendments to such land use scheme;
- Statements of Intent (SOI);
- Land Use Definitions;

- Zones and Districts;
- Tables that indicate which land uses are allowed or not allowed for each Zone or District;
- Development Controls for each of the Districts identified;
- Land Use Procedures; and,
- Policies or Guidelines to assist with special developments.

2.3.3.6.3 Land uses within land use management schemes

The Land Use policies are developed in terms of a number of zones for example, ten at the primary level or a more complex set of zones at the comprehensive level. Some of the primary zones are presented below (Deutsche Gesellschaft für Internationale Zusammenarbeit, 2012:13):

- Agriculture;
- Environmental Areas;
- Civic and Social;
- Commercial;
- Industrial;
- Quarrying and Mining;
- Recreational;
- Residential;
- Transport;
- Services; and
- Special Zones.

It is possible to develop the different zones in different ways. Consequently, each Zone is divided up in a series of Districts depending on the density of development and different kinds of development controls.

2.4 Identified challenges

The following section discusses the identified challenges within three aspects; land use management, sustainable development and liveable communities. This section will assist in formulating accurate proposals in Chapter 6.

2.4.1 The challenges of land use management

Land use planning in this century faces both threats and opportunities. It is expected that land use planning should deliver sustainable development and liveable communities, but it should also cope with serious conflicts regarding these two visions (Godschalk, 2004:5). It seems that the

future of land use planning depends on how it resolves these conflicts and creates cities that are liveable and sustainable.

Urban sprawl could be identified as one of the main challenges of land use management. Urban sprawl refers to land development that occurs at a specific pattern and a specific pace, where the pace refers to the rate which land is consumed for urban processes to ensure the growing population has sufficient land to develop on (Pfister, 2004:4). Urban sprawl also refers to the following (Burchell *et al.*, 1998:43): (i) low-density development dispersed over a large area of land; (ii) geographic separation of necessary resources such as work, homes, schools, and shopping; and (iii) high dependence of automobiles. Therefore, urban sprawl leads to higher public and private costs, being less economic as the cost to supply infrastructure and services are more expensive (Bhatta, 2010:28). Bhatta (2010:28) suggests that mixed land-use planning will fight against urban sprawl, otherwise it causes separation and fragmentation which in turn leads to urban sprawl.

2.4.2 Challenges in sustainable development

According to Godschalk (2004:5), the main aspect that energizes land use planning is sustainable development. In a similar vein, Farrington and Kuhlman (2010:3436) observe that sustainability as a policy concept has its origin in the Brundtland Report of 1987. The document was concerned with two conflicts; the aspirations of mankind towards an optimal life and the limitations imposed by the conservation of nature (Farrington & Kuhlman, 2010:3436). The concept has since been re-interpreted in order to consist of three dimensions; social, economic and environmental (Farrington & Kuhlman, 2010:3436). According to Gruis *et al.* (2006:8) the dimensions of sustainability can be viewed from a number of perspectives, for example:

- an economic perspective that focuses on the market position and the value of the settlements.
- a social perspective, focussing on levels of social capital, social cohesion and residential stability in settlements; and
- an environmental perspective, focussing on energy efficiency and the use of materials in restructuring strategies.

As a result, sustainable development can only take place when there is an improvement in the environmental, social and economic situation, the objective should always be to create a better city for all to enjoy and benefit from (Gruis *et al.*, 2006:8). While this balance seems attractive in theory, the efforts to manage the conflicts arising from the separate aspects of environment, economy and equity (social aspects) have often met with little success (Cowell & Owens, 2002:57).

Modern sustainable development reaches out to two new visions within two new movements; new urbanism and smart growth (Godschalk, 2004:5). Land use planners are testing the visions of sustainable development, New Urbanism and Smart Growth and exposing their tensions and challenges (Godschalk, 2004:6). According to Godschalk (2004:6), land use planning has shown to be the one of the most important aspects in which sustainable development is disputed. Therefore, it has become clear over time that turning broad principles into procedures and policies does not resolve conflicts, rather it exposes challenges inherent in the idea of sustainable development. The contradictions among the goals of sustainable development have been illustrated by Campbell in 1996 through a triangle with a goal at each point and the conflicts and challenges occurring on each axes (Figure 12).

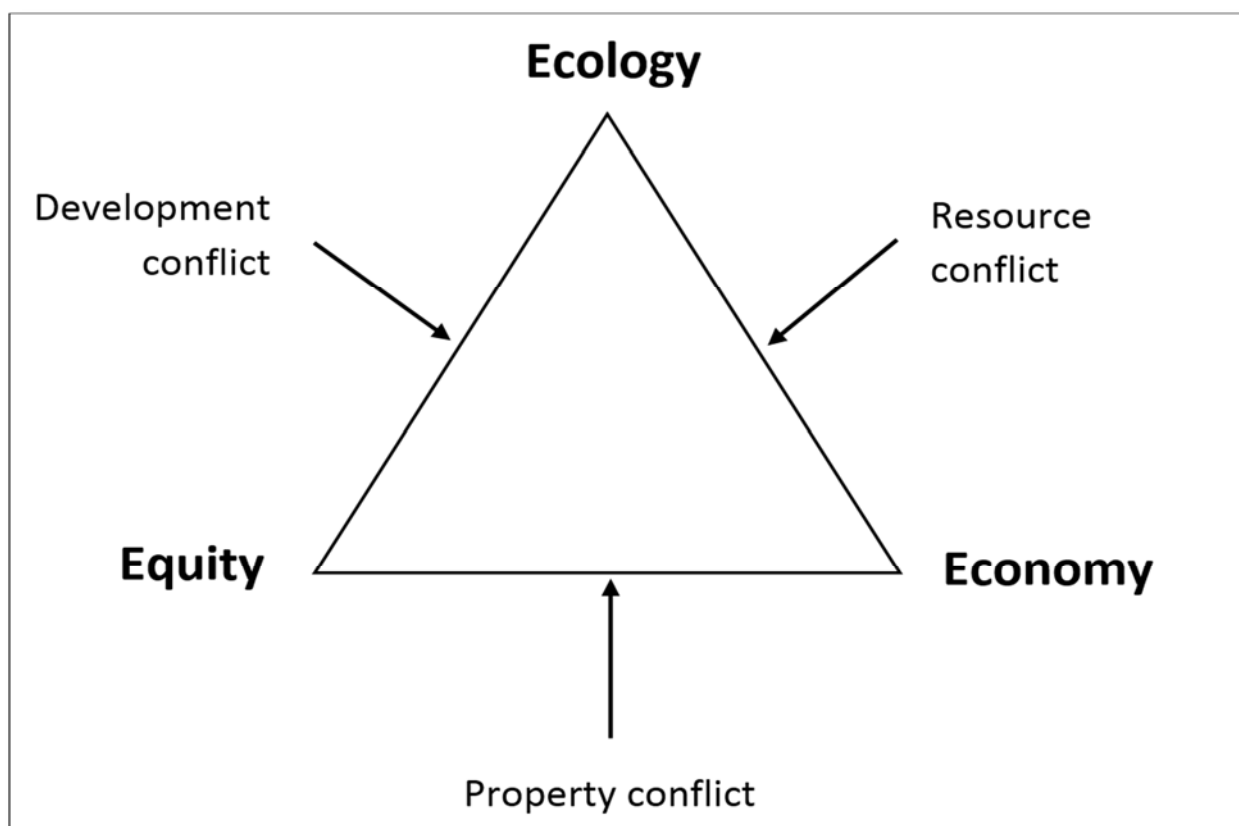


Figure 12: Conflicts among sustainable development

Source: Adapted from Campbell (1996: 296).

Godschalk (2004:6) defines the conflicts as:

- Property conflict arises from competing claims on uses of property as both a private resource and public good;
- Resource conflict arises from competing claims on the consumption of natural resources and the preservation of their ability to reproduce; and

- Development conflict arises from competing needs to improve the lot of poor people through economic growth while protecting the environment through growth management.

The integration of pairs of opposing goals seems to be blocked by these three conflicts.

2.4.3 Challenges in liveable communities

Godschalk (2002:7) states that liveable cities are the second main aspect that energizes land use planning. Liveability operates at the level of the everyday physical environment and focuses on place making, with this aspect there are two-dimensional concepts (emphasized by sustainable development) and three-dimensional aspects of public space, movement systems and building design.

New Urbanism and Smart Growth are the two main approaches under the liveability concept. Godschalk (2002:7) defines New Urbanism as an urban design movement that is committed to re-establishing the relationship between the making of the community and the art of the building, through citizen-based participatory planning and design, while Smart Growth is rooted more broadly in urban planning and public principles. This movement evolved from growth management initiatives and got its name from legislation and programs. Smart Growth consists of different desired types of planning and regulatory processes, as well as urban form outcomes (Godschalk, 2002: 7).

According to Godschalk (2002:7), this vision of liveability seems to have fewer internal conflicts and challenges than the sustainability vision, but despite some commonalities, the values of liveability encounter some serious conflicts with the values of sustainability.

2.5 Conclusion

This chapter provided an in depth discussion and explanation of the different land-use models, including Burgess' Concentric zone model, Hoyt's Sector model, Harris and Ullman's multiple-nuclei model, Kearsley's modified Burgess model, White's model of the twenty-first century city and the Apartheid city model.

The second part of the chapter focused on land use management and land use planning. The definitions were provided as well as the applications thereof. It was concluded that land use planning and land use management are essential aspects in urban planning that can have several benefits if managed correctly.

After the completion of this chapter a proper background is formed with adequate knowledge and information on land use and land use planning which is very important, as the rest of the study will refer back to this chapter and will build and collaborate on this chapter.

This chapter is essential in determining to what degree land uses and land use management may contribute to the resilience and efficiency of cities. This serves as a basis for this entire study. This chapter also serves as a basis for the following chapter which will focus on resilience and later on where land use planning will be linked with resilience.

CHAPTER 3: RESILIENCE IN SPATIAL PANNING

3.1 Introduction

Rapid urbanisation and growing mega cities result in a need for more resilient cities which enables cities to withstand the shocks of world economic crisis, population growth, rapid demographic shifts in population and environmental catastrophes (Desouza & Flanery, 2013:89).

This chapter seeks to provide the existing definitions of resilience, determine the origin of the term, and how it may be applied and integrated into the planning environment. The existing mechanisms to improve resilience are discussed as a step towards developing a unique set of tools later in Chapter 6.

This chapter is essential because it connects resilience to the planning realm and determines how land use types and urban efficiency could improve the resilience of a city.

3.2 Resilience defined

According to Christopherson *et al.* (2010:3), the term resilience originates from the field of environmental studies where it is used to describe the biological capacity to adapt and thrive under adverse environmental conditions. According to Stumpp (2013:231), the concept of resilience has been applied to different systems and increasingly understood in more fields for the last forty years, with its definition becoming ambiguous. Although the term “resilience” gained prominence in the planning and environmental spheres over the last forty years, however, the term originated in the 1620’s and was derived from the Latin word “resiliens” which means “act of rebounding” or “elasticity” (Dictionary.com, 2010).

This section aims to provide a few existing definitions in order to deduce a single definition for the purpose of this study.

The study of existing literature confirms that urban resilience lacks clarity and is therefore a contested concept. Meerow *et al.* (2016:42) argue that the problem with resilience is its multitude of different definitions and turning any of them into operational tools. He further states that the definition has become so broad that it is seemingly meaningless. Table 1 lists the 25 most recognised definitions of urban resilience. These definitions were categorized and compared based on the main spheres identified in the literature.

Table 1: Definitions of urban resilience

Source	Subject area	Definition
Ahern (2011:341)	Environmental science	“...the capacity of systems to reorganize and recover from change and disturbance without changing to other states ...systems that are “safe to fail”
Alberti et al. (2003:1170)	Environmental science	“...the degree to which cities tolerate alteration before reorganizing around a new set of structures and processes”
Brown et al. (2012:534)	Environmental science: Social science	“...the capacity to dynamically and effectively respond to shifting climate circumstances while continuing to function at an acceptable level. This definition includes the ability to resist or withstand impacts, as well as the ability to recover and re-organize in order to establish the necessary functionality to prevent catastrophic failure at a minimum and the ability to thrive at best”
Brugmann (2012:217)	Environmental science: Social science	“the ability of an urban asset, location and/or system to provide predictable performance – benefits and utility and associated rents and other cash flows – under a wide range of circumstances”
Campanella (2006:141)	Social science	“...the capacity of a city to rebound from destruction”
Chelleri (2012:287)	Earth and planetary sciences; social science	“...should be framed within the resilience (system persistence), transition (system incremental change) and transformation (system reconfiguration) views”
Coaffee (2013:323)	Social science	“...the capacity to withstand and rebound from disruptive challenges...”
Desouza and Flanery (2013:89)	Business management; social science	“ability to absorb, adapt and respond to changes in urban systems”
Ernstson et al. (2010:533)	Environmental science: Social science	“To sustain a certain dynamic regime, urban governance also needs to build transformative capacity to face uncertainty and change”
Godschalk (2003:137)	Engineering	“...a sustainable network of physical systems and human communities”
Hamilton (2009:109)	Engineering; social sciences	“ability to recover and continue to provide their main functions of living, commerce, industry, government and social gathering in the face of calamities and other hazards”
Lamond and Proverbs (2009)	Engineering	“...encompasses the idea that towns and cities should be able to recover quickly from major and minor disasters”

Leichenko (2011:164)	Environmental science: Social science	“...the ability to withstand a wide array of shocks and stresses”
Lhomme et al. (2013:222)	Earth and planetary sciences	“...the ability of a city to absorb disturbance and recover its functions after a disturbance”
Liao (2012:5)	Environmental science	“...the capacity of the city to tolerate flooding and to reorganize should physical damage and socioeconomic disruption occur, so as to prevent deaths and injuries and maintain current socioeconomic identity”
Pickett et al. (2001:373)	Environmental science	“...the ability of a system to adjust in the face of changing conditions”
Romero-Lankao and Gnatz (2013:358)	Environmental science: Social science	“...a capacity of urban populations and systems to endure a wide array of hazards and stresses”
Thornbush et al. (2013)	Energy; engineering; social science	“...a general quality of the city’s social, economic, and natural systems to be sufficiently future-proof”
Tyler and Moench (2012:312)	Environmental science: Social science	“...encourages practitioners to consider innovation and change to aid recovery from stresses and shocks that may or may not be predictable”
Wagner and Breil (2013:114)	Agricultural and biological sciences	“...the general capacity and ability of a community to withstand stress, survive, adapt and bounce back from a crisis or disaster and rapidly move on”
Wamsler et al. (2013:71)	Business management; energy; engineering	“A disaster resilient city can be understood as a city that has managed... to: (a) reduce or avoid current and future hazards; (b) reduce current and future susceptibility to hazards; (c) establish functioning mechanisms and structures for disaster response; and (d) establish functioning mechanisms and structures for disaster recovery”
Wardekker et al. (2010:988)	Business management	“...a system that can tolerate disturbances (events and trends) through characteristics or measures that limit their impacts, by reducing or counteracting the damage and disruption, and allow the system to respond, recover, and adapt quickly to such disturbances”

Source: Own compilation adapted from Meerow *et al.* (2016:41).

This table will assist in developing a new single definition of urban resilience within the urban system, which is essential for the outcomes of this study.

3.2.1 Defining resilience within spatial planning

In order to define the term urban resilience within an urban system, it is important to establish a common understanding of the term urban system and what it entails.

3.2.1.1 Urban Systems

Many early writers, such as Christaller (1933), Harris and Ullman (1945) and Lösch (1937) discussed the origin and nature of systematic variations in the characteristics of urban places, however, a lot of detail remains uncovered.

Bourne and Simmons (1978:15) provide a detailed nature of urban systems. They define it as “set of interdependent cities comprising a region or nation”. They argue that urban systems are the examination of cities within one country and how they interact with one another as a system to create patterns of growth and development. Furthermore, Bourne and Simmons (1978:15) stress that the mere understanding of how a city changes (grows, stagnates or declines) is not enough to study that particular city. Rather, the city should be seen as part of a larger system. According to Bourne and Simmons (1978:15), it is a complex system where the strong interaction between the elements creates “feedback effects which regulate growth and change”, however this complex system was modelled as a relatively simple hierarchical order of cities- “a national system dominated by metropolitan centres and characterised by a step-like hierarchy”.

Bourne (1975:32) states that the cities and urban regions of a modern industrial economy constitute a set of interrelated subsystems nesting in a complex hierarchy of increasing scale upward from individual urban areas to a national urban system. He adds that urban systems are structures which are determined by the spatial distribution of centres of production and consumption in the private and public sectors of the economy. He further categorizes an urban system into three levels:

The national system which:

- Is dominated by metropolitan centres;
- A stepped hierarchy;
- Number of nodes at each level increases as population decreases; and
- Therefore fewer nodes with a large population and more centres with a small population.

The subsystem at Regional Level:

- Nestled in the national system takes a subsystem on a regional level;
- Similar hierarchical division - but less obvious hierarchical division;
- Is found around a single metropolitan centre; and

- Size of nodes is smaller and decreases faster than in the national system

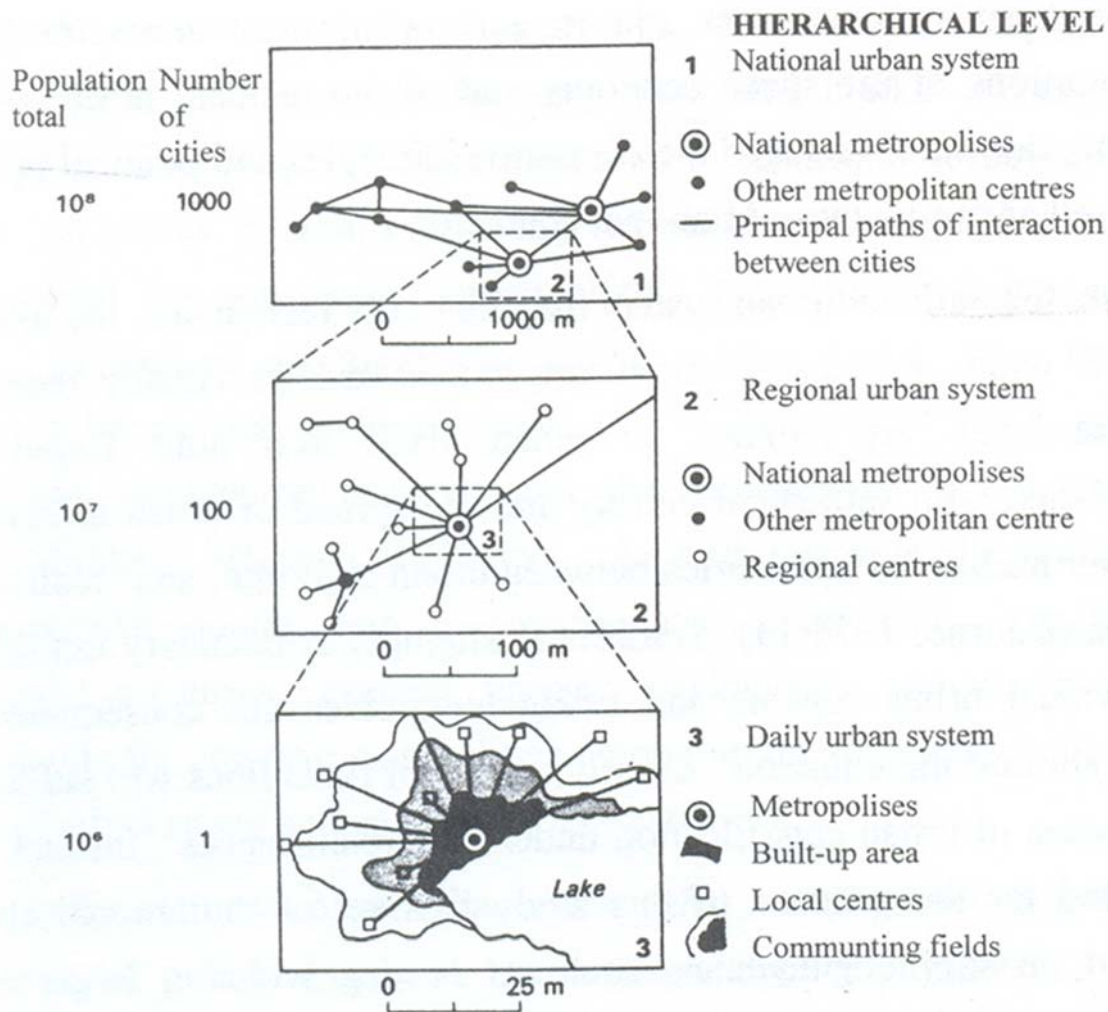


Figure 13: Levels of an urban system

Source: Bourne (1975:35).

Finally the daily urban system:

- Nested within the regional system
- Daily movement of local residents
- Is found on a small scale and is difficult to differentiate between different orders nodes.

For the purpose of this study, references regarding the urban system will be focused on the third level (daily urban system) only, although it is apparent that each level impacts on the larger urban system as referred to by Bourne (1975).

According to Bretagnolle *et al.* (2010:1), the organization of urban systems can be defined on three main levels: the (i) micro level represents elementary units (persons, firms, institutions) that

are living together in a city, (ii) the meso level corresponds to the city itself (as a consistent geographical entity), and the (iii) macro level is the system of cities, which is made up of a large number of towns and cities which interact under a combined control (national political territory or a global economic network). This organization is shaped by interactions operating on different spatial and temporal scales of observation.

Meerow *et al.* (2016:45) argue that urban systems are theorised as adaptive, complex, emergent ecosystems that include four subsystems- a) governance networks, b) networked material and energy flows, c) urban infrastructure and form, and d) socioeconomic dynamics. They mention that these four subsystems are multi-scalar, networked and often strongly coupled. Figure 14 provides a simplified schematic of these systems. These four sub-systems form part of the daily urban system.

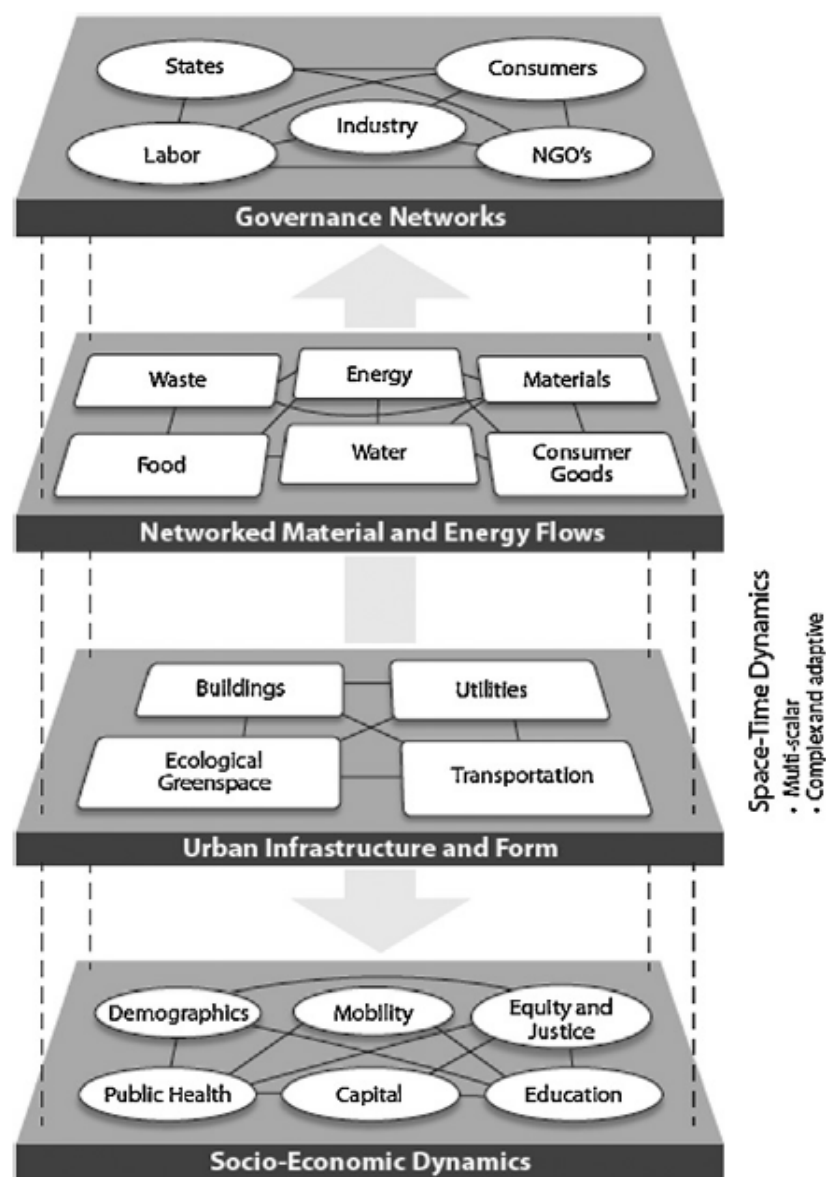


Figure 14: Simplified conceptual schematic of urban systems

Source: Meerow *et al.* (2016:45).

In Figure 14, governance networks refer to the varying range of institutions and actors whose decisions form the urban system. This includes the levels of government, non-governmental organizations and businesses (Meerow *et al.* 2016:45). Networked material and energy flows refer to the materials, goods and services that are produced or consumed in or by an urban system, this includes water, energy, food, and waste flows, this is often referred to as the “urban metabolism” (Meerow *et al.* 2016:45). They mention that urban infrastructure and form include the built environment such as buildings, transportation networks, energy, and water grids (utilities), along with urban green space and parks. Lastly, socio-economic dynamics such as monetary capital, demographics, and justice and equity shape the other subsystems and the livelihoods and capacities of urban citizens. The purpose of this schematic representation is to emphasize the interconnections between and within the four adaptive and complex sub-systems, which interact at multiple levels and is also essential to consider for a comprehensive assessment of urban resilience.

3.2.1.2 A comprehensive definition of urban resilience

A comprehensive definition of urban resilience needs to incorporate these four sub-systems conducted from the daily urban system and its interactions and to do so in an inclusive and flexible way, it is essential to allow some degree of perspectives and emphases to remain. Consequently, for the purpose of this study urban resilience is defined as:

Urban resilience refers to the ability of a daily urban system-and all its constituent socio-ecological and socio-technical networks across temporal and spatial scales-to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity.

This definition was carefully worded and developed to articulate each of the four sub-systems (refer to 3.2.1.1). Urban resilience operates in non-equilibrium (explanation in subsequent paragraph). It emphasizes the importance of timescales and adaptive capacity and recognizes multiple change pathways (Meerow *et al.* 2016:45). It is also safe to say that resilience shares much with other key contemporary urban goals such as sustainability, governance and economic development (Hurlston & Thompkins, 2012:171).

Meerow *et al.* (2016:45) identified six conceptual notions and tensions in the studying of the definition of resilience. One of these notions is the notion of equilibrium. In the resilience literature, a divide exists between single-state equilibrium, multiple-state equilibrium, and dynamic non-equilibrium (Folke, 2006; Holling, 1996). Single-state equilibrium refers to the capacity of a system to revert to a previous equilibrium post-disturbance (Holling, 1996). Often identified as “engineering resilience,” single-state equilibrium is also prevalent in the fields of disaster

management, psychology, and economics (Pendall *et al.*, 2010:26). Multiple-state equilibrium resilience (also known as “ecological resilience”) posits that systems have different stable states and, in the face of a disturbance, may be transformed by tipping from one stability domain to another (Holling, 1996). Recently, the concept of equilibrium has been challenged by notions of dynamic non-equilibrium, which suggests that systems undergo constant change and have no stable state (Pickett *et al.*, 2004:36). This development has moved theory away from the idea of resilience as “bouncing back” (Matyas & Pelling, 2014:54). Urban resilience scholarship is also trending slightly more towards multi- or non-equilibrium conceptualizations of resilience (13 of the 22 definitions adopt such a position). For example, Ahern (2011:341) maintains that resilient urban systems are “safe-to-fail” as opposed to “fail-safe,” reflecting a non-equilibrium perspective. Other definitions do not take an explicit stance, nonetheless, they acknowledge that cities are constantly changing (Desouza & Flanery, 2013) and may not return to a prior state (Lhomme *et al.*, 2013:16, Lu & Stead, 2013:27). Nevertheless, some definitions suggest that recovering a previous equilibrium may be possible. For example, Campanella (2006:141) focuses on a city’s ability to “rebuild” and “recover” and Wagner and Breil’s (2013:114) definition stresses the capacity to “bounceback” and is seen as a desirable state.

Resilience is a broad concept. Although it seems easily achievable, it is important to specify and clarify to what, who, where, when and why something is resilient. This would lead to more effective approaches to resilience.

Resilience as a process involves diverse stakeholders with different motivations, power dynamics and trade-offs that plays out across different scales (Meerow *et al.* 2016:46). Therefore, resilience for *whom*, *what*, *when*, *where* and *why* needs to be considered. One should briefly consider the five W’s in relation to the definition proposed above. In this definition, resilience is recognized as a desirable state, but who determines what is ‘desirable’ and for whom? Urban resilience is formed by who outlines the agenda, whose resilience is being prioritized, and who loses or benefits as a result. Resilience for ‘when’ involves deciding whether the focus is on short-term disruptions or long-term stressors and converting the phrases “quickly transform” or “rapidly return” in the definition to a particular setting. Similarly, resilience for ‘where’ refers to the challenge of defining spatial boundaries of an urban system with a complex set of global networks. Lastly, why is resilience being promoted and what are the fundamental motivations for doing so? (Meerow *et al.* 2016:46).

Table 2: Fundamental questions related to urban resilience

<i>Questions to consider</i>	
<i>Who?</i>	▪ Who determines what is desirable for an urban system? ▪ Whose resilience is prioritized? ▪ Who is included and excluded from the urban system?
<i>What?</i>	▪ What perturbations should the urban system be resilient to? ▪ What networks and sectors are included in the urban system? ▪ Is the focus on generic or specific resilience?
<i>When?</i>	▪ Is the focus on rapid- onset disturbances or slow onset changes? ▪ Is the focus on short term resilience or long term resilience? ▪ Is the focus on the resilience of present or future generations?
<i>Where?</i>	▪ Where are the spatial boundaries of the urban system? ▪ Is the resilience of some areas prioritized over others? ▪ Does building resilience in some areas affect resilience elsewhere?
<i>Why?</i>	▪ What is the goal of building urban resilience? ▪ What are the underlying motivations for building urban resilience? ▪ Is the focus on process or outcome?

Source: Adapted from Meerow *et al.* (2016:46)

The focus of this study is on the third level of Bourne's urban system, which is the daily urban system. Therefore, it can be interpreted in the same way as mentioned in the above table.

It is clear that there are no right or easy answers to these questions, but dealing with them collectively through an open and inclusive discourse is essential if one hopes to forge cities that are indeed resilient.

3.3 Resilience and related terms

For the purpose of this study it is essential to distinguish between resilience and other closely related terms as they are easily confused. This will provide the necessary support needed to explain why resilience is the main focus of this study, and not any of the other related terms.

3.3.1 Resilience and sustainability

Sustainability and sustainable development have preoccupied research and the public-and-private environment since the term first came to prominence in 1987 (Nicol & Knoepfel, 2014:229).

The term sustainable development was popularized in “Our Common Future” a report published by the World Commission on Environment and Development in 1987 and also known as the Brundtland Report. “Our Common Future” includes the “classic” definition of sustainable development (World Commission, 1987:48): “development which meets the needs of the present without compromising the ability of future generations to meet their own needs”.

Similarly Cartalis (2014:261) defines sustainable development as development that meets the needs of the present without jeopardizing the ability of the next generations to meet their own needs.

Whereas sustainability focus on linear or circular processes of growth and development and long-term consumption and continuity of performance, resilience deals with ideas of networks, self-renewal and survival (Stumpp, 2013:165). Sustainability refers to continuous change, vulnerability and sensitivity and deals with the unknown by planning for possible futures, while in the context of resilience it refers to sudden disturbances, recovery and renewal and it tries to prepare for the un-projectable (Stumpp, 2013:165). Resilience as a concept is more dynamic, it is non-linear and cross-linked, complex and embraces the uncertainty (Stumpp, 2013:165). Arguably, the resilience of a system is a necessary condition for sustainability, therefore, sustainability at a time requires resilience at each time (Nicol & Knoepfel, 2014:229).

Resilience and sustainability do not share the same public prominence, while sustainability is considered a societal goal, resilience is infrequently referred outside of academic and research spheres (Nicol & Knoepfel, 2014:230). Saunders and Becker (2015:75) suggest that sustainability and resilience are not one and the same; however they affirm that they are interdependently linked. They argue that a sustainable community can only be sustainable if it holds some degree of resilience and as a result, resilience enhances the likelihood of sustaining development into the future.

3.3.2 Resilience and smart cities

Giffinger *et al.* (2007:78) define a smart city as a city well performing in a forward-looking way in governance, people, economy, environment, mobility, and living, built on the smart combination of endowments and activities of self-decisive, aware and independent citizens. Washburn *et al.* (2010:121) state that a smart city is a “city that monitors and integrates conditions of all of its critical infrastructures, including roads, bridges, tunnels, rails, subways, airports, seaports,

communications, water, power, even major buildings, can better organize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens”.

These definitions support Weisi and Ping’s (2014:68) statement that smart cities is a relative abstract concept that is highly dependent on aspects such as the country, government, natural resources, IT knowledge, and capacities. According to Letaifa (2015:1416) smart cities can be developed through the SMART model (Figure 15).

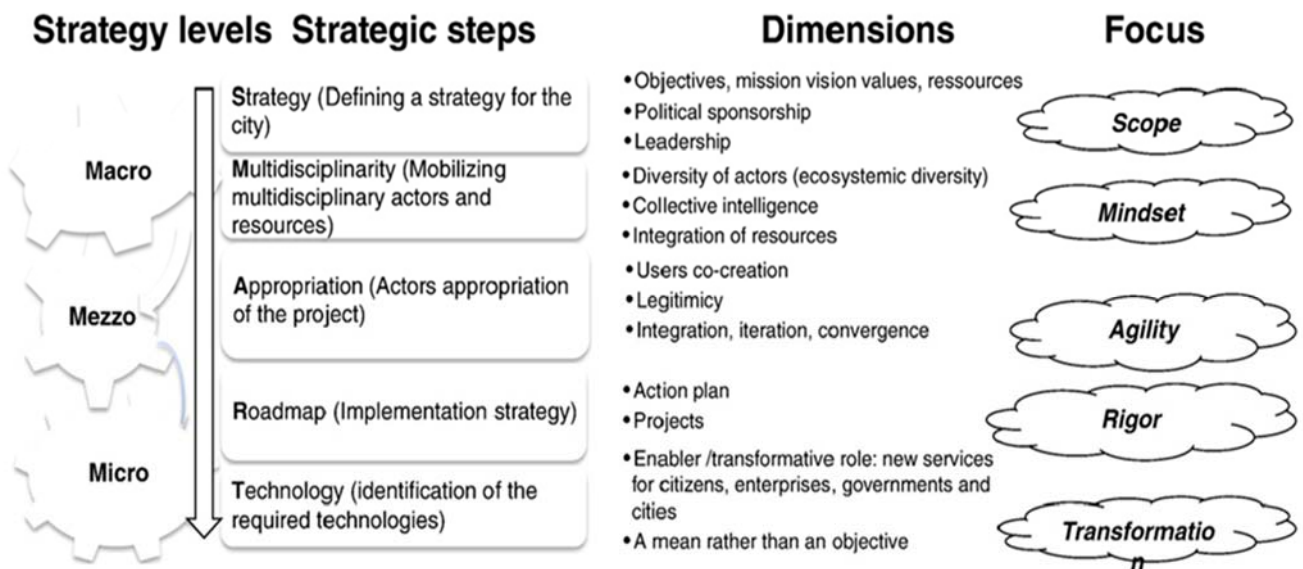


Figure 15: The SMART model

Source: Letaifa (2015:1416).

From the illustration in Figure 10, it is evident that some of the issues hindering this model focus on technology instead of service provision, a lack of political leadership and coordination, a short term and unclear vision of the future, the absence of economic and social diversity in creating the urban social change, and the lack of a clearly set out plan (Letaifa, 2015:1416). These levels also link to the urban systems approach as identified by Bourne (1975) and Meerow *et al.* (2016).

3.3.3 Resilience and Liveable cities

Appleyard (1981:35) suggests that streets should be places where neighbours socialize and build community. It should be a safe place where young and old alike engage in activities that strengthen their creative and physical health. Therefore, liveability should be the guiding design principle for neighbourhood residential streets.

According to Bandarabad and Shahcheraghi (2012:1063), concepts of liveability comprise of a range of different definitions which mainly focus on the “quality of life” and “social values” aspects, which seem to be considered in the liveable design process. They state that similar to

sustainability, liveability is an abstract concept in urban planning. As Crowhurst and Lennard (1987:23) suggest, “liveable cities pay attention to the creation of architecture, streetscape and public space design that facilitate the presence of city dwellers in the public domain and in the heart of the city”.

Evans (2002:16) states that "the coin of liveability has two faces; livelihood and ecological sustainability. Livelihood means jobs close enough to decent housing with wages corresponding with rents and access to the services that make for a healthful habitat. Livelihood must also be sustainable". He argues that for a city to be liveable, it must put both sides of the coin together, providing livelihood for its citizens in ways that still preserve the quality of environment.

Therefore, liveability refers to daily an urban system that contributes to the mental, social and physical wellbeing and personal development of all its inhabitants.

3.3.4 Resilience and Compact cities

The Compact City model may be seen as a response to urban sprawl. Urban sprawl is visible in many cities in the world, developed and developing countries. This leads to many negative impacts such as transportation problems and people living in sub-urban areas, with activities still centred in the CBD (Central Business District). The Compact City model is perceived as a solution to urban sprawl and a solution to the un-resilient city (Mahriyar & Rho, 2013:2). According to Harasawa (2002:2), the Compact City aims to (i) propose what form a city should take in order to realize the construction of a recycling-oriented society and (ii) study policies to realize a sustainable compact city (a city compact enough to perform its functions properly).

Kotharkar *et al.* (2012:3) attest that a Compact City can facilitate: i) sustainable transportation meaning pedestrian traffic and lesser travel distances; ii) sustainable use of land by efficiently utilizing it; iii) social sustainability as compactness promotes social cohesion and cultural development; and iv) economical viability as per capita cost of infrastructure provision is less and the threshold population to support minor businesses is available. The compact city thus suggests open space protection, high urban density, mixed land uses, revitalizing downtowns, central business districts with residential uses and high use of public transit system

Mahriyar and Rho (2013:4) suggest that the ‘Urban Compactness Measurement’ includes three indicators. These indicators cover the mixed use, density and intensification. First, the mixed use indicator consists of the availability level of elementary school services , senior high school services, junior high school services, health facilities services, the number of medical power (medical doctors, dentists, and nurses). The percentage of offices or working areas in land use, and percentage of recreational or free or green spaces in land use variables. The density indicator

includes built-up density, population density and residential density variables. The last is the intensification indicator which covers population growth rate and migration rate variables.

The following terms are prominently highlighted in the model, namely:

- mixed land uses;
- revitalisation;
- intensification;
- compactness;
- viability;
- sustainability;
- high urban density; and
- efficient land use.

These terms are important as they potentially contribute to urban resilience and focus on the combination of the types of land uses, as the study aims to support.

3.4 Resilience in the built environment

Moffatt (2014:217) indicates that the extremely high time preferences that have emerged and accelerated over the past three centuries have led to resilience in the built environment. Therefore, resilience should be at the centre of any city's intelligent planning efforts, this will assist in creating places that can manage a wide range of network signalling stressors (Desouza & Flanery, 2013:89).

3.4.1 Resilience, urban planning and urban structures

According to Desouza and Flanery (2013:89), resilience, like sustainability, is an abstract concept, it can be challenging to determine specific ways to plan for it. For instance, one might ask: to what must cities be resilient? Can cities, as complex systems, be resilient in their entirety (This reiterates the first W in Table 2) It could be an overwhelming task to build a capacity for resilience when taking the multitude of components, processes, and interactions that take place within and beyond a city's boundaries into consideration. Moffatt (2014:217) argues that timing (which reiterates the third W in Table 2) for resilience could be complex and that it requires a systems approach that synchronizes planning, design, management and investment, and the sometimes divergent temporalities of the stakeholders involved. Planning for resilience requires an evaluation of the vulnerable network components of cities, an understanding of how these components enable certain interactions, and the capacity to design several components and their connections with the eventual goal of achieving resilience (Desouza & Flanery, 2013:89).

3.4.2 Resilience and complex systems

Cumming (2011:899) provides a contemporary definition of urban resilience which states that it consists “of (1) the amount of disturbance a system can absorb while still remaining within the same state or domain of attraction; (2) the degree to which the system is capable of self-organization; and (3) the degree to which the system can build and increase its capacity for learning and adaptation”. He maintains that these three levels reflect systemic integrity, self-improvement and integrity with relation to local conditions. Similarly, Desouza and Flanery (2013:89), affirm that resilience and systemic identity is a function of system components and relationships as they relate over time.

Furthermore, Desouza and Flanery (2013:90) argue that the conceptual and practical goal of resilience is part of the evolution of planning, whereas Wilkinson (2011:148) adds that ecology, urban planning and urban design may be reframed and reintegrated through reimagining resilience in the context of complexity.

Table 3: Strategies for resilience

Strategies for resilience

<i>Assume change and uncertainty</i>	Buffering
	Redundancy and modularization
	Evoking disturbance
	Strategic foresight
	Learning from crisis
	Adaptive planning
<i>Nurture conditions for recovery and renewal after disturbance</i>	Social capital
	Social–ecological memory
	Ecological diversity
<i>Combine different types of knowledge for learning</i>	Combine experimental and experiential knowledge
	Tight feedbacks
<i>Create opportunities for self-organization</i>	Multi-scale networks and connectivity
	Interplay between diversity and disturbance

Source: Adapted from Wilkinson (2011:148)

Wilkinson (2011:148) compiled “Strategies for Resilience” (Table 6), which include accepting the change and uncertainty inherent to complex adaptive systems like cities and their associated

ecosystems. Wilkinson's aim was to do so while maintaining the social and ecological diversity and network capacity so that the recovery after disturbances creates and generates a self-organizing capacity (Wilkinson, 2011:148). Table 6 represents the raw materials or strategies from which resilient urban planning should emerge into more practical application and modelling.

3.4.3 Towards resilient cities

In order to conceptualize the resilience of cities, Desouza and Flanery (2013:90) proposed a model towards more resilient cities.

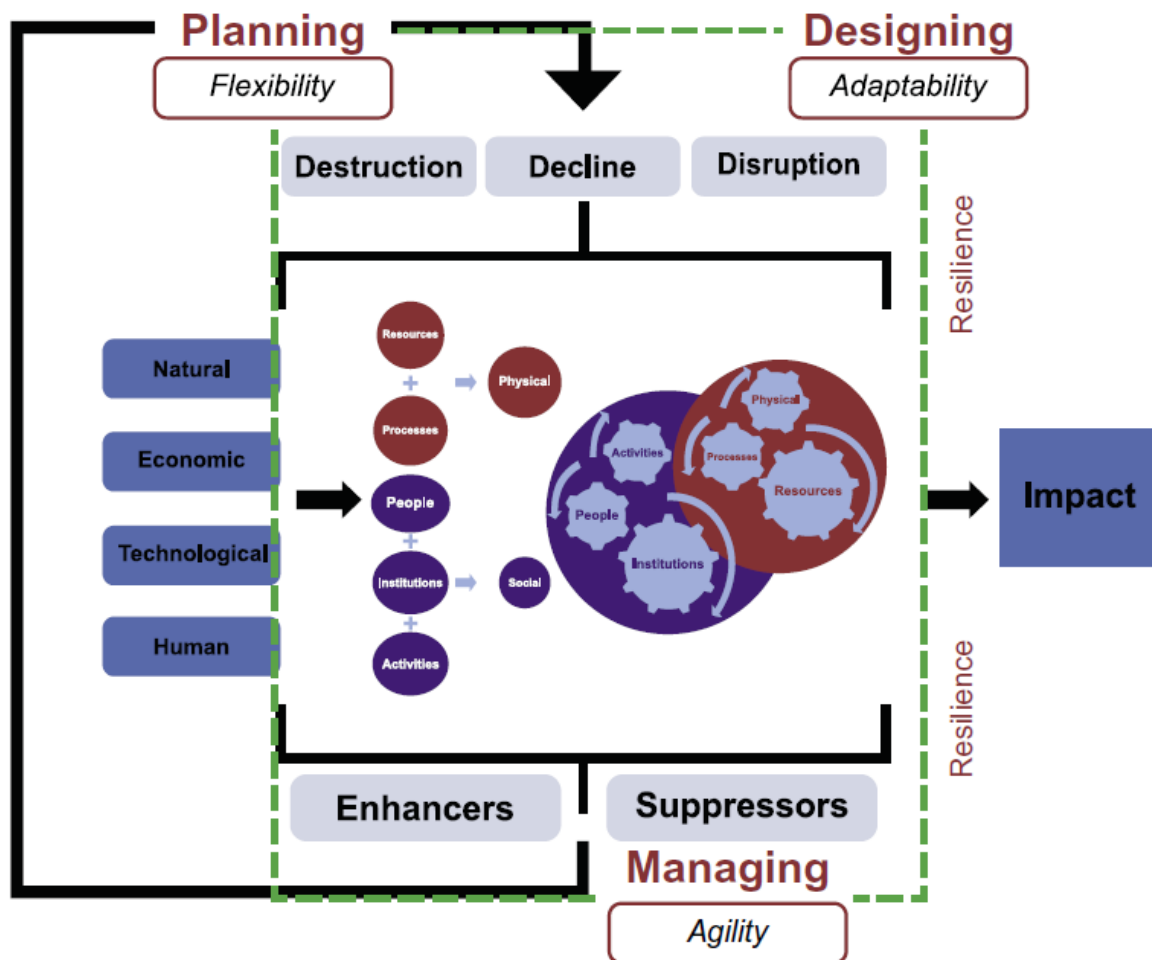


Figure 16: A model towards resilient cities

Source: Desouza and Flanery (2013:95).

This model studies the (i) components within a city, the (ii) stressors and outcomes, (iii) the enhancers, suppressors and impact on a city and (iv) the sets of interventions for incorporating resilience within cities (reiterates Table 2).

3.4.3.1 The components within a city

Pickett *et al* (2001: 380) state that the components of a city, at the highest level (see Urban Systems, section 3.2.1.1), can be separated into physical and social spheres. Physical

components include physical resources and processes that the city interacts with, within a city's boundaries and control (manmade or artificial elements). Social components include the human elements that reside within a city permanently or those that flow into a city (people, institutions and activities).

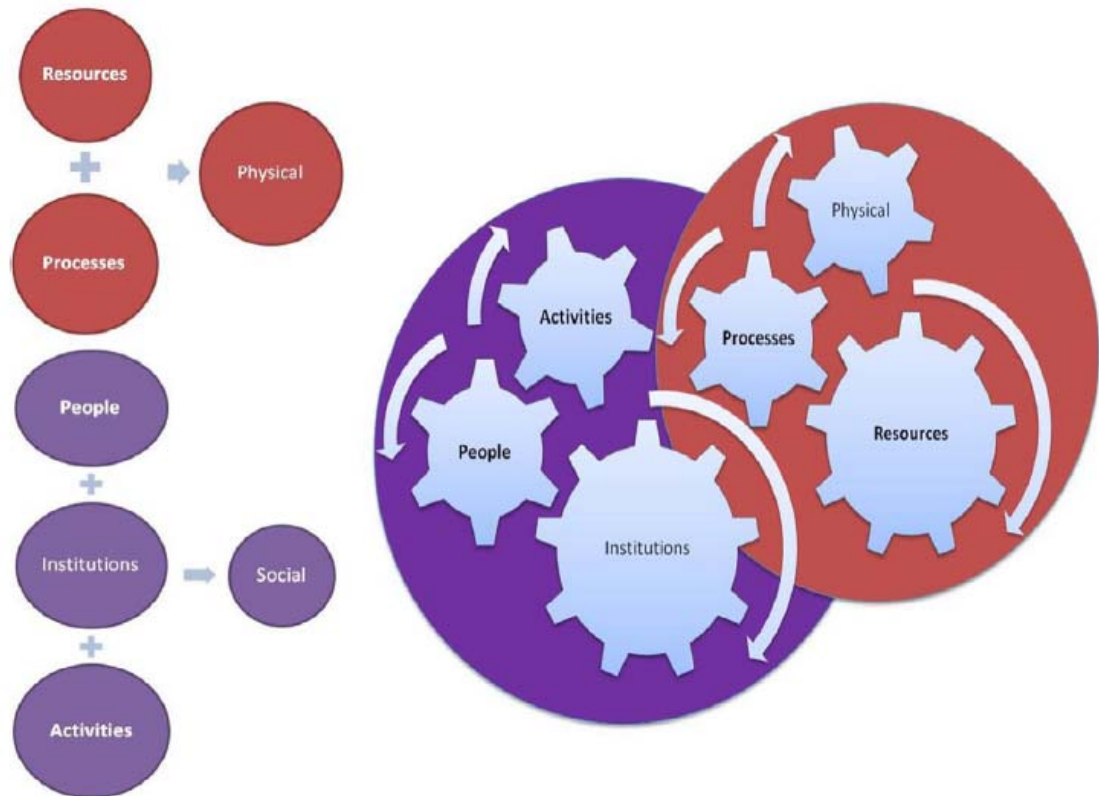


Figure 17: Components and interactions within a city

Source: Desouza and Flanery (2013:92)

The social and physical components interact with one another on a daily basis to give rise to collections that bring a city to life.

3.4.3.2 The stressors and outcomes

To measure the resilience of a system, one needs to identify the stressors that the system should be resilient to. Figure 17 indicates the four broad categories of stressors; (i) natural (hurricanes, floods and tsunamis); (ii) technological (errors in complex technical systems); (iii) economic (poverty, unemployment and deteriorating infrastructure) and (iv) human (terrorism, war, crime etc.). Figure 17 also indicates the harm that these stressors might cause to one or more of these components; (i) destruction; (ii) decline and (iii) disruption. Destruction is a permanent loss of any component of a city, while decline is a gradual obsolescence of a component, making it less capable to function as it is supposed to. Disruption is a temporary loss of a component to function.

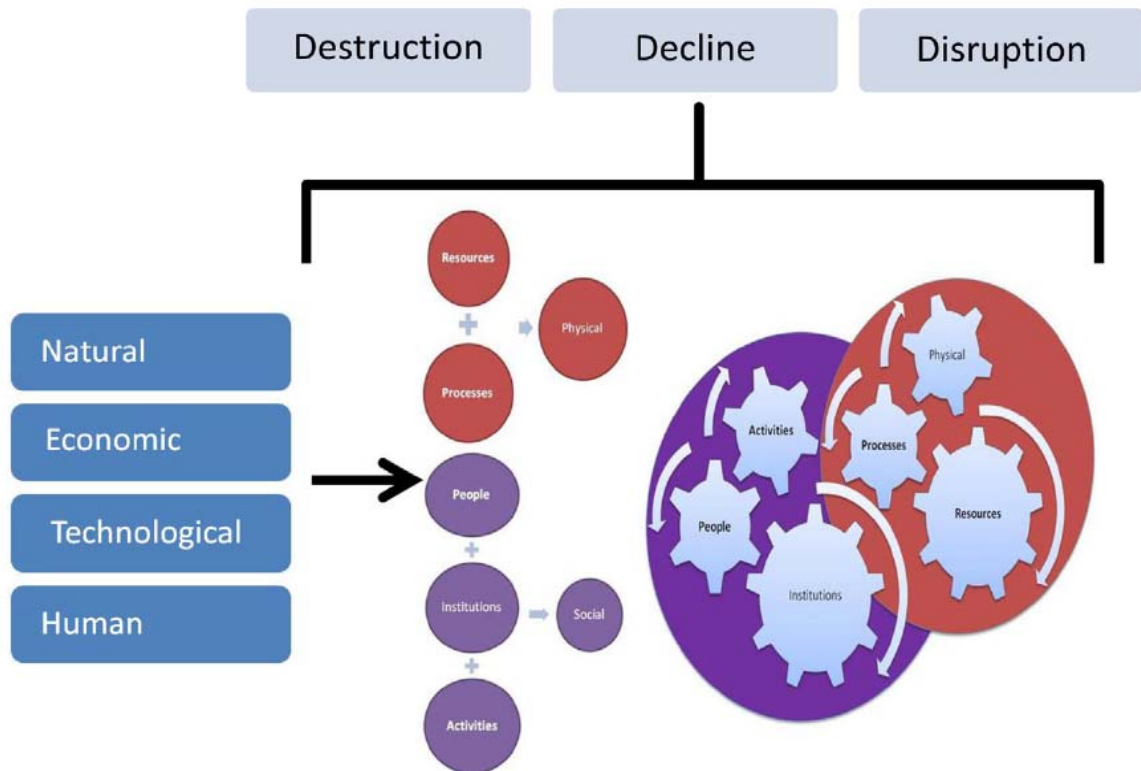


Figure 18: Cities and stressors

Source: Desouza and Flanery (2013:93).

3.4.3.3 The enhancers, suppressors and impact

Cities can influence the impacts of the stressors through its components, plans and people. If a city has inhabitants (reiterates with Table 2- the five W's) that are familiar with feedbacks from a particular kind of stressor, the impacts will possibly be lower with each successive occurrence for they are more equipped and prepared. Enhancers and suppressors mediate the impact of stressors on a city, and its components (see Figure 18). An enhancer is anything that increases the duration or intensity of the stressor on the components of a city, while a suppressor is anything that reduces the duration or intensity of the stressor. As the primary component of cities, people are essential in mediating the impact of stressors and other system disruptions on a city's governance as well as other individuals by self-organizing to facilitate appropriate action at appropriate scales.

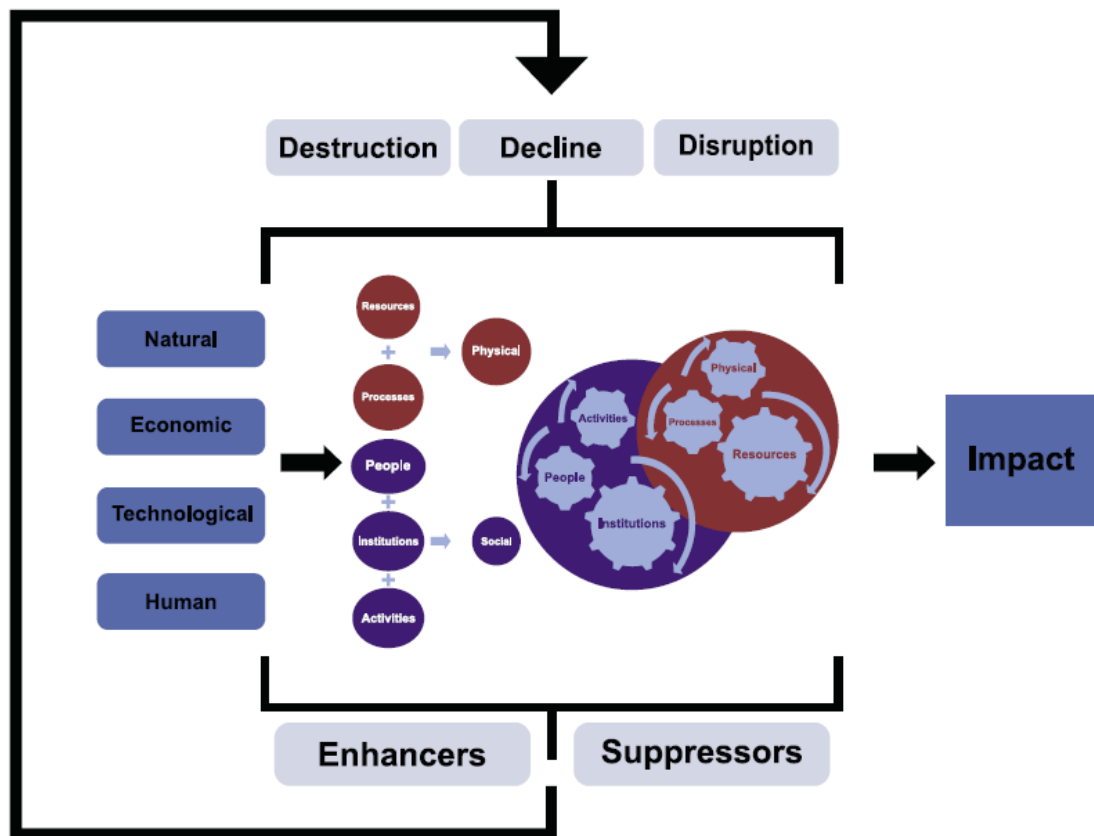


Figure 19: Cities, stressors, enhancers and suppressors, impact

Source: Desouza and Flanery (2013:94).

3.4.3.4 The sets of interventions

Given the framing of cities (Figure 16), the stressors (Figure 17), enhancers and suppressors, and network impacts (Figure 18), the focus now turns to potential actions of urban planners, policy makers, and citizens (Figure 19). There are three action sets that each of these players can participate in to develop more resilient cities; (i) planning; (ii) designing and (iii) managing.

During the planning phase the main focus is the consideration of the new components to install within a city. It is important that public facilities do not plan for the citizens, but rather with them, it is vital to involve the people throughout the whole process so that the information and feedbacks flow in multiple directions.

The second action set is designing. Once the plans are constructed, this process kicks off. While the planning phase concentrates more on flexibility, designing focuses more on adaptability, to build things that are objective. Whether it is designing physical or logical aspects, a focus on adaptability will lead to creating things that can be repurposed, stretched and modified during times of stress. Adaptable objects have a greater success at taking the impact of a stressor and quickly reconfiguring it.

Managing represents the third and last action set. This comprises of a set of decisions and actions usually taken within times of normality and crisis that impact the current and future state of city components. For a city to be more resilient, managing should be done in an agile manner. Agility includes the ability of a city or system to sense changes in the environment, use the information to assess the impacts and make proactive changes to deal with the awaiting stressors.

This model may be seen as a basic instruction or baseline regarding the resilience within a city or system. Therefore, it is clear that this model mainly focuses on providing an overall perception and does not regard any detail or exact guidelines on attaining resilience within a city. This will be addressed later in the study where this model will serve as a background and foundation to elaborate and improve on.

Based on discussion in this section, it is evident that resilience in cities and the providence of guidelines is insignificant and is not sufficiently incorporated within the planning, development and management of cities. This supports the purpose and goal of this study, and will be provided for later on in the study (Chapter 6).

3.5 Resilience and urban planning mechanisms

From the foregoing it is clear that there is insufficient information regarding resilience within the planning and urban realm. There seems to be no existing studies and sources that connect (urban) resilience with the compilation and intensity of land uses. This section includes a comprehensive study which aims to identify the application and tools of land use and land use management within the closely related terms (see section 3.3). These interrelated terms will be studied in order to determine which of the applications (see section 2.3.4) are addressed in these models. This will assist with conclusions later in the study regarding the applications and tools that contributes to urban resilience. As seen in section 3.2.1.1, it is clear that a city cannot be isolated from the different levels, but for the purpose of this study the focus will be narrowed to a daily urban system.

3.5.1 Resilience and revitalisation

During the late nineteenth and early twentieth centuries, downtowns or central business districts (CBDs) contained the retail and services core of most cities (Padilla & Eastlick, 2008:8). As a result, urban retailing was integral to a city's social and economic climate (Hernandez & Jones, 2005). However, many retailers abandoned their downtown locations for the suburbs due to the economic and social stability of CBDs that began to decline. During the 1960s, a few downtown revitalization projects that incorporated urban retailing were initiated to attract shoppers back to the CBD. These projects have produced mixed results in stimulating urban retail development, consumer traffic, and sales (Padilla & Eastlick, 2008:8).

3.5.1.1 CBD revitalization and urban retail marketing strategies

Four independent groups of revitalization strategies have been proposed as potential contributors to successful CBD revitalization efforts. These four strategies include; (i) creating the required infrastructure; (ii) a strategy that includes the development of a pedestrian-friendly environment; (iii) creation of a plaza designed to incorporate walkways and open greenspace; and (iv) legislating government-sponsored economic development policies that encourage business activity (Moss, 1997:475). Other recommended categories of desirable revitalization strategies include; (i) offering cultural activities designed to attract consumers to downtown areas; and (ii) maintaining the CBDs historic character and sense of place (Filion *et al.*, 2004).

Two specific recommendations were made for urban retail development in addition to the general revitalization strategies associated with CBD redevelopment effort. One strategy is to use accessibility, market position and range of benefits offered by downtown businesses to promote the downtown shopping area as an integrated unit (Houston & Nevin, 1980:21). The other strategy includes the synchronization of management and marketing efforts in order to create a perception that the CBD retailers have complementary images and that they act as an interconnected system of business entities (Brodeur, 2003).

Padilla and Eastlick (2008:12) conducted a study to determine whether there are common retail management and marketing strategies that enhance urban retail development in CBDs and to determine what role is played by urban retailers in working with other stakeholders to plan and execute the broad-based economic revitalization strategies that enhance CBD redevelopment? The following were conducted from the study:

Table 4: Revitalization strategies to enhance the CBD

<i>Strategy theme</i>	<i>Strategies</i>
<i>Retail strategy themes</i>	1. Creating an urban shopping experience via the retail mix 2. Developing strategic partnerships to manage urban retail operations • Responding to environmental changes • Coordinating retail management strategies 3. Pursuing coordinated and individual marketing strategies
<i>Economic development strategy themes</i>	1. Creating an urban design plan • Planning for walking environment and spaces

- Planning for space and building renovations
2. Emphasizing cultural activities and events to attract consumers and businesses
- Creating a mixed-use environment
 - Offering special events to attract consumers downtown
 - Stimulating new business growth in the downtown
 - Addressing space availability issues
3. Creating shared ownership of the CBD via community management
- Managing CBD via private and public partnerships
 - Fostering civic pride and ownership of the CBD
4. Creating attractive neighbourhoods for urban residents
- Attracting affluent residents
 - Improving housing availability to attract diverse residents
5. Managing auto and pedestrian traffic flow
- Creating available and accessible parking
 - Managing traffic flow for pedestrians and vehicles
 - Establishing connectivity among CBD districts

Source: Conducted from Padilla and Eastlick (2008:12).

The above table contains important information regarding revitalisation, resilience and land uses. Retail mix, mixed use environments and shared ownership are all aspects that are closely related to land use and will be vital for later parts in the study where recommendations will be made in order to develop more resilient land uses and urban spaces.

It is vital to connect the link between resilience and revitalisation. As resilience, in its basic form is seen as a recovery from a shock, revitalization may also be seen as a recovery. Campanella (2006:142) conducted a study to determine whether it is possible for a city to be rebuilt or revitalised without being resilient. The outcome of the study shows that although revitalisation on its own is not a sufficient condition for resilience, it has a remarkable contribution to resilience.

Mullin and Kotval's (2003:3) study to determine the effectiveness of revitalisation reveals that it is indeed a very effective tool comprising of effective strategies. If revitalisation is regarded as a successful strategy on CBD-level, similar strategies could be applied as tools simultaneously with

resilience and its tools on larger scales leading to more resilient cities. This contributes directly to the purpose of the study and could be seen as an important contribution that will lead to recommendations and conclusions in later chapters.

3.5.2 Land use types and resilience

According to ICLEI (2012:2), integrated land-use planning is an essential key to land use decisions and zoning extensions; they argue that a better land use management and integrated urban planning strategy, are essential to improve the current and future resilience of cities and that it should involve all levels of governance and local communities.

Saunders and Becker (2015:75) state that land use planning is one of the main measures that contribute to resilience (as shown in figure 19). This idea is supported by Paton *et al.* (2013:38), who argue that land use planning is an integral part of creating a resilient society. He states that it is therefore vital to involve citizens (reiterates with Table 2- the five W's) in these processes in order to develop plans with the necessary policies in order to provide a decision making framework that is robust, transparent, and acceptable to the community, while achieving urban resilience.



Figure 20: Measures that contribute to resilience

Source: Saunders and Becker (2015:75).

Clearly, the implementation and application of land use planning and land use management immensely contributes to the resilience of a city (Figure 20). Therefore, it is important to integrate these two aspects within urban planning and land use types. In Chapter 6 suggestions will be made on how to approach this.

3.5.3 Urban connectivity

Taaffe *et al.* (1963) were the first who did research and carried out studies about transportation and development corridors. The focus was initially mostly placed on transport and eventually more focus was placed on other aspects. Taaffe *et al.* (1963:503) allege that the improvement of internal accessibility through the expansion of a transportation network has been a critical factor in the economic growth of underdeveloped countries. This expansion is a continuous process of spatial diffusion and an irregular or occasional process influenced by many specific social, economic or political forces.

The development of transportation networks commonly leads to the creation of corridors through the spatial concentration of flows along privileged axis. Transport corridors are considered as backbones of transportation networks, linking major centres of articulation (e.g. gateways and hubs) and facing a convergence of freight and passenger flows. Often, they lay at the intersection of economic, demographic and geographic processes as they perform both market-serving and market-connecting functions. A corridor development model has been developed by Taaffe *et al.* (1963) to explain this process (Figure 21).

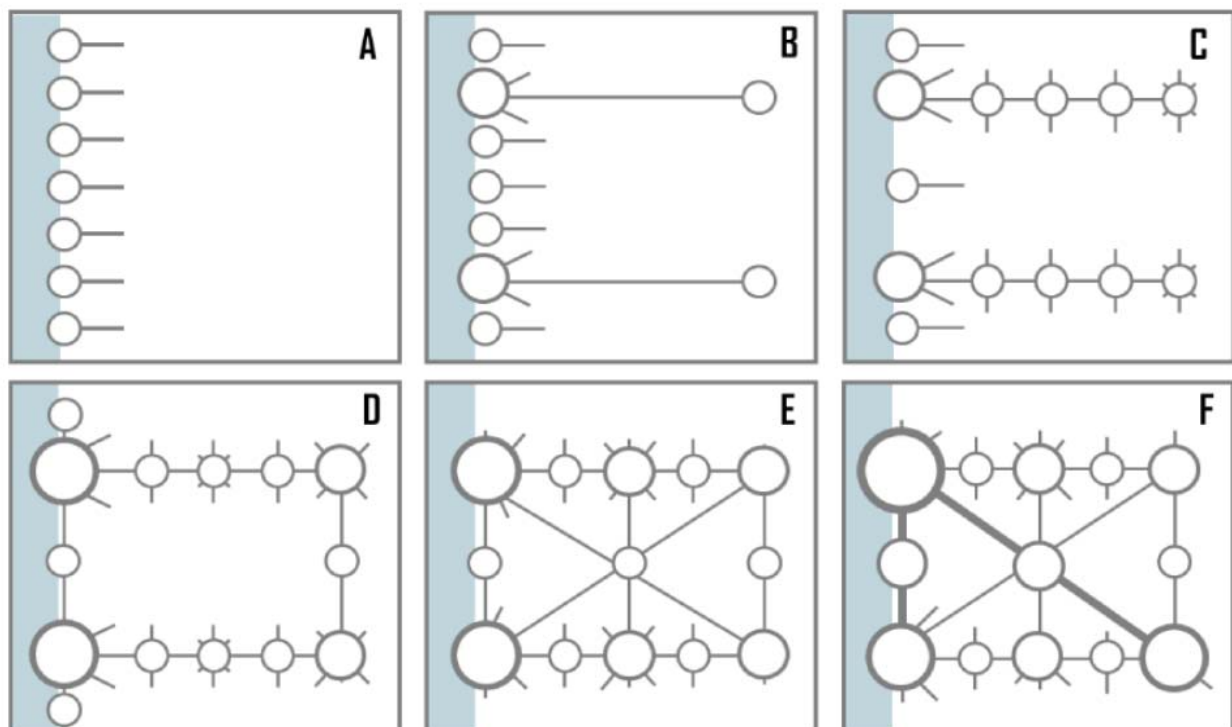


Figure 21: Corridor development model

Source: Adapted from: Taaffe *et al.* (1963:503).

Scattered ports (Phase A) provide access to locally supplied resources through a set of small trade ports, connected to a wider network of trade. This process can take place over centuries as it was the case for the global port system prior to the industrial revolution.

Penetration lines and port concentration (Phase B) indicate that the development of new resources and/or markets is permitted by the constructed trade lines accessing the hinterland. The ports to which they are connected grow in proportion to the new traffic generated. This represents the early stages of the industrial revolution where the first canal and rail connections were established.

Development of feeders (Phase C) explains how the development of feeders further expands the hinterland of penetrating lines. This is a representative of the early stages of rail corridor developments.

Beginning of interconnections (Phase D) shows how the transport networks that have so far been developing independently gradually become interconnected. Intermediate centres start to emerge along with the first road systems. The setting of rail corridors is peaking.

Complete interconnection (Phase E) exists when traffic tends to concentrate in the most connected ports as the level of connectivity increases, implying that several less well connected ports decline or disappear. This phase usually imply the rapid construction of highway systems supporting existing rail corridors and the setting of air connections between large city-pairs.

Emergence of high priority links (Phase F) indicates how economies of scale benefit the concentration of the traffic along the most efficient links, supporting the emergence of transport corridors. Links having lower volumes can even be shut down. The regional transport system has reached a phase of maturity and the structure of the network is unlikely to change unless of significant economic or technological developments.

It is important to note that this model focuses on a national and sub-regional level (refer section 3.2.1.1), but it can be applied on a daily urban system level. This model represents crucial aspects of development in South Africa and will be referred to later on in the study.

Urban Corridor Planning is derived from corridor development. Urban Corridor Planning focuses on changing a city's land development regulations and infrastructure standards to accommodate a broad range of mobility options – walking, bicycling, public transit, and driving – in order to improve access to jobs, services, entertainment and recreation, now and in the future (Houston, 2016: 32).

This section is important because it can be applied on a micro-scale (urban level), which contributes to the goal and purpose of this study.

3.5.4 Spatial planning principles

This section of the study concludes that the composition of various land use types make a significant contribution to resilience and resilient urban areas. Therefore, it is vital to refer back to land use planning (Chapter 2) to try and establish the theoretical principles for successful land use compilation in order to achieve urban resilience. Bearing in mind that urban resilience is a relative new concept, this section also includes land use compilation in terms of the closely related terms (see section 3.3).

This section consists of two main aspects. The first focuses on spatial planning principles that contribute to well-planned and well organised cities and therefore leads to urban resilience, while the second aims to determine the different land use types and the most effective compilation thereof in order to achieve urban resilience through land uses. This is regarded as an international move towards principle driven planning (refer section 4.2.3).

3.5.4.1 The best-practice city

Spatial planning principles have an impact on land uses. Therefore it is essential to include these principles as a vital part of this study.

Lynch's (1984:121) study on the several principles that contribute to the best practice city, shows that a city and its planning policies should make provision for the following dimensions:

Table 5: Lynch's spatial planning principles for the best practice city

Vitality	The degree to which the form of the settlement support the vital functions.
Sense	The degree to which degree to which a city can be clearly perceived and mentally differentiated and structured in time and space.
Fit	The degree to which the form and capacity of spaces, channels, and equipment in a city match the pattern and quantity of actions.
Access	The ability to reach other persons, resources, information, services and other people.
Control	The degree to which the use and access to spaces and activities, and their modification and management are controlled by those who use, work, or reside them.

Efficiency	The cost of creating and maintaining the city.
Justice	The way in which the environmental benefits and costs are distributed among people.

Source: Adapted from Lynch (1984: 121)

Lynch regards the above mentioned principles important for the spatial planning of an urban area. Correspondence may be observed from Behrens and Watson (1996) and Lynch and Hack (1998) in some of the principles, which highlight the importance of these principles.

Behrens and Watson (1996:66) state that the following principles are intended to contribute to the best practice city. The principles are discussed as normative concerns presented as:

Table 6: Behrens and Watson's spatial planning principles for the best practice city

Place making	The concept of a 'sense of place' has been the subject of considerable intellectual exploration within a range of disciplines, and has been filled with several layers of meaning. The concept of a 'sense of place' attainment cannot be accomplished through the submission of standardized planning actions: it results from imaginative, appropriate actions based on an understanding of site, human need, function and culture.
Scale	The design of widths, heights, surfacing and operations of a number of elements of a layout plan from the perspective of the person on foot has implications for the planning and design of public facilities.
Access	Circulation needs and maximisation of levels of access should be met, especially to commercial, facility and employment opportunities. Public transport, road network design and city-wide land use distribution patterns are important and therefore have implications for planning and design of circulation and public facility systems.
Opportunity	Maximization of the economic opportunities happens in large agglomerations of people through the arrangement of infrastructural investments in space. Local economic development and creation of economic opportunities have implications for the planning and design of amenity, circulation and utility systems.
Efficiency	Land use policies, transport policies and capital investment programmes are affected by the cost effective utilisation of land and financial resources.
Choice	The maximisation of the range of choices available to end- user communities regarding housing consolidation, urban surroundings, service provision and

	movement modes affects design and planning of circulation, utility systems and amenity.
--	---

Source: Adapted from Behrens and Watson (1996:66)

Behrens and Watson's (1996) principles are very similar to Lynch's (1984) identified principles, but it is notable that Behrens and Watson (1996) elaborate more on these principles which might ease the application by making the principles more understandable and practical.

Lynch and Hack (1998:75) suggest that the following principles will lead to the best practice city:

Table 7: Lynch and Hack's spatial planning principles for the best practice city

Identity and change	Each site is unique and different in some degree. Interrelations on sites indicate the planner's limits and point out the damage that may be imposed, since site development can provide unexpected effects that pass along the entire chain.
Proportion and scale	Spatial character varies with proportion and scale. Proportion is the internal relation between parts or areas, while scale is the relation of size of elements to the size of other objects through the observer.
Enclosure	Outdoor spaces are defined by trees, buildings, hedges and hills, but are seldom completely enclosed. Level changes can define spaces, while creating effects of dynamic movement. The success of a site is more dependent on the levels, than the general shape itself. The intimacy of exhilaration of a great opening and a small enclosure are universal sensations.
Access	Access is the degree to which users can reach other persons, resources, services, places or information. The quality of dealing with traffic is a fundamental advantage of any organized site, therefore it is important to create linkages between important activities with provision to various kinds of transport.

Source: Adapted from Lynch and Hack (1998:75).

Lynch and Hack (1998:75) emphasise the enclosure and access of an urban area which contributes to the aesthetic and the practical aspects of the city, as it assists to maintain the balance in the spatial aspects of an urban area.

Chapin's (1976:39-75) suggests that the following principles will lead to the best practice city:

Table 8: Chapin's spatial planning principles for the best practice city

Liveability	The qualities in the physical environment of the urban area which tend to induce the citizens a feeling of mental, physical, and social well-being.
Health and safety	This refers to regulatory measures such as health, sanitation, housing and building codes. This includes density controls, controls over hazardous areas and control of exposure to adverse environmental influences.
Convenience	Public convenience is an element of the public interest in upholding the construction of streets and highways as a public purpose.
Economy	This term is associated with efficiency in the land use pattern and its public cost implications in terms of municipal expenditures etc.
Amenity	This term refers to the pleasantness of the urban environment as a place in which to live, work and spend leisure time.

Source: Adapted from Chapin (1976:39-75).

From the table above it is evident that Chapin has a different approach to the spatial planning principles with emphasis on aspects such as the economy. It is less corresponding with other sources, which means that the combination of these different sources will lead to a comprehensive set of principles. The above tables (Table 9- Table 11) illustrates that there is a lot of accordance between the different sources. It can be concluded that the overarching and most important principles consist of the following:

- | | |
|------------------------|---------------------|
| • Place making | • Enclosure |
| • Opportunity | • Access |
| • Efficiency | • Movement networks |
| • Choice | • Public transport |
| • Identity and change | • Open spaces |
| • Proportion and scale | • Public facilities |
| • Liveability | • Economy |

These principles can be applied in the urban planning process in order to improve urban resilience.

3.5.4.2 Land use compilation for the best practice city

Marsal-Llacuna and Lo'pez-Ibanez (2014:39) argue that traditional urban planning methods consist of procedures and rules that are based on planning values, which are in large part derived from the experience of urban planners as visible in various countries' spatial planning legislation

(refer to Chapter 4). Therefore, traditional planning proposals are not only subjective, but sometimes even biased, due to political and other influences. Urban Planning legislation generally provide recommended values and/or planning standards for urban lands and their allocated uses (such as public spaces, facilities, housing, roads, commercial, etc.). Many of these standards were created during the urban planning exercises of the 1970s, or even earlier which makes them problematic. They argue that the situation should be changed. Cities are completely different, and with the passage of time, the needs of citizens have also changed.

Marsal-Llacuna and Lo'pez-Ibanez (2014:39) suggest that the problem of giving a real and accurate answer to citizens' needs should be solved through a pioneering algorithm that transforms the urban time use of citizens into urban land use, obtaining rules of correspondence and indicators of equivalence between urban time-use distributions and urban land-use allocations. This includes that citizens are questioned on their current urban activities and their desired and ideal scenarios of urban activities. This will then be used to determine the optimal land use allocation corresponding to the citizens' desired use of their city.

Dewar and Uytenbogaardt (1991:22) argue that the multifunctional use of space and facilities is not only desirable, but is also economically essential. They identify the integration of urban activities and land uses as one of six central conceptual changes required for the transition of South African cities onto a more positive urban developmental path. The other changes include: (i) balance, (ii) freedom, (iii) equity, (iv) intensity, diversity and necessary complexity, and (v) community . They argue that positively performing urban environments reflect a high degree of integration between different parts and elements of the city. Groups and communities should be able to benefit from a greater range of opportunities and facilities. For this to occur, they suggest that the more intensive activities and events need to be exposed to the inhabitants of many local areas.

The principles of section 3.5.4.1 and section 3.5.4.2 can be combined in order to develop a set of tools that will improve the resilience of cities. This section will serve as an essential basis in Chapter 6.

3.6 Conclusion

The main purpose of this chapter was firstly, to determine an overall background of the term resilience, this includes the existing definitions of resilience and the origin of the term. Afterwards, the study moved on to discuss resilience within the planning realm as well as the application and integration of the term into the planning environment. The chapter studied the existing mechanisms to improve resilience which will be used later in Chapter 6 to develop a unique set of tools.

In conclusion, it is clear that resilience is a relative recent term in the planning sphere. It is also evident that there are still many gaps and room for improvement and expansion. Gaps were identified especially in some of the models and theories (see sections 3.2.1.1 and 3.4.1). These gaps and shortcomings will serve as a basis for the proposals in Chapter 6 in order to contribute to the main goal of the study.

This chapter forms an important part of the study because of the important linkage that is made between resilience and the planning realm. The chapter also acts as an aid to determine how land uses and urban efficiency can contribute to improved resilience within cities.

The following chapter focuses on providing policy and legislation on land use types in a South African context to determine how existing legislation contribute to urban resilience, or how it limits urban resilience in South African cities.

CHAPTER 4: RESILIENCE: POLICY AND LEGISLATION

Policy and legislation on development planning and land uses may have a positive or negative effect on the resilience of an urban area. This chapter will evaluate such policies in order to determine the extent of the resilience of urban areas and whether it is sufficient or insufficient to make a significant contribution towards the resilience and efficiency of a city. The first section focuses on international policies and documents. It also serves as a basis and potential best practice guidelines to the second section, which discusses national policies and legislation to measure South Africa's approach towards resilience in terms of land use types.

From the previous chapter it is important to note that urban resilience is a relative new concept, especially its application into land use planning in South Africa. Therefore many of the policies and legislation will be examined in terms of sustainability (refer Section 3.3.1) as there are no concrete legislation and policies for urban resilience yet.

The main purpose of this chapter is to determine whether there is sufficient legislation to support urban resilience and to determine to what extent the legislation and policies affect this resilience. This chapter serves as a guide to Chapter 6, where proposals will be made on how to improve urban resilience through land use planning.

4.1 International policies and legislation on resilience

This section focuses on international policies and legislation regarding urban resilience (and sustainability), with specific emphasis on whether it will improve or limit urban resilience through different types of land uses. It will specifically refer to the European Union Resilience Policy (2014), The UN Habitat City Resilience Profiling Programme (2013), The Millennium Development Goals (2000), The Sustainable Development Goals (2015) and The New Urban Agenda (2016).

4.1.1 The European Union Resilience Policy

The European Union (EU) is an economic-political union of 28 member states that are located primarily in Europe. The EU traces its origins from the European Coal and Steel Community (ECSC) and the European Economic Community (EEC), formed by the Inner Six countries in 1951 and 1958, respectively and was established by the Maastricht Treaty established in 1993 under its current name the European Union funds (European Commission, 2014:1).

The EU's main focus on sustainability extends from 1997 when sustainable development became a central objective of the EU and it was included in the Treaty of Amsterdam as an overarching objective of EU policies (European Commission, 2015a).

In 2001 the EU leaders used on a proposal from the European Commission to launch the first EU sustainable development strategy. This 2001 strategy consists of two main parts; (i) policy measures and objective for main unsustainable trends and (ii) a new approach to policy-making that ensures the EU's social, environmental and economic policies mutually support each other. Later on a third dimension was added by the EU that emphasised and elaborated on the environmental dimension.

This declaration did not only serve as the basis of the EU's policies towards sustainable development, but it also led to other programmes and commitments, such as those made at the 2002 World Summit on Sustainable Development in Johannesburg and the Millennium Development Goals in 2000. It also led to global pledges to increase official development aid and take account of the needs of developing countries in international trade (European Commission, 2015a).

A set of objectives and actions were created in order to address the seven key priority challenges for the period until 2010. Most of the challenges focus on the environmental aspect:

1. climate change and clean energy;
2. sustainable and viable transport;
3. sustainable consumption & production;
4. conservation and management of natural resources;
5. public health;
6. social inclusion, migration and demography; and
7. global poverty and sustainable development challenges.

Since 2007, the Commission conducts a progress report in order to determine the progress on implementation of the strategy.

In terms of resilience, the European Union has made several attempts to resilience plans, policies and legislation. In 2015, the EU introduced the Resilience Marker in all the humanitarian projects it funds (European Commission, 2014:2). This marker defines ways to reduce disaster risks and to strengthen people's coping capacities so as to minimise humanitarian needs. It also launched the Resilience Compendium (2015) — a collection of 29 practical examples of disaster risk reduction and resilience activities carried out by the EU, other donors, organisations and vulnerable communities.

4.1.1.1 Resilience Marker

The Resilience Marker is a tool to which may be used to determine to what extent humanitarian actions integrate resilience considerations. The Marker aims to improve the quality of humanitarian actions by (European Commission, 2014:2):

- ensuring a systematic consideration and inclusion of resilience tools and aspects in project proposals, implementation and assessment;
- develop a platform which can serve as a communication basis for European Commission Humanitarian Aid (ECHO) staff to discuss how they can include resilience in humanitarian programming;
- encouraging reflection on the various definitions on resilience and what it means in practice in different contexts; and
- allowing ECHO to monitor its own performance in supporting resilience.

The marker works through four key steps to help promote resilience in humanitarian programming through (European Commission, 2014:3):

- an analysis of dangers, threats, vulnerabilities and their causes;
- risk-informed programming;
- local capacity building; and
- longer-term strategies.

These elements are reflected in the four criteria or core questions of the Marker:

RESILIENCE MARKER CRITERIA		
(1) Does the proposal include an adequate analysis of shocks, stresses and vulnerabilities?	☐ Yes	☐ Not sufficiently
(2) Is the project risk informed? Does the project include adequate measures to ensure it does not aggravate risks or undermine capacities?	☐ Yes	☐ Not sufficiently
(3) Does the project include measures to build local capacities (beneficiaries + local institutions)?	☐ Yes	☐ Not sufficiently
(4) Does the project take opportunities to support long-term strategies to reduce humanitarian needs, underlying vulnerability and risks?	☐ Yes	☐ Not sufficiently

Figure 22: Resilience Marker Criteria

Source: European Commission (2014:4).

NUMBER OF CRITERIA MET		MARK
The Marker is not applicable	➔	N/A
The action meets none or only 1 criterion	➔	0
The action meets 2 or 3 criteria	➔	1
The action meets all 4 criteria	➔	2

Figure 23: Resilience marker key

Source: European Commission (2014:4).

Actions receive an overall resilience mark depending on how many criteria are met. The relevance of these two figures (Figure 22 and Figure 23) can be linked to the context and background they create. It provides a current measure that is in place to assess and promote resilience. It is clear that it acts as a very broad measure with no related detail. It is important to contextualize

the current awareness and level that resilience is maintained as this will serve as an important linkage in the formation of the proposals later in the study.

4.1.1.2 Resilience Compendium

The key aim of the above system is to foster learning and an improved understanding of how resilience can lead to more effective humanitarian assistance and transformational change for the most vulnerable (European Commission, 2015b:4). Each example presented in the compendium shows that successful and cost-effective methods and approaches exist, and they can reduce vulnerability and build resilience of populations.

The document includes a set of methodologies and tools to support resilience which includes and mainly focuses on the following mentioned aspects (European Commission, 2015b:97-104):

i. Developing new joint analysis and planning tools:

This aspect aims to improve the strategic dialogue on food and nutrition security between humanitarian and development EU institutions in the country. This results in a twin-track holistic approach which proposes to build the resilience of vulnerable populations by improving and linking immediate hunger relief interventions to longer-term development programmes in areas of protracted crises.

ii. Information for decision making:

The European Union (EU), Food and Agriculture Organization of the United Nations (FAO), World Food Programme (WFP) and other partners such as IFAD (International Fund for Agricultural Development) are working to develop specific technical capacities and analytical tools to strengthen rigour and transparency of resilience measurement and analysis while improving response and decision making.

iii. Development of a joint EU-DFID resilience strategy:

The UK's Department for International Development (DFID) and the European Union's (EU) aim to transform the current prominence on emergency food assistance to deal with chronic food insecurity towards a resilience approach that focuses on addressing underlying vulnerability, while including preparedness and emergency response capacity aligned to longer term developmental processes.

iv. European Union/United Nations/World Bank partnership on Post Crisis Assessment and Recovery Planning:

Post-Crisis Assessments and Recovery Planning, led by government and supported by the international community, can strengthen countries' resilience to crises. This is enabled by answering to recovery needs of vulnerable populations and accordingly strengthening the capacity of national institutions for effective prevention, response and recovery.

From the above section, it can be concluded that the European Union has some strategies in place to plan for and integrate resilience. However, a thorough study of the content reveals that the EU focuses mainly on dealing with resilience through risk management with specific emphasis on food insecurities and nature disasters. For the purpose of this study, there are many useful guidelines and tools in these publications that can be slightly changed and modified in order to measure urban resilience. The Resilience Measure may especially contribute to the proposals later in this study.

4.1.2 The United Nations Habitat

The United Nations Human Settlements Programme (UN-Habitat) is the United Nations agency for human settlements and sustainable urban development, which was established in 1978. The UN-Habitat headquarters is situated at the United Nations Office in Nairobi, Kenya and is delegated by the United Nations General Assembly to encourage socially and environmentally sustainable towns and cities with the goal of providing sufficient shelter for all (United Nations, 2012b).

The overall goal of the UN-Habitat is to increase the resilience of cities to the impacts of human-made and natural crises (United Nations, 2012a:7). Local governments are the closest level to citizens, and have a huge role to play in delivering critical infrastructure and services to protect lives and assets during crisis response. Therefore, it is essential that cities and local governments needs to increase their capacity to reduce both the damage and the recovery period from any potential disaster.

UN-Habitat introduced the ten “essentials”, which all deal with risk and disaster management, and not with urban resilience (United Nations, 2012b:25).

The City Resilience Profiling Programme (CRPP) released in 2013 aims to improve national and local governments with a number of tools which enables them to measure and increase resilience to multi-hazard impacts, including those associated with climate change. The CRPP aspires to develop an integrated and comprehensive urban planning and management approach for profiling and monitoring the resilience of any city to all possible hazards. The overall goal and expected accomplishments of the CRPP are (United Nations, 2013:4):

- an adaptable and flexible urban systems model suitable for all human settlements

- a set of indicators, standards and profiles to support cities for calibrating urban systems' ability to withstand and 'bounce back' from crisis
- software systems that produce city resilience profiles
- global standards set for urban resilience
- a new UN-Habitat normative framework for monitoring urban systems globally.

The CRPP will be implemented in four plus phases starting consecutively and running concurrently as follows:

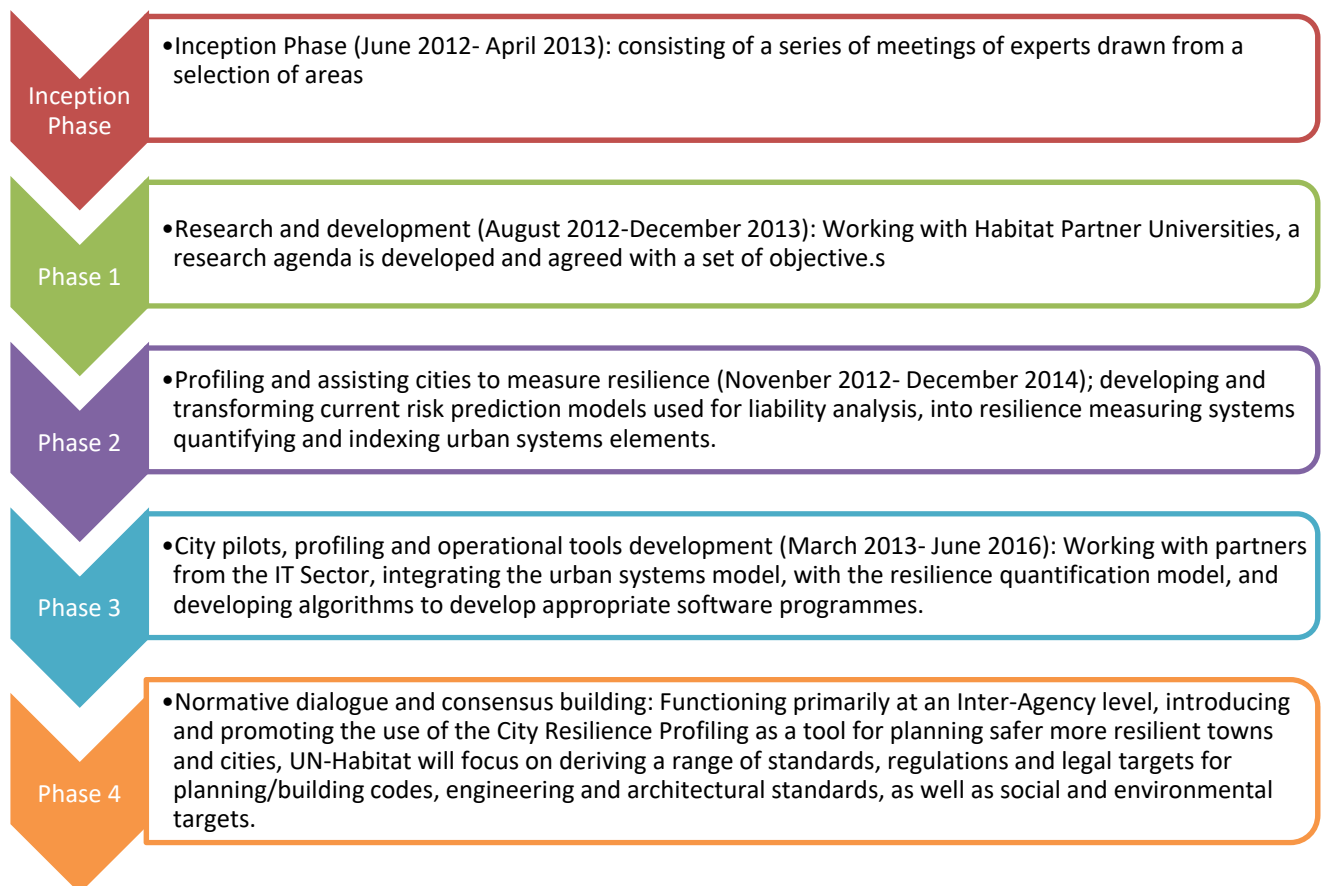


Figure 24: Phases of the CRPP

Source: Adapted from United Nations (2013).

Figure 24 demonstrates that Phase 2 and Phase 4 place particular emphasis on aspects that directly relate to this study. This indicates urban systems and the creation of regulations and standards that will contribute to the implementation of resilience. Although these goals seem very promising, it is pertinent that that the focus remains on resilience in terms of urban resilience and not on disaster and risk management.

4.1.3 The Millennium Development Goals

The Millennium Development Goals (MDGs) are the eight international development goals established (for 2015) following the Millennium Summit of the United Nations in 2000. All 189

United Nations member states at the time (currently 193), and at least 23 international organizations, made a commitment to help achieve the following Millennium Development Goals by 2015 (United Nations, 2000):

1. to eliminate extreme poverty and hunger
2. to accomplish universal primary education
3. to promote gender equality and empower women
4. to reduce child mortality
5. to improve maternal health
6. to combat HIV/AIDS, malaria, and other diseases
- 7. to ensure environmental sustainability**
8. to develop a global partnership for development.

For the purpose of this study, the emphasis lies on the seventh goal; to ensure environmental sustainability.

Table 9: MDG: To ensure environmental sustainability

<i>Targets</i>	<i>Indicators for monitoring progress</i>
<i>Target : Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources</i>	• Proportion of land area covered by forest • Ratio of area protected to maintain biological diversity to surface area • Energy use (kg oil equivalent) per \$1 GDP (PPP) • Carbon dioxide emissions (per capita) and consumption of ozone-depleting CFCs (ODP tons) • Proportion of population using solid fuels
<i>Target: Halve, by 2015, the proportion of people without sustainable access to safe drinking water</i>	• Proportion of population with sustainable access to an improved water source, urban and rural
<i>Target: By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers</i>	• Proportion of urban population with access to improved sanitation • Proportion of households with access to secure tenure (owned or rented)

Source: Adapted from United Nations (2000).

**Remember that urban resilience is a relative new concept, and therefore many of the policies and legislation will be examined in terms of sustainability as there are no concrete legislation and policies for urban resilience yet.*

It is evident from the above table that the main focus of this goal is placed on improving sustainability through environmental resources and services. Although it is not entirely inadequate, however, more attention is needed on the improvement of urban aspects such as land use types and how to combine it to improve urban sustainability (resilience).

4.1.4 The Sustainable Development Goals

The Sustainable Development Goals (SDGs) officially known as 'Transforming our world: the 2030 Agenda for Sustainable Development' is an intergovernmental set of aspirational goals with 169 targets, adopted by the General Assembly on 25 September 2015.

Table 10: Sustainable Development Goals

Goal	Description
Goal 1	End poverty in all its forms everywhere
Goal 2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
Goal 3	Ensure healthy lives and promote well-being for all at all ages
Goal 4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
Goal 5	Achieve gender equality and empower all women and girls
Goal 6	Ensure availability and sustainable management of water and sanitation for all
Goal 7	Ensure access to affordable, reliable, sustainable and modern energy for all
Goal 8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
Goal 9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
Goal 10	Reduce inequality within and among countries
Goal 11	Make cities and human settlements inclusive, safe, resilient and sustainable

Goal 12	Ensure sustainable consumption and production patterns
Goal 13	Take urgent action to combat climate change and its impacts
Goal 14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
Goal 15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
Goal 16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
Goal 17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

Source: Adapted from United Nations (2015:15).

Table 10 provides the Sustainable Development Goals of the United Nations. Although not all of these principles directly relate to the purpose of this study, it remains necessary to provide all of the goals in order to serve as broad context and emphasise the amount of provision that is made to resilience and sustainability. Even though some of the other goals indirectly contribute to urban resilience, minimal provision and emphasis is placed on resilience. A greater concentration on the improvement of urban resilience will address many of the other aspects.

From the 17 SDGs provided in the above table only one goal seems to focus on resilience (Goal 11). The following diagram illustrates the ten secondary goals of Goal 11 United Nations (2015:21-22).



Figure 25: Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable

Source: United Nations (2015:21-22).

Once again, the focus seems to be mostly on services, disaster management and environmental aspects, with very little (almost none) attention given to resilience regarding land uses and urban resilience.

By studying some of the most significant international policies and legislation (Section 4.1) it is clear that there are existing policies and legislation that seem to integrate resilience and sustainability, however, there are fewer (or no) inclusion of policies or legislation on how to

improve urban resilience with specific reference on the types of land uses and the resilient urban planning aspects (Chapter 3) that could be integrated and implemented into the policies and legislation. This is understandable because it is regarded as national legislation and policies, therefore, it focuses on a country or state as a whole. Consequently, it cannot go into too much depth or detail, because it serves as an overall guidance in the development and compilation of policies and legislation on National levels. Nonetheless, there are still very few countries that recognize the importance of urban resilience and integrate it into their policies and legislation, as such, there is still room for expansion and improvement in this aspect of urban planning (refer Chapter 6).

4.1.5 New Urban Agenda

The New Urban Agenda is a recent document which among other things focuses specifically on resilience. One of the major goals of this agenda is to foster resilience and protect the environment (United Nations, 2016: 3).

Some of their major principles include (United Nations, 2016: 5):

1. Ending poverty in all its forms and dimensions, including the eradication of extreme poverty, by ensuring equal rights and opportunities, socio-economic and cultural diversity, integration in the urban space, enhancing liveability, education, food security and nutrition, health and well-being.
2. Sustainable and inclusive urban economies, by leveraging the agglomeration benefits of well-planned urbanization, high productivity, competitiveness, and innovation.
3. Environmental sustainability, by promoting clean energy, sustainable use of land and resources in urban development as well as protecting ecosystems and biodiversity.

The agenda includes comprehensive principles focusing on a broad perspective of aspects. The principle that is most directly linked to this study is the third principle. It aims to improve environmental sustainability through building urban resilience. In addition, it is committed to promoting the development of urban spatial frameworks, including urban planning and design instruments to support sustainable management, densification, mixed land uses, infill planning, resource efficiency, urban resilience and environmental sustainability (United Nations, 2016: 7).

This agenda provides useful principles that are directly relevant to this study. This includes aspects and suggestions that could make a significant contribution to this study, but it still lacks practical solutions for implementation. If this Agenda is correctly interpreted and integrated into the different levels of planning, it could be an immense contribution to the improvement of urban resilience.

4.2 National policies, legislation and guidelines on resilience

This section focuses on South African policies, legislation and guidelines regarding urban resilience (and sustainability), with an emphasis on whether it will improve or limit urban resilience through different types of land uses.

This section specifically refers to The Constitution of the Republic of South Africa (1996), Local Agenda 21 (1996), National Environmental Act (1998), Urban Development Framework (1997), The CSIR Redbook (2000), National Spatial Development Perspective (2006), Urban Development Framework (2009), The CSIR Guidelines for the Provision of Social Facilities in South African Settlements, Integrated Urban Development Framework (2016), National Development Plan (2013) and the Spatial Planning and Land Use Management Act (2013). These policies and strategies have an urban-specific focus with specific regard to land use management.

The Constitution of the RSA, National Environmental Act (NEMA), National Spatial Development Perspective (NSDP) and the National Development Plan (NDP) will be generally discussed to provide some background information as these acts and programs constitute the majority of documents discussed in this section. The remaining documents will be studied specifically in terms of their applicability to resilience or sustainability.

The Constitution of the Republic of South Africa (South Africa, 1996) forms the basis for the government and law of the nation of South Africa. It includes a bill of rights for the residents of South Africa. The Constitution describes the division of South Africa into nine provinces, and establishes the structure of national, provincial and local spheres of government and the principles that govern the interaction between the spheres. It establishes a single independent national judiciary along with several other independent organisations to support democracy and the constitution. The 1996 Constitution was enacted in one of the phases of the transition process from apartheid to democracy. It replaced an Interim Constitution which was drafted in 1993 by the Multiparty Negotiating Forum and came into effect on the day of the elections of 1994. The Constitution states that everyone has the right to an environment that is not harmful to their health or well-being; and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures. Everyone has the right to have access to adequate housing and services in a safe and clean environment (South Africa, 1996:15).

The National Environmental Management Act [101 of 1998] (NEMA) attempts to protect and conserve the environment of South Africa by describing the legal rules in South Africa relating to the social, economic, philosophical and jurisprudential issues raised (South Africa, 1998:2). This incorporates natural resource conservation and utilization, as well as development and land use

planning. Issues of enforcement are also considered, together with the international dimension, which has shaped much of the direction of environmental law in South Africa. The role of the country's Constitution, crucial to any understanding of the application of environmental law, is also examined. Therefore, NEMA serves as the underlying framework for environmental law.

The NSDP 2006 offers a framework for reflecting the future development of the national space economy and recommends mechanisms to encourage optimum alignment between infrastructure, investment and development programmes within localities (South Africa, 2006:ii). It is not a national development plan; nor does it determine what should happen where, when and how. Instead, it utilises principles and the concepts of need and potential as a common backdrop against which investment and spending decisions should be considered and made.

Following the NSDP, the National Development Plan 2030 is an important policy document of the South African government drafted in August 2012 by the National Planning Commission. The NDP aims to eradicate poverty and reduce inequality by 2030. South Africa can realise these goals by drawing on the energies of its people, growing an inclusive economy, building capabilities, enhancing the capacity of the state, and promoting leadership and partnerships throughout society (South Africa, 2011:4). The plan sets out six interlinked priorities (South Africa, 2011:13):



Figure 26: Interlinked priorities of the NDP

Source: Adapted from: South Africa (2011:13)

Figure 26 is relevant to show that this level does not provide the sufficient attention to promote issues that will lead to improved urban resilience.

In terms of spatial development, the document provides a set of principles that human settlements should conform with:

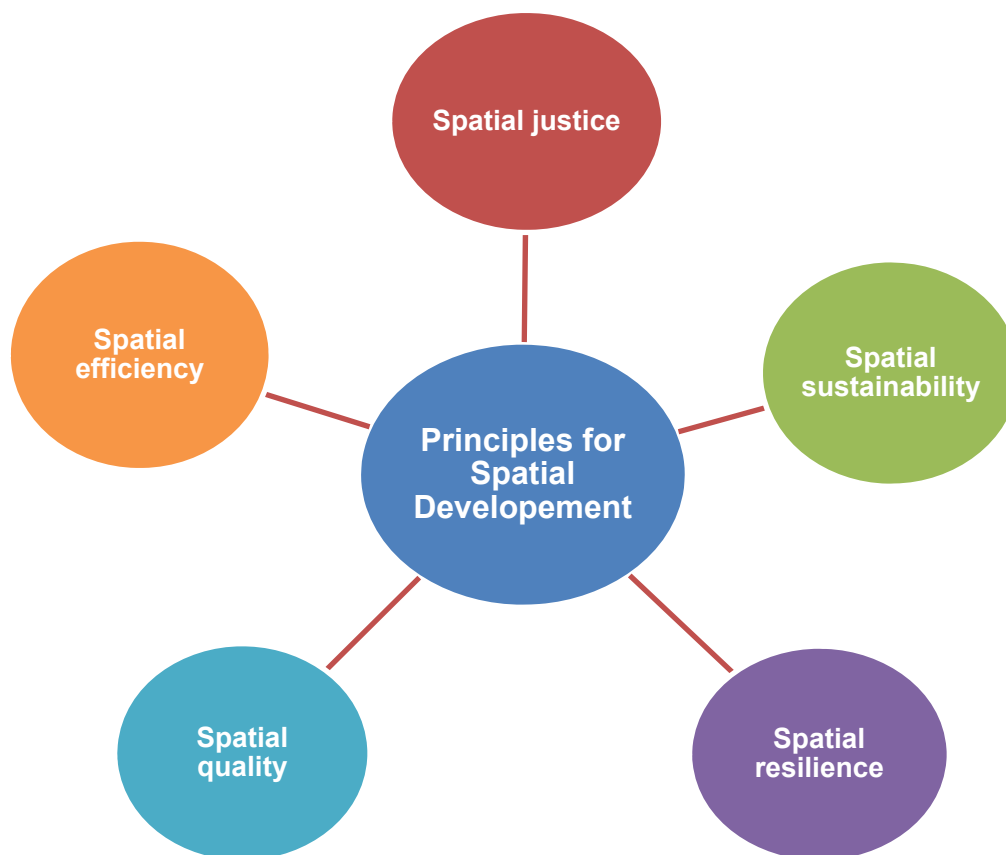


Figure 27: NDP Principles for Spatial Development

Source: Adapted from: South Africa (2011:13):

They aim to achieve the above mentioned principles by: (i) reversing segregation and unfair allocation of public resources; (ii) support consumption and production of sustainable patterns; (iii) reducing environmental degradation, resource scarcity and climatic shocks; (iv) improving the aesthetic and functional features of the built environment; (v) encouraging efficient commuting patterns and circulation of goods and services. From Figure 27 it is clear that four of these principles directly relate to the purpose of this study. These principles include spatial sustainability, spatial resilience; spatial quality; and spatial efficiency. These principles will be discussed in detail later in the study.

The document also includes an urban vision to inform development policy. This vision includes a set of aspects that could make progressive change in the situation of South African cities. The vision focuses on aspects such as improving distorted growth patterns, stimulating growth potential, leading to infrastructure investment and the coordination between different levels of government. No specific proposals are made in terms of how it may be physically implemented and achieved.

It is positive to see these aspects as part of South African policies. This indicates an overall awareness and commitment to achieving this vision. Seemingly, the provisions at the lower levels of government are inadequate and ineffective therefore, the effects are yet to be noticed in South African cities.

It is important to bear these documents in mind as a background for the following documents to be discussed.

4.2.1 National Policies

This section includes a detailed discussion of the applicable aspects within the Local Agenda 21 and The Urban Development Framework (1997, 2009, and 2016). It is relevant to study the three different versions of the UDF, as they collectively illustrate the progress towards resilience within South African planning.

4.2.1.1 Local Agenda 21

Local Agenda 21 is conducted from the UN Habitat Agenda and is a local-government-led, community-wide, and participatory effort to establish a complete action strategy for environmental protection, economic success and community well-being in the local jurisdiction or area (Education & Training Unit, 2016). This requires the integration of planning and action across economic, social and environmental spheres. This strategy includes key elements such as full community participation, assessment of current conditions, target setting for achieving specific goals, monitoring and reporting.

The Local Agenda 21 is one of the factors that led to the development of Integrated Development Planning in South Africa. The institutional local government's response to Agenda 21 was the IDPs which represent South Africa's commitment towards sustainable development.

Integrated development planning is implemented by local municipalities in South Africa as a means of planning for future development in their areas. Apartheid planning left us with cities and towns that (National Development and Planning Commission, 1999):

- have divided residential and business areas according to race
- disadvantages the poor through long travelling distances to work and other essential amenities and with inadequate public transport
- inefficient and inadequate services in the informal/poor areas
- Urban sprawl and spread out residential areas that disable cost effective service delivery.

Rural areas were left underdeveloped and with insufficient services. The new approach to local government aims to overcome the poor planning of the past through a developmental approach. Integrated Development Planning is regarded as an approach to planning that involves the entire municipality and its citizens in finding the best solutions to achieve decent long-term development (Education & Training Unit, 2016).

An Integrated Development Plan is an inclusive framework for development and is regarded as a super plan for an area. It aims to improve the quality of life for all the people living in an area by organising the work of local and other spheres of government in a coherent plan (Education & Training Unit, 2016). This plan should be based on the existing conditions and problems and the resources available for development. It should include economic and social development for the area as a whole. It should include a framework that states how land should be utilised, what infrastructure and services are required and how the environment should be protected. The main goals of the IDP's are provided in the figure below.



Figure 28: IDP main goals

Source: Adapted from Education & Training Unit (2016).

4.2.1.2 Urban Development Framework

The Urban Development Framework contains government's vision for sustainable urban settlements, as well as programmes and guidelines for the achievement of the vision.

According to the Department of Housing (1997:5), the aim is to promote a consistent urban development policy approach for effective urban reconstruction and development, to guide development policies, strategies and actions of all stakeholders in the urban development process and to steer them towards the achievement of a collective vision.

The national cabinet approved the first Urban Development Framework (UDF) in 1997 (along with a rural counterpart). This framework is one of the first policy statements that is clearly concerned with urban issues. The Reconstruction and Development Program (RDP) office started the framework as an urban strategy, but it was taken over by the Department of Housing when the RDP office closed. It places exact focus on the positive terms about the advantages of cities for social and economic development and calls for more coherent and compact spatial development, with a more sustainable and efficient urban form. Integrated economic and spatial planning targeted at disadvantaged urban communities was said to be a priority, along with a more cautious, planned approach to major physical projects. It was however discovered that the urban challenges went much broader than settlement and that a broader approach to urban challenges was necessary.

This section will study the three different versions of the Urban Development Framework to determine the growth and progress of this framework in terms of developing sustainable and resilient urban areas.

4.2.1.2.1 Urban Development Framework – 1997

This framework was released in 1997 by the Department of Housing. The Urban Development Framework strives to outline the urban initiatives necessary to give substance to the requirements outlined in the Growth, Employment and Redistribution Strategy and relevant other development programmes and strategies. It aims to achieve this through the assistance and guidance from the basic tenets of the Reconstruction and Development Programme.

For the purpose of this study, focus will only be on sections that specifically refer to the promotion and implementation of sustainability and resilience within urban areas. This sections include:

1. the Urban vision: towards 2020;
2. urban development goals;
3. integrating the city;

4. integrated planning;
5. planning for higher density land use and development; and
6. sustainable development.

The following section provides a brief overview of the above mentioned aspects, with an emphasis on sustainability and resilience within the urban area.

1. The urban vision: towards 2020

The government is committed to ensuring that the policies and programmes support the development of urban settlements that will achieve the following by 2020 (Department of Housing, 1997:7):

- reduced racial and gender discrimination and segregation achieved through planning and providing guidelines that creates spatially and socio-economically integrated areas.
- economic growth and success through international economic competitiveness.
- centres of economic, environmentally and social opportunities and activities which improves the safety and quality of life.
- centres of vibrant urban governance which is managed in a democratically, efficient and sustainable manner, creating accountable metropolitan and local governments.
- environmental sustainability as one of the key aspects maintaining a balance between quality built environment and open space.
- highly participative planning fashion, promoting the sustainability and integration of urban environments.
- an equitable standard of living in terms of housing, infrastructure and other services.
- commercial, residential, industrial and educational centres that is integrated.

In order to achieve the vision for 2020 a number of development goals have to be in place. This aims to promote the success of implementation.

2. Urban development goals

The urban development goals contributing to the vision for 2020 include (Department of Housing, 1997:8):

- use the growth and development of local economies as a tool to create and achieve more productive and efficient cities;
- reduce disparities in disadvantaged communities by providing facilities and infrastructure;
- provide urban residents with access to better housing and greater security;

- Combat spatial inefficiencies with better accessibility and opportunities by promoting densification and public transportation;
- Improve the overall quality of the urban environment by integrating environmental concerns in urban management and development planning; and
- Use capacity building programmes to transform municipalities into effective and accountable institutions.

3. Integrating the city

South African cities and towns must achieve a higher level of integration between a wide variety of social and cultural groups. Efficient services and infrastructure should be maintained by the local government, while also securing and protecting democratic and accountable local institutions of governance. Local governments should also collaborate effectively with other cities and political jurisdictions of governance in an increasingly interconnected national and international urban system (Department of Housing, 1997:11).

4. Integrated planning

Local economic development planners and urban planners should work as a team to maximise urban generative capacity which aims to ensure that economic, spatial, social and environmental planning is integrated and targets the disadvantaged (Department of Housing, 1997:11). To achieve this, zoning should be less rigid, more flexible planning mechanisms and more mixed land uses should be integrated. This will compliment local economic development, while enhancing the efficiency of settlements.

5. Planning for higher density land use and development

Spatial and social integration of our multi-centred cities through a process of densification and effective public transportation, is already on South Africa's urban agenda (Department of Housing, 1997:12). Planning for integration must incorporate city cores and peripheries as currently defined. It should integrate the social and economic activities of citizens in all areas of the city with a more comprehensive focus. Sustainability should be improved through higher densities, affordable living environments for the targeted and innovative design which is habitable in the longer term.

6. Sustainable development

Sustainable development relates to the way in which we balance development with the use of resources so that the generations to come will still be able to benefit (Department of Housing, 1997:13). Sustainable human settlements require that integrated projects are designed with the

community concerned. It should meet the social, economic and physical needs of the community while considering the effect that it would have on the natural environment. This also requires that standards of services and amenities must be affordable in the long term.

This document focuses mainly on the promotion and integration of the previously disadvantaged, which is understandable, because it is one of the first post-independence documents. It provides sustainability aspects to a lesser extent, which is not really sufficient. There is not any clear guidelines or suggestions for urban resilience.

4.2.1.2.2 Urban Development Framework – 2009

The purpose of a national urban development framework is to provide a common nation-wide view on how to strengthen the capacity of South Africa's towns, cities and city-regions to realise their potential to support shared growth, social equity and progress and environmental sustainability as key components of our national agenda (Department of Cooperative Governance, 2009:2). Integrated spatial and economic planning targeted at disadvantaged urban communities was said to be a priority in the first UDF (1997), along with a more deliberate, planned approach to major physical projects. However, it was recognized that the urban challenges went much broader than settlement and that a broader approach to urban challenges was required.

For the purpose of this study focus will be on sections that specifically concern promotion and implementation of sustainability and resilience within urban areas. This section includes:

1. National urban development principles
2. Urban outcomes and indicators

The following section provides a brief overview of the above mentioned aspects, with specific focus on sustainability and resilience within the urban area.

1. National urban development principles

A number of guiding principles relevant to the effective management of South Africa's towns, cities and city-regions and applicable to all of government can be derived from the analysis in the study. These are (Department of Cooperative Governance, 2009:35):

- **focused national attention on urban challenges.** In order to achieve policy objectives, amongst which poverty alleviation is key, sustained, inclusive economic growth is required.
- **commitment to inclusive pro-poor urban development.** Policy will actively seek to ensure that the urban development process is inclusive and pro-poor.

- **proactive management of urbanization.** A strong proactive approach to managing urbanization needs to be adopted into the future, given the continuing trend of significant migration to the cities.
- **integrated approach to urban and rural areas.** Urban and rural areas form part of a single interdependent system that needs to be managed in an integrated and holistic manner. Therefore, they should be seen as interdependent and complementary rather than as being in competition or mutually antagonistic.
- **regional inter-governmental co-operation.** In order to address the economic, social and ecological challenges facing urban areas and their functional hinterlands, increased co-operation and accountability across jurisdictional boundaries is required. This is dependent on collaborative planning, coordination and cooperation.
- **differentiated support.** A strategic approach and differentiated policy is required for different kinds of urban spaces that acknowledge the widely varying challenges and capacities of different types of settlement. It must include the need to invest in nodes of economic competitiveness and potential growth in the linkages between them while also ensuring a good quality of life for all, regardless of location.

2. Urban outcomes and indicators

The critical national goal of this framework is expressed by the Department of Cooperative Governance (2009:36-39) as :

to ensure the proactive and integrated management of South Africa's towns, cities and city regions in a way that maximizes the poverty reduction, social progress and sustainable growth impact of urban development in the short, medium and long-term and that minimizes the negative social and environmental consequences often linked with the urbanization process.

Based on the analysis of the trends and challenges above, a number of strategic outcomes related to this effective urban management goal have been identified. In each case, a consistent, multi-sphere, multi-sectoral approach will be needed to achieve the outcome. The document consists of six outcomes, however, only those relevant to the study will be discussed. These are outlined below.

Outcome 1 - Improved urban form and sustainability.

It is widely acknowledged that South Africa's urban form, characterised by urban sprawl, poor public transport infrastructure and poorly located lower income settlement has a negative impact on both social and economic progress (Department of Cooperative Governance, 2009:36). In order to achieve this outcome the following measures should be included:

- greater urban integration and densification along major transport corridors;
- greater access and mobility improved through public transportation; and
- greater resource efficiency and sustainability.

Outcome 2 - Improved management of urbanisation and urban growth.

Similarly, the response of government at all levels to continuing urbanisation is seemingly more reactive than proactive. Key steps towards achieving this outcome would include managing both the motives and process of urban migration as well as managing the resulting growth in urban areas (Department of Cooperative Governance, 2009:36). These will be detailed out in a separate rural development strategy while the latter will include measures to promote the following:

- improving forward planning linked to spatial development at all levels of government;
- enhancing land release mechanisms to minimise unplanned informal settlement growth;
- better implementation of the integrated human settlement approach; and
- more effective and efficient processes to ensure consistent land use management.

Outcome 3 - Improved urban infrastructure and service delivery systems

Regardless of the major gains in basic service delivery extension, there are a number of areas where urban service delivery realities and practices represent an obstacle to further development. Key areas for attention in achieving this outcome will include measures to promote the following (Department of Cooperative Governance, 2009:37):

- refining the basic services agenda to enhance equity;
- improving urban social services;
- improved systems of infrastructure maintenance; and
- improved mechanisms for providing higher order services for key economic areas.

Outcomes 4 - Improved urban governance

Major reform of the municipal governance system has occurred over the past decade and structures and systems much more conducive to effective development have been put in place (Department of Cooperative Governance, 2009:39). There are still significant areas where the current governance arrangements can be refined to achieve better national objectives. These include:

- ensuring that the necessary functions and fiscal capacity is devolved to enable municipalities to manage the challenges of complex urban development;
- improving the local responsiveness of the large urban municipalities;

- improving inter-governmental coordination regarding urban challenges; and
- developing more effective strategic partnerships with private and community sectors at town/city and regional level.

This document focuses on the portrayal of a complete background and studied historical events. This led to the goals and outcomes which were proposed in response to the findings of the study. Clearly, this document emphasizes on urban resilience and sustainability through aspects such as regional economic clusters, urban integration and densification, efficiency and sustainability, incentives for green buildings and infrastructure and ensuring consistent land use management. Despite this, there is still room for more specific guidelines for urban resilience especially regarding combination and collation of different types of land uses.

4.2.1.2.3 Integrated Urban Development Framework - 2016

The IUDF responds to the post-2015 Sustainable Development Goals (SDGs), particularly the eleventh goal: making cities and human settlements inclusive, safe, resilient and sustainable. It also builds on various chapters of the National Development Plan (NDP) and extends the eighth chapter entitled 'transforming human settlements and the national space economy' and its vision for urban South Africa.

The overall outcome of the IUDF is spatial transformation, which marks a New Deal for South African cities and towns, by directing urban growth towards a sustainable growth model of connected, coordinated and compact cities and towns.

To achieve this transformative vision, four overall strategic goals are introduced (Department of Cooperative Governance and Traditional Affairs, 2016:8).



Figure 29: IUDF Strategic Goals

Source: Adapted from the Department of Cooperative Governance and Traditional Affairs (2016:8)

The above mentioned goals will be achieved by; (i) forging new spatial forms in settlement, social, transport and economic areas; (ii) ensuring access to economic and social services, opportunities and choices; (iii) harnessing urban dynamism for inclusive, sustainable economic growth and development; and (iv) by achieving spatial and social integration through enhancing the capacity of the state and its citizens.

These strategic goals inform the priority objectives of the nine policy levers (Department of Cooperative Governance and Traditional Affairs, 2016:42-105):

- 1. integrated urban planning and management;**
2. integrated transport and mobility;
- 3. integrated sustainable human settlements;**
- 4. integrated urban infrastructure;**
- 5. efficient land governance and management;**
6. inclusive economic development;
7. empowered active communities; and
8. effective urban governance.
9. sustainable finances

This study focuses on policy levers with specific reference to the promotion and implementation of sustainability and resilience within urban areas. This policy levers include the previously highlighted levers listed above.

The following section provides a brief overview of the above mentioned aspects, with a specific focus placed on sustainability and resilience within the urban area.

1. Integrated urban planning and management

Effective urban planning stimulates a more rational organisation and use of urban spaces. This policy lever aims to provide (Department of Cooperative Governance and Traditional Affairs, 2016:45):

- more compact, socially inclusive and better-integrated cities that are resilient to climate change and urban risk;
- infrastructure investments that are sequenced, coordinated and integrated with land development;
- clarity for all government spheres and sectors about the investments required to maximise opportunities for transforming people's lives for the better;
- efficient approval processes to facilitate economic development;

- spatial integration to reverse undesirable settlement patterns emanating from past practices; and
- inclusive, safe, resilient and sustainable human settlements.

2. Integrated sustainable human settlements

The goal of this lever is to ensure that integrated and sustainable human settlements result in (Department of Cooperative Governance and Traditional Affairs, 2016:62):

- improved quality of life for all citizens who have full access to all basic services and the multiple social, cultural and economic opportunities of urban areas;
- multi-functional spaces with varied shelter, locational and economic choices; and
- well-serviced, safe, cohesive and vibrant communities.

3. Integrated urban infrastructure

The integrated urban infrastructure lever aims to provide (Department of Cooperative Governance and Traditional Affairs, 2016:70):

- equality and inclusivity through universal access to basic social and other services;
- environmental benefits, through the protection of ecological resources;
- sustained economic activity, growth and job creation; and
- urban resilience.

4. Efficient land governance and management

This policy lever aims to achieve the following (Department of Cooperative Governance and Traditional Affairs, 2016:77):

- poor people being able to access well-located land, close to social amenities and economic opportunities, with security of tenure;
- sustainable urban form (compact cities) and land use;
- spatial transformation and the creation of inclusive cities;
- stronger municipal revenue base (mainly property taxes and rates); and
- resilient urban areas.

This document also includes a section on urban resilience which will be briefly discussed.

3.Urban Resilience

Urban growth and development causes and increases risks, which have the potential to weaken efforts to transform urban areas and to create spaces of opportunity, investment and safety. For instance, economic growth may boost urban sprawl and in-migration, which- if poorly managed, can drive poverty and the expansion of settlements into unsafe areas (Department of Cooperative Governance and Traditional Affairs, 2016:31). New and continued human settlement or infrastructural developments in high-risk areas, such as floodplains, will increase exposure to hazards and flooding, which will result in losses to communities, the private sector and the government. The population and the national resources can be protected from such losses by investments which will reduce disaster risks.

South Africa needs to build the resilience of the poor and those in vulnerable situations, and reduce their exposure to climate-related extreme events and other economic, social and environmental shocks and disasters (Department of Cooperative Governance and Traditional Affairs, 2016:32). The country needs to strengthen resilience and adaptive capacity to climate-related hazards and disasters, and to realise the opportunities associated with the rising incidence and costs of urban disasters, the current and anticipated impacts of climate change, and the protection of critical ecosystems and natural resources.

This document integrates more aspects of resilience than the previous two. Although, there is an increasing awareness of resilience it does not include a focus on resilience in terms of natural disasters, however, the appearance of urban resilience can still be observed.

4.2.2 National Legislation

This section includes a detailed discussion of the Spatial Planning and Land Use Management Act 16 of 2013 (SPLUMA).

4.2.2.1 Spatial Land Use and Management Act

The Spatial Planning and Land Use Management Act 16 of 2013 (SPLUMA) is a national law that was passed by Parliament in 2013. The law gives the Department of Rural Development and Land Reform (DRDLR) the power to pass regulations in terms of SPLUMA to provide additional detail on how the law should be implemented.

SPLUMA builds forward on the fact that many people in South Africa continue to live and work in settlements defined and influenced by past spatial planning and land use laws and practices which were based on segregation; racial inequality; and unsustainable settlement patterns (South Africa, 2013:2).

This document includes aspects of sustainable land uses and aspects to improve urban sustainability. It states that sustainable development of land requires the integration of social, economic and environmental considerations in both forward planning and ongoing land use management to ensure that development of land serves present and future generations.

The act makes provision for sustainability with a specific focus on land uses and urban aspects, which may be witnessed in the principles, norms and standards of this act.

4.2.2.1.1 Development principles, norms and standards

The application of the development principles:

The general principles apply to all organs of state and other authorities responsible for the implementation of legislation regulating the use and development of land, and should guide (South Africa, 2013:6):

- a. the preparation, adoption and implementation of any spatial development framework, policy or by-law concerning spatial planning and the development or use of land;
- b. the compilation, implementation and administration of any land use scheme or other regulatory mechanism for the management of the use of land;
- c. the sustainable use and development of land;
- d. the consideration by a competent authority of any application that impacts or may impact upon the use and development of land; and
- e. the performance of any function in terms of this Act or any other law regulating spatial planning and land use management.

Development principles:

The following principles apply to spatial planning, land development and land use management (South Africa, 2013:7):

- a. the principle of spatial justice, whereby promote land development in locations that are sustainable and limit urban sprawl; and result in communities that are viable;
- b. the principle of spatial resilience, whereby flexibility in spatial plans, policies and land use management systems are accommodated to ensure sustainable livelihoods in communities most likely to suffer the impacts of economic and environmental shocks; and

Norms and standards:

The norms and standards must promote social inclusion, spatial equity, desirable settlement patterns, rural revitalisation, urban regeneration and sustainable development. It should also ensure that land development and land use management processes, including applications, procedures and timeframes are efficient and effective by including the following (South Africa, 2013:8) :

- i. a report on and an analysis of existing land use patterns;
- ii. a framework for desired land use patterns;
- iii. existing and future land use plans, programmes and projects relative to key sectors of the economy; and
- iv. mechanisms for identifying strategically located vacant or under-utilised land and for providing access to and the use of such land.

SPLUMA shows good progress in integrating sustainability in terms of land uses. It also includes resilience in a smaller degree, however, since urban resilience is a relatively new concept, this act is examined in terms of sustainability. The act specifically refers to sustainable use and development of land, limitation of urban sprawl, spatial resilience, and economic- and environmental resilience. Although the focus of National legislation on these aspects is laudable, however, there remains a paucity of more specific guidelines and policies on how to integrate and improve urban resilience through land uses.

From this section, it is evident that until recently, little legislation and policies were centred on the issue of urban resilience. . In the more recent documents this aspect is more integrated, but there are still no clear and specific guidelines and legislation to address urban resilience in terms of the combination and compilation of different types of land uses.

4.2.3 National Guidelines

This section provides national guidelines regarding resilience and sustainable development. These guidelines include the CSIR Redbook (2000) and the CSIR Guidelines for the Provision of Social Facilities in South African Settlements (2012).

4.2.3.1 The CSIR Redbook

The CSIR Redbook (2000:1 suggests the following aspects as principles and guidelines for human settlement planning:

Table 11 The CSIR's guidelines for human settlements and planning design:

Movement networks	Local movement networks consists of links and junctions of public rights-of-way or reserves. These links and junctions contain overlapped systems of ways for different movement modes including pathways, footways, cycle ways, roadways and sometimes railways.
Public transport	The public transport context is where the planners of new settlements will be working in the short to medium term (five to ten years). Planners will be challenged to assist transport in changing direction and building cities and towns which assist public transport, and make it more accessible, sustainable and viable.
Open spaces	Public spaces include all land that does not belong to private institutions or individuals. Soft open space is the unbuilt or green space flowing almost in natural lines through the settlement, while hard open space is accessible and built public space within the built environment and can be seen as either semi-public or public hard open space.
Public facilities	Public facilities are basic services which cannot be supplied directly to the individual dwelling unit and are therefore operated away from the individual residential dwelling unit within the public environment. Public facilities satisfy certain individual or community needs, including safety and security, communication, health, sport, education, recreation, public administration, religious, cultural and social.
Scale	Scale refers to judgement about relationships such as size, distance and height. In settlement this usually refers to elements made to a human scale, which is the scale that human beings feel comfortable with.
Choice	Multifaceted places perform well as settlements. They offer a diversity and choice for users, of places, lifestyles, activities and interaction opportunities.
Definition	In positive environments the public space is defined by buildings and other space-defining elements, such as walls and planting. This creates a sense of enclosure.
Flexibility	Positive environments reflect flexibility in their spatial structures. The principle of flexibility thus refers to the creation of spatial structures which can accommodate the unexpected demands made upon them over time.
Intensity of space use	Land should be used as intensively as possible as this has positive spin-offs for settlement-making.

Source: Adapted from CSIR (2000:1)

Although most of the guidelines (Table 14) will either directly or indirectly contribute to sustainability and resilience, the aspects that seem to be the most applicable are the intensity (refer Section 2.3.3.1) of space use. The CSIR further elaborates on this by emphasizing several important suggestions to achieve it. These include:

- the creation of higher levels of support for economic and social goods and services;
- the establishment of an economic climate in which economic activity can thrive;
- the creation of the preconditions for viable public transportation systems;
- the efficient use of infrastructure; and
- the achievement of better utilisation of the land, contributing to compact urban environments, reduced travelling and energy consumption, as well as a reduction in pollution.

It further recommends intensification (refer Section 2.3.3.1) as a solution. Intensification does not imply a standardisation of living conditions, or uniform densities. In the context of the minimalist approach, a choice of living condition which is an important objective of settlement-making is facilitated in a number of ways, such as:

- by encouraging the development of areas of different character throughout the settlement;
- by the presence of contrasts within the structural system, with respect to space that is private and space that is public;
- by the natural development or evolution of a range of urban densities; and
- by an evolution of configurations of plot shapes and sizes, which result in the promotion of different housing types.

The CSIR (2000:2) facilitates the provision of higher density (refer Section 2.3.3.1) and mixed land uses (refer Section 2.3.3.3). Although the above mentioned aspects are lightly touched upon by the CSIR, it is quite positive to see that the awareness is growing in South Africa.

4.2.3.2 The CSIR Guidelines for the Provision of Social Facilities in South African Settlements

The CSIR Guidelines for the Provision of Social Facilities in South African Settlements (2012) mentions two valuable aspects for the purposes of this study: (i) density, and (ii) facility clustering and multi-use of buildings.

Table 14: CSIR Guidelines for the provision of social facilities in South African settlements

Density	There is a direct link between the density of the residential development and the potential to ensure facilities are provided as close as possible to residents, and in some cases to even achieve walking access. Higher densities also imply that larger facilities are required as long as the maximum size for the facility type is not exceeded. Larger facilities often mean higher-order, more specialist services are provided or that a better level of service can be delivered.
Facility clustering and multi-use of buildings.	The clustering of facilities creates opportunities for facility multi-use, sharing, etc. and should result in land savings and trip reductions. Also important is the contribution that this type of investment can make to creating islands of development and structure for city/town building. The successful sharing between departments/multi-use of buildings is largely dependent on excellence in design and management and also requires cooperation and joint financial planning between the departments that form part of the multi-purpose centre/ cluster and may therefore share buildings. If this is achieved within all towns, particularly within the higher-order towns where a larger range of facilities are being provided, it can contribute positively to service delivery and to financial sustainability.

Source: Adapted from CSIR (2012:19)

These principles may be regarded as essential tools, and directly contribute to the purpose and goals of this study.

4.3 Application of policies and legislation

It is important to understand how the different policies are integrated in order to make it applicable to the management of land uses. The levels of hierarchy within the planning system of South Africa are essential in order to understand the implementation of the policies and legislation on an urban level (refer to Chapter 2- LUMS).

Figure 30 illustrates the spatial planning context and relationships in South Africa at the national, provincial, municipal and precinct scales. At the national scale the NDP sets the country's strategic direction. To give spatial expression to the NDP the Department of Rural Development and Land Reform (DRDLR) will prepare the National SDF, which will consolidate the Integrated Urban Development Framework (IUDF) and its rural component (South Africa, 2014:7).

South Africa (2014:7) state that the provinces are responsible for preparing Growth and Development Strategies (GDS) that are aligned with the NDP. SPLUMA also requires that each province prepares a PSDF to give spatial expression to these agendas, and align municipal planning in the province.

It is at the municipal level that delivery takes place. Here the municipal Integrated Development Plan (IDP) serves to provide strategic direction and align the efforts of all government spheres (South Africa, 2014:7). The Municipal Spatial Development Framework serves to give spatial direction to the IDP, and provide a common spatial agenda for diverse sector plans. National Treasury has a range of programmes in place to ensure alignment between the allocation of financial resources and achievement of development objectives.

4.3.1 Policy Context

The National Development Plan (NDP) 2030 was developed by the National Planning Commission in the office of the President in 2012. The Plan sets out an integrated strategy for accelerating growth, eliminating poverty and reducing inequality by 2030 (South Africa, 2014:8).

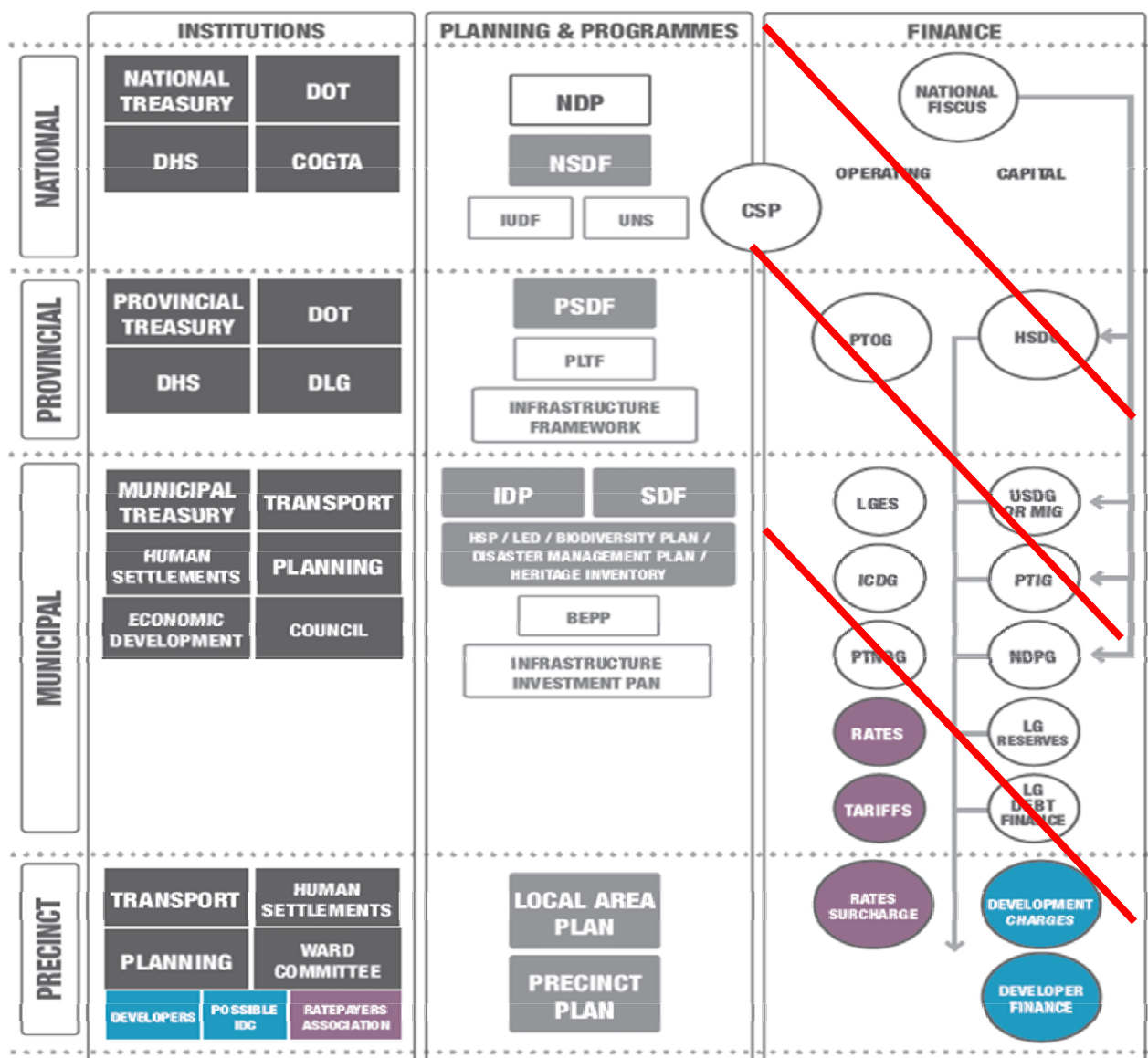


Figure 30: The spatial planning context and relationships in South Africa

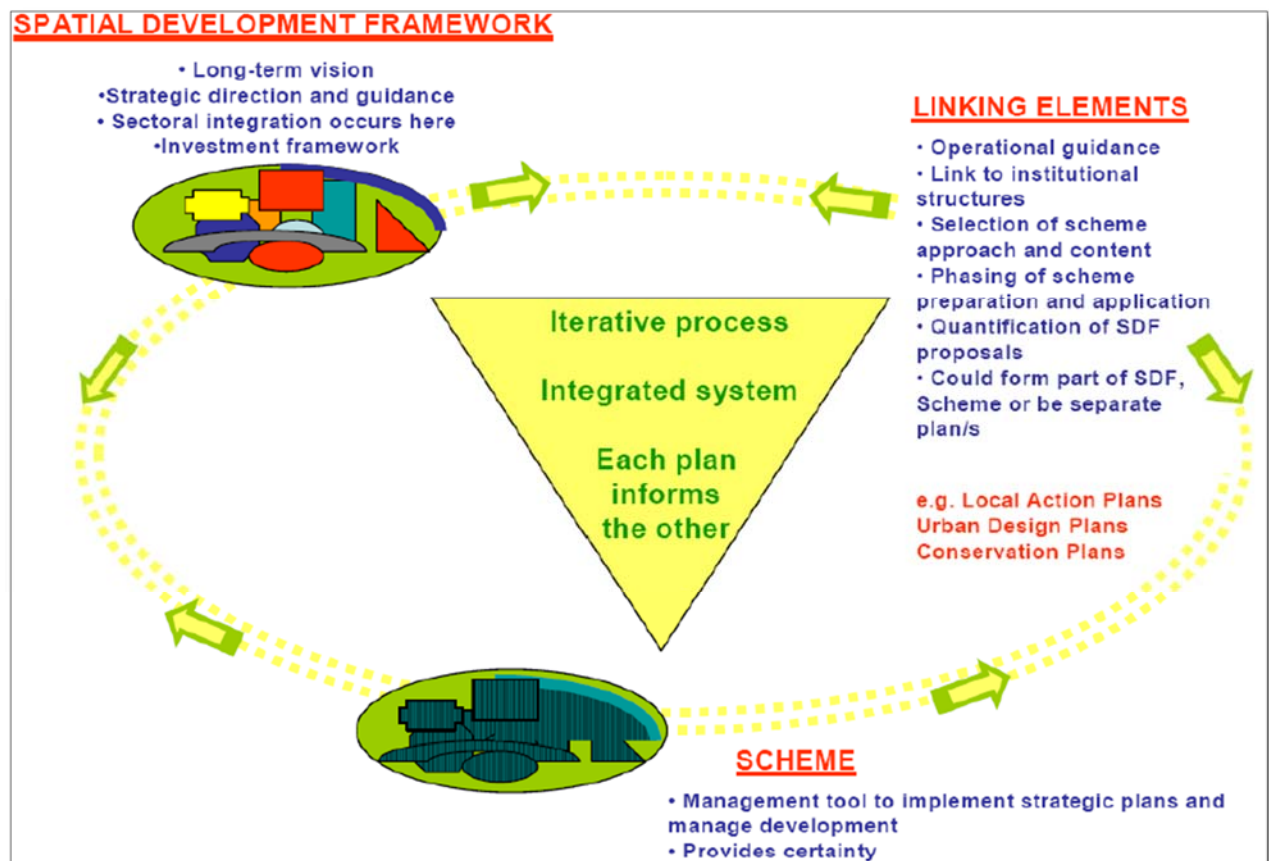
Source: South Africa (2014:9)

Thelt further states that the NDP, supported by the New Growth Path and other relevant programmes provides a platform to look beyond the current constraints to the transformation imperatives over the next 20 to 30 years.

The Spatial Planning and Land Use Management Act, 2013 (SPLUMA) is a framework act for all spatial planning and land use management legislation in South Africa. It seeks to promote consistency and uniformity in procedures and decision-making (South Africa, 2014:9).

It mentions that SPLUMA requires national, provincial, and municipal spheres of government to prepare SDFs that establish a clear vision which must be developed through a thorough inventory and analysis based on national spatial planning principles and local long-term development goals and plans. SDFs are mandatory at all three spheres of government. Figure 30 indicates the integration and cooperation between these spheres. It indicates the spatial planning context in South Africa with its relevant institutions and planning programmes. This diagram confirms the importance of the vertical integration and alignment between the levels of planning and will serve as a focalpoint for the management of the proposals (refer Section 6.3). For the purpose of this study the third column is regarded as irrelevant.

South Africa (2014:10) states that the Local Government Municipal Systems Act (MSA), 32 of 2000, first introduced the concept of the Municipal Spatial Development Framework (MSDF) as a component of the mandatory integrated development plan (IDP) that every municipality has to



adopt. Chapter 5 of the Act deals with integrated development planning and provides the legislative framework for the compilation and adoption of IDPs by municipalities.

Figure 31: Linking the SDF and the LUMS

Source: The Planning Initiative Team (2005)

It specifically requires an SDF as a mandatory component of the municipal IDP. It also provides the basic guidelines for a Land Use Management System (LUMS) that would be applicable to the whole municipality. In terms of the management of land uses it is vital that the linkage is made between the SDF and the LUMS. The most important linkages include:



Figure 32: Linkages between the SDF and LUMS

Source: Adapted from the Planning Initiative Team (2005).

Figure 32 illustrates the linkages between the SDF and LUMS, in order for these documents to be implemented and applied effectively, it is essential that these key linkages are followed and integrated. As it will eliminate confusion by providing the necessary guidelines and specific regulations.

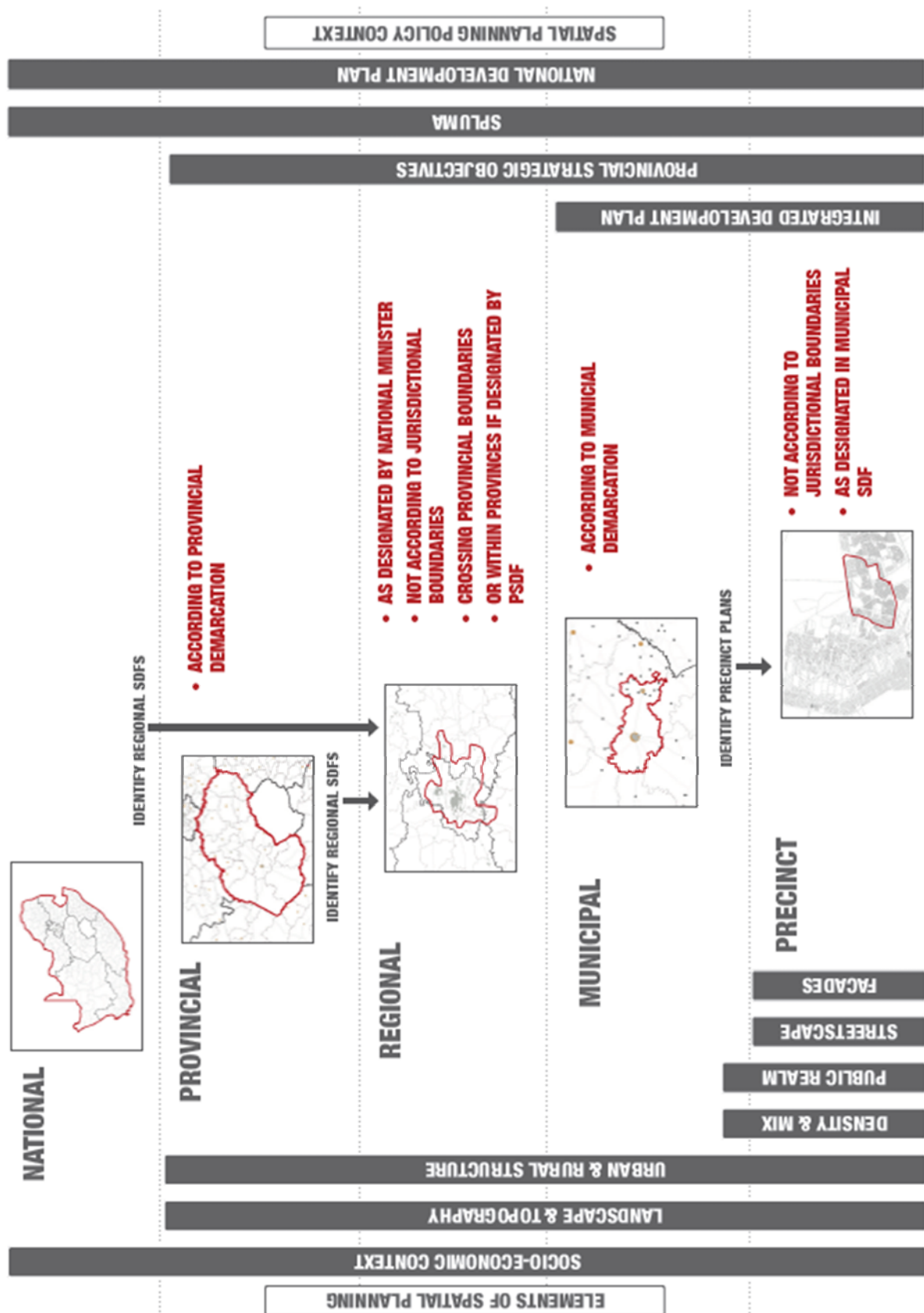


Figure 4. Differentiating the different scales of planning according to the relevant elements, policy contexts and legislative demarcations

Figure 33: Differentiating the different scales of planning according to the relevant elements, policy contexts and legislative demarcations

Source: South Africa (2014:15).

Figure 33 differentiates between the different scales of planning according to the relevant elements, policy contexts and legislative demarcations. From Figure 31 it is clear that land use management is subject to national and provincial level, but the application and physical principles generally occur at municipal and precinct level. Therefore, the LUMS and SDF may be seen as tools to implement the national principles and policies on an urban level. This figure serves as a basic point of departure for the management of the proposals (refer Section 6.3).

4.4 Conclusion

This chapter consisted of a study on international and national policies and legislation on urban resilience. It was found that this concept is partially integrated into international and national policies and legislation, however, it was observed that it mainly focuses on resilience in terms of nature disasters. The legislation and policies on urban resilience with specific regard to the combination and compilation of different types of land uses seems insufficient.

The main purpose of this chapter was to determine whether there is sufficient legislation for urban resilience and to determine to what extent the legislation and policies affect this resilience. The findings in this chapter concludes that these specific policies and legislation are insufficient and need improvement. The urban resilience of cities may significantly improve when greater focus is placed on specific guidelines and legislation on the compilation and combination of different types of land uses.

This chapter will make a significant contribution in the compilation of Chapter 6, where proposals will be made on how to improve urban resilience through land use planning. Proposals will be made in terms of the findings in this chapter. The next chapter includes the empirical study which consists of both international and national case studies, which focus on the implementation of urban within the selected case studies.

CHAPTER 5: EMPIRICAL STUDY

5.1 Introduction

The previous chapter studied the international and national policies and legislation on urban resilience in order to create a broader background and understanding. This chapter includes the empirical study which consists of both international and national case studies. The purpose of this chapter is to determine the integration and application of urban resilience through the different types of land uses.

First the applicable methodology will be discussed. The focus will then shift to an international perspective which includes a developed country and developing country case study and then to a national (South African) perspective. These two parts consist mainly of the studying of two respective case studies. This chapter will make a substantial contribution to the conclusions and recommendations in Chapter 6.

5.2 Methodology

The qualitative empirical method followed during this study is the Document Analysis Protocol . (case study method). According to Guba and Lincoln (1981:52), document analysis is a form of qualitative research in which documents are interpreted by the researcher to give voice and meaning around an assessment topic. Analysing documents incorporates coding content into themes similar to how focus group or interview transcripts are analysed. A rubric can also be used to grade or score a document. Document analysis is a valid research strategy with considerable merit as a methodology for policy evaluation and reform an can provide very engaging, rich explorations of a project or application as it develops in a real world setting (Blundell, 2010:1).

Document analysis consists of three methods, namely:

- **Thematic analysis** is a method for identifying, analysing and reporting patterns within data. It minimally organises and describes your data set in detail. However, frequently it goes further than this, and interprets various aspects of the research topic.
- **Content analysis** is a method used to make replicable and valid inferences by interpreting and coding textual material. By systematically evaluating texts (e.g, documents, oral communication, and graphics), qualitative data can be converted into quantitative data.
- **Open Coding analysis** includes labelling concepts, defining and developing categories based on their properties and dimensions. It is used to analyse qualitative data and part of many qualitative data analysis methodologies.

Therefore, it is imperative that the right method is applied to ensure that the outcome is reliable and accurate. The document analysis method that will be used for this study is the content analysis method, as certain policies and documents will be studied and evaluated in order to determine a standard at the end of this section.

The specific choices regarding the selected cities were mostly influenced by the objective to choose a city from a developed country and a city from a developing country. The main reason for the choice of a developing country is to measure South Africa to a country that is more or less its equivalent. The developing country is integrated to determine how South Africa compares with the development and implementation specifically of urban resilience in terms of the combination and allocation of different types of land uses. Barcelona was chosen as the case study in Spain because of the significant development in terms of resilience with various resilience institutions and organizations present in Barcelona. India forms part of the BRICS countries which also contributes to its applicability as a choice. Durban was chosen as the case study in South Africa, because its recent addition as a member of the 100 Resilient Cities, emphasizes the city's commitment towards resilience. Durban is also regarded as one of the cities in South Africa with the most sophisticated and sustainable planning policies (eThekweni Municipality, 2016a).

5.3 International Case Studies

This section includes a developed country and a developing country international case study. Firstly, Barcelona will be studied as a city within a developed country on an international level, followed by New Delhi as a city within the developing country international case study. The purpose of this approach is to establish an international standard by which to measure Durban as a South African case study. The main aspects will be studied to determine: (i) when they started to integrate sustainability and resilience, (ii) mechanisms implemented to move towards resilience, and (iii) the various tools used by each country or city.

5.3.1 Spain

Spain, a country on Europe's Iberian Peninsula, includes 17 autonomous regions with diverse geography and cultures. High plateaux and mountain ranges such as the Pyrenees and the Sierra Nevada dominate much of mainland Spain. To the north, the country is bordered by France and Andorra, and to the west by Portugal. Spain also includes the Balearic Islands in the Mediterranean Sea, the Canary Islands in the Atlantic Ocean, and two autonomous exclaves in North Africa namely Ceuta and Melilla. Spain became a part of the European Union in 1986, today Spain has 54 seats in the European Parliament (European Union, 2016).

5.3.1.1 Current Guidelines in Spain

European Union legislation and case law impacts upon the planning law of member states. By adopting the European Spatial Development Perspective (ESDP), the member states and the Commission reached an agreement on common objectives and concepts for the future development of the territory of the European Union. The following table includes the Planning Principles found within this document (Lees & Vinuales, 2016).

Table 12: Planning Principles of the European Union

Densification	Support for effective methods of reducing uncontrolled urban expansion; reduction of excessive settlement pressure, particularly in coastal regions.
Accessibility and Transport	Accessibility of cities has an important influence on the quality of life, the environment and economic performance and therefore accessibility should be improved through different types of transport which are not only effective but also environmentally friendly.
Public Transport	Improve public transport in cities and metropolitan areas through an appropriate location policy and land use planning that will stimulate mixing of urban functions.
Open spaces	Create public spaces that will promote the ecological and social aspects.
Cultural Heritage	Increasing awareness of the contribution of urban and spatial development policy to the cultural heritage of future generations.
Sense of Place	Promotion of contemporary buildings with high architectural quality and creative design of urban areas.
Corridor Development	The spatial concept of corridors can establish connections between the sectoral policies, such as transport, infrastructure, economic development, urbanisation and environment.

Source: Adapted from European Commission (1999).

This table creates a background to understand the national planning aspect of India and also assists in the comparison of the different case studies.

5.3.1.2 Barcelona

Barcelona is the capital city of the independent community of Catalonia in the Kingdom of Spain and is governed by the municipality of Barcelona. It is regarded as the country's second most populous municipality, with a population of 1.6 million within city limits. Its urban area extends beyond the administrative city limits with a population of around 4.7 million people, being the seventh-most populous urban area in the European Union. Barcelona is on plain bordered by two rivers: the Llobregat in the south and the Besòs in the north. The Collserola ridge (part of the Serralada Litoral) borders the west side of the city, with pine and oak woodland, fields and meadows, as well as wetland vegetation (López *et al.*, 2015:235).



Figure 34: Map of Catalonia

Source: Google Maps (2016a)

In 1909 the city of Barcelona was burnt down. The arson formed part of protests by unhappy citizens who started to burn down mainly religious buildings and schools, but it was not long until the entire city burned down (Silvestre, 2009). This may be seen as one of the largest “shocks” that Barcelona had to recover from and is also regarded as the main reason for the unique city form and layout of Barcelona.

5.3.1.3 The origin of the paradigm shift towards sustainability and resilience

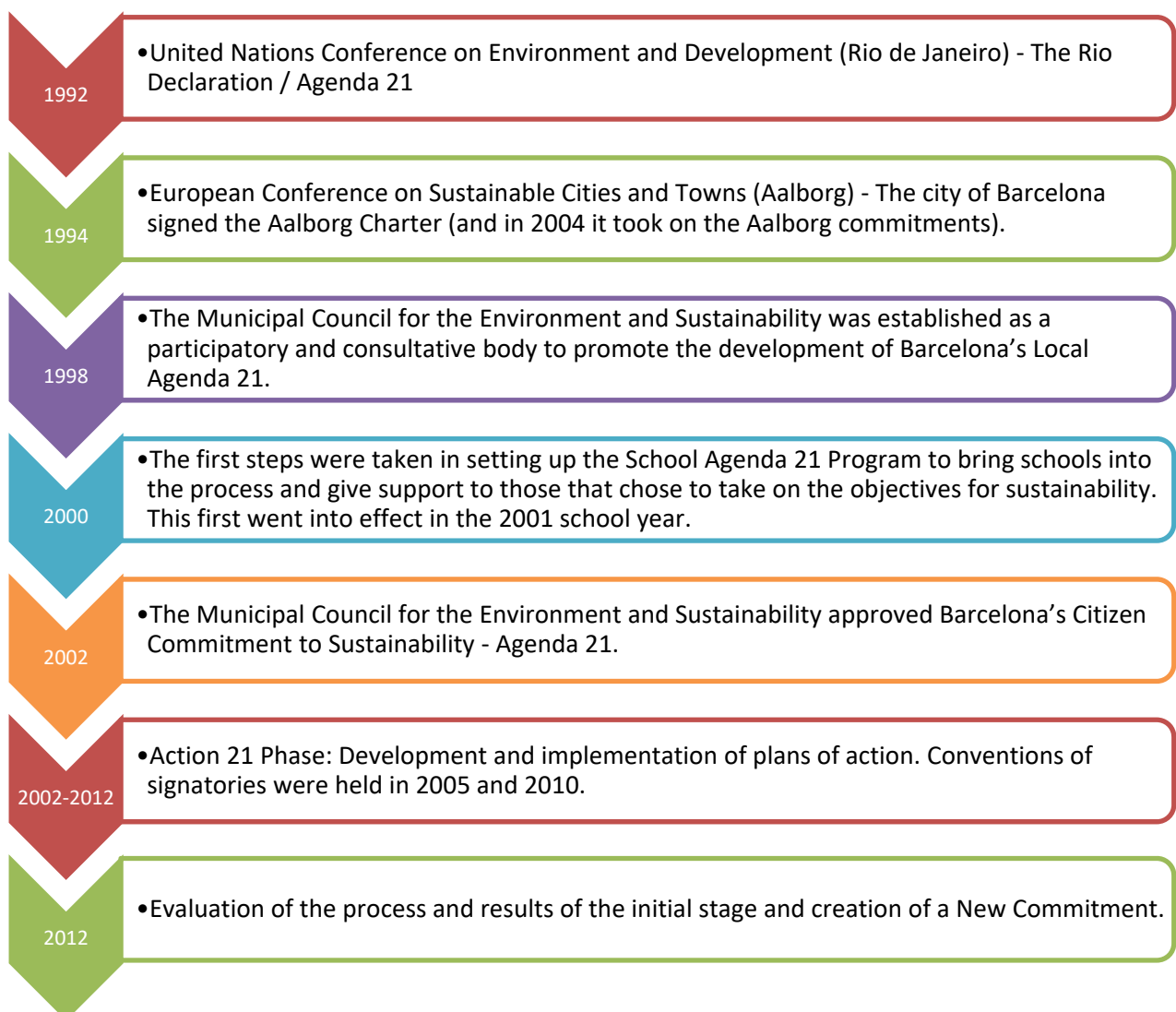
The following section provides a brief overview of the history of sustainability and resilience within Barcelona. It serves as a basis to determine how advanced this city is in terms of these two aspects.

5.3.1.3.1 Sustainability

The Barcelona City Council (2016) is committed to building a sustainable city. This commitment coupled with the community's whole-hearted devotion to conserving the environment enables the city to transform its challenges into opportunities to advance towards a more sustainable model.

The Barcelona Field Study Centre (2016) states that Barcelona aims to create an urban environment that provides the best quality of life possible for present and future citizens.

Sustainability as principle has formed and developed over the years and has become a big part of the urban planning of Barcelona, this is evident in the following key dates:



(Barcelona City Council, 2016).

Figure 35: Barcelona key dates for sustainable development

Source: Adapted from Barcelona City Council (2016).

Some of the more recent developments include the emphasis on green areas, cleaning and management of waste, beaches and cycles of water, energy and environmental quality, road space and works, and the transversal approach to urban planning with the implementation of a new urban management model. This model serves as an urban platform for sustainable city growth (Shafie, 2014:382). Shafie (2014:382) mentions that their four main approaches are (i) optimizing urban services management and integration through urban platform model development (ii) low risk and technological trend – fiber and WIFI networks (iii) efficiency – the improvement of cost / service delivery, quality and management, and (iv) Scalable: allow to face connections growth and take advantage of internet market opportunities.

5.3.1.3.2 Resilience

Barcelona joined the 100 Resilient Cities Organisation in the beginning of 2014. The 100 Resilient Cities organisation run by the Rockefeller Foundation consists of cities who have demonstrated a commitment to building their own capacities to navigate the shocks and stresses of an increasingly complex 21st Century (Berkowitz, 2014:16). He indicates that each city was asked to present a clear and compelling description of their major resilience challenges, how they are approaching and planning for resilience to decrease vulnerabilities, and how they plan to partner with us and after which Barcelona was chosen as one of 35 countries to join the organisation. However, it seems Barcelona began integrating several aspects of resilience since 1987.

Today Barcelona is regarded as one of the major cities in Europe with a strong commitment to building urban resilience, with its Urban Resilience Board for Infrastructure and Services Supply created to counter the impact of various types of crises and to strengthen infrastructures and services supply capacities (Barcelona City Council, 2016). The following section provides more information regarding the resilience mechanisms and tools.

5.3.1.4 Mechanisms for moving towards resilience

The Barcelona initiative was launched in 1987, when they won the Olympic bid for 1992, the city formalized the implementation of resilient strategies with important projects to provide defensive infrastructures to guarantee services, such as ring roads, rain water collection tanks and tools for a better coordination of the operations (Opticits, 2015:3).

Twenty years later, after a series of incidents in 2007 (mainly a three-day electrical blackout, a draught-related lack of water supply and disruptions in the railway services caused by the works on high speed railway), the need increased to develop new strategies to increase the resilience of the city especially in terms of service delivery (López *et al.*, 2015:236).

This led to the 3S's (security on services supply) project which is an assessment project. The project started in 2008 with the aim of collecting and structuring information about several infrastructures and services coming from different sources and to perform a diagnosis to identify the weak points and risks in the networks of infrastructures and services supply of the city and its metropolitan area (Figure 36).

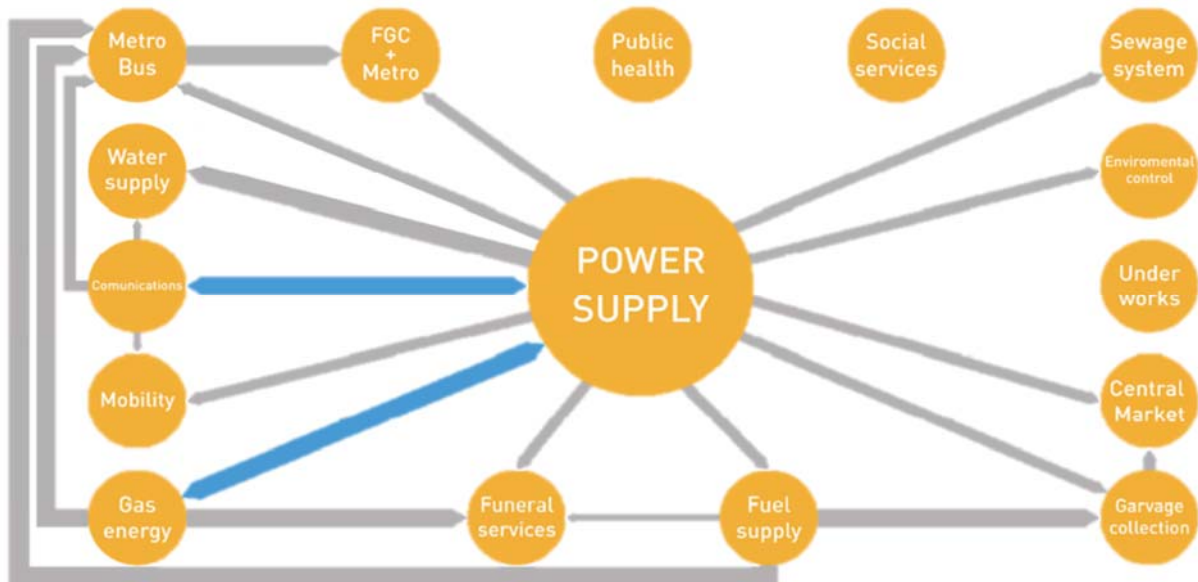


Figure 36: The vulnerability of the city in terms of service delivery and its interconnections

Source: Opticits (2015:3).

Summarily, the resilience mechanisms applied in terms of infrastructures and services supply had four components:

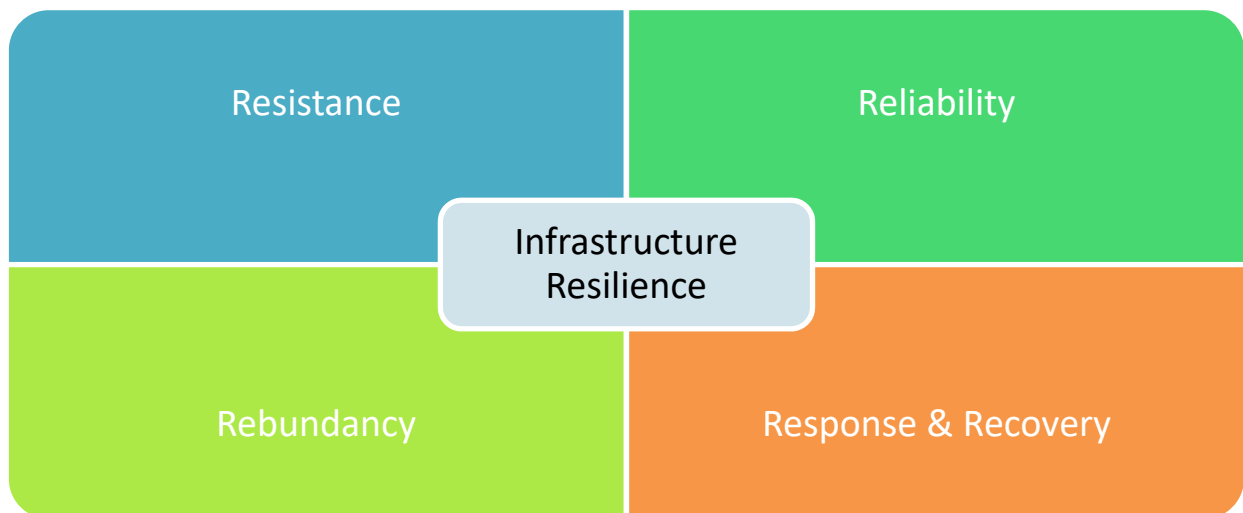


Figure 37: Strategic components of the resilience applied to infrastructure

Source: Adapted from López *et al.*, (2015:237).

This led to the identification of actions aimed at improving the quality of the operational plans that focused on overcoming situations and in the development of integrated defensive investments through urban resilience procedures.

The methodology of this project can be summarised by Figure 38. The steps called identify and assess risks were done in the 3Ss project phase, while build and evaluate resilience were done in another phase.

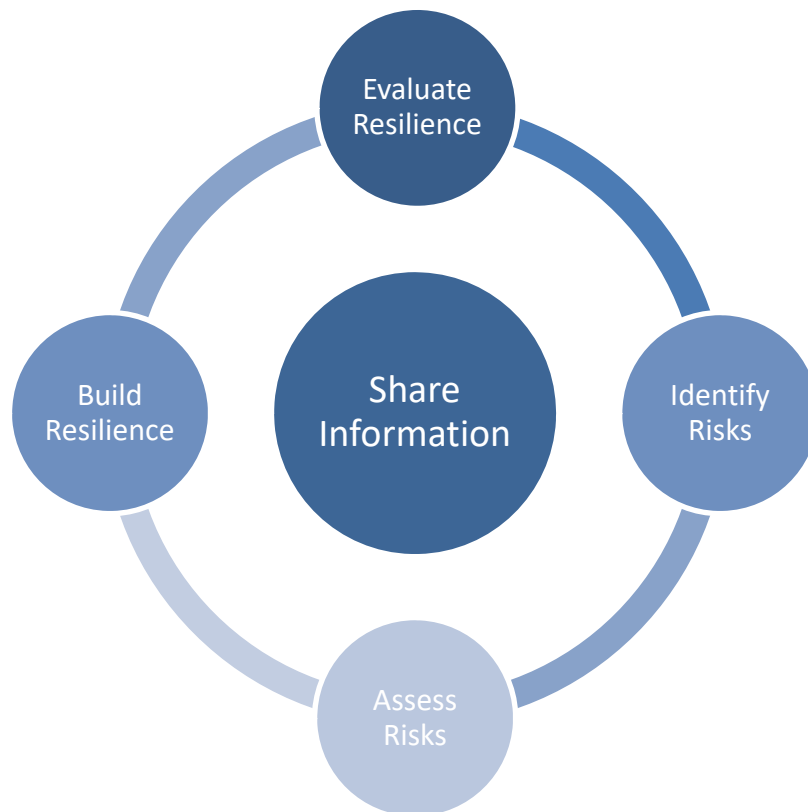


Figure 38: Resilience cycle

Source: Adapted from López *et al.*, (2015:237).

The most important information obtained (Barcelona City Council, 2008b) from the process was the detection and definition of the critical services supply:

- electricity supply
- water supply
- fuel supply
- telecommunications
- mobility
- water waste
- social services
- health services
- food
- waste management
- infrastructure management

Opticits (2015:5) states that at the end of the 3S's Project (2009) 40 areas were identified as the ones where resilience had to be improved. As a result of this diagnosis the Mayor created an intersectoral body named TISU (Taula de Infraestructuras de Serveis urbans). The successes from this project include:

- the identification of 40 improvement areas;
- creation of a permanent resilience board;
- revamping the Operations Centre;
- reduction of the recovery time; and
- significant savings.

After this project, Barcelona's awareness towards resilience continued to grow. This project helped to define risks and made a diagnosis to design strategies and projects in order to protect the city's infrastructure. The following section includes some examples of the actions that have been drawn up, implemented or are underway in Barcelona's resilience plan.

Figure 39 indicates the experiences which were the basis where the resilience strategy of the city were founded, and gained the recognition of organizations such as UNISDR or UN-Habitat. Currently, in view of an urban future where resilience will be crucial, and with global stakeholders such as the Rockefeller Foundation selecting Barcelona as one of the 100 Resilient Cities-, municipal city managers keep embracing this concept (Opticits, 2015:7). In 2015, following the policies and actions to improve the resilience of the city, Barcelona City Council awards OPTICITS conducting an analysis and management resilience project through HAZUR Resilient Systems platform in a particularly critical area of the city.

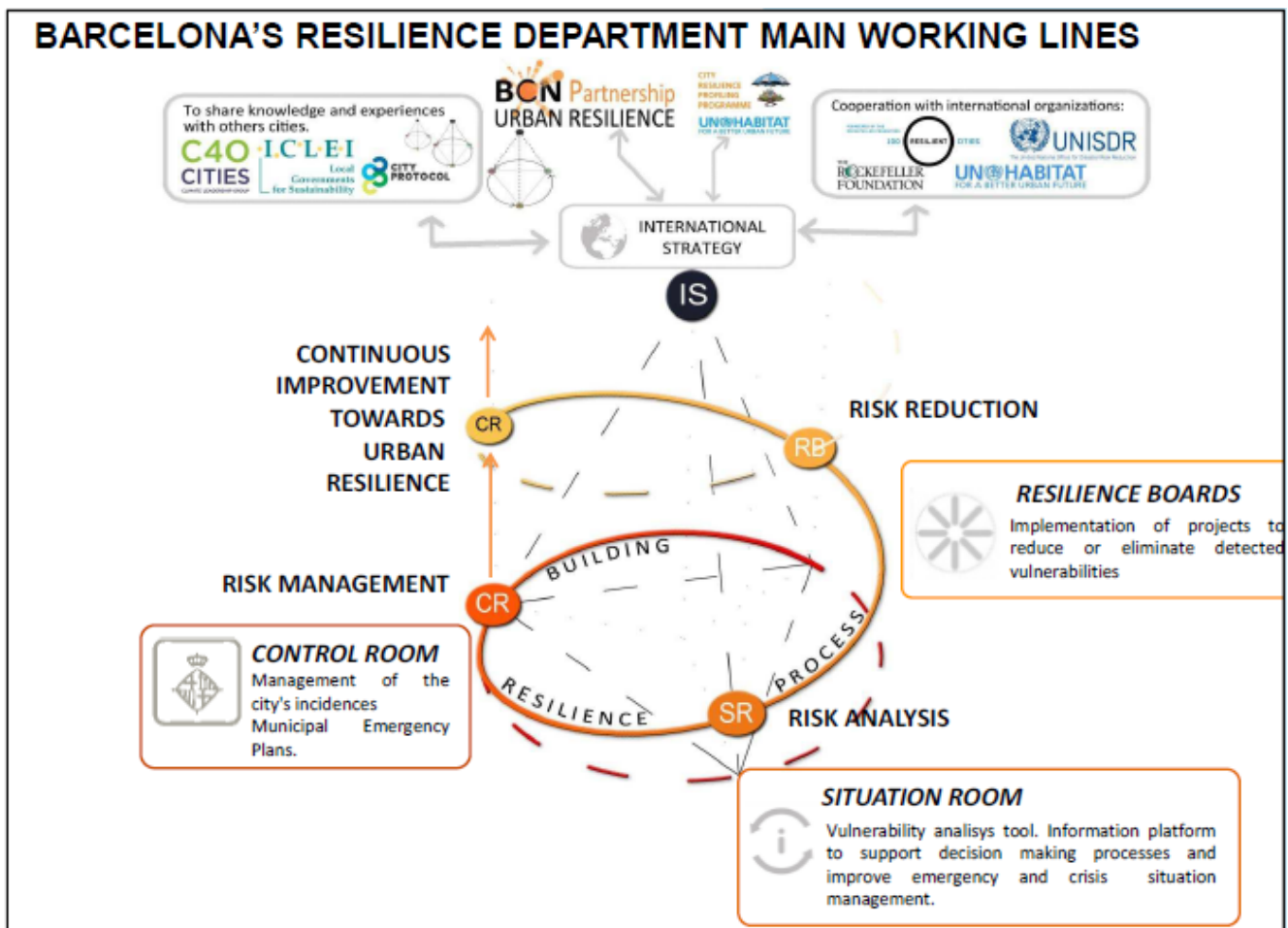


Figure 39: Resilience in Barcelona

Source: Opticits (2015:6)

Opticits (2015:6) states that this project can be considered as the final conclusion of all the work done to date, bringing together all the accumulated knowhow over the previous years.

Main objectives of the project includes (Opticits, 2015:9):

- offer tools for carrying out the decision making process ahead of crises and for preventing future crises;
- allow the management of crisis situations in real-time by monitoring the variables detected in the previous resilience study;
- provide a Resilience Map that visually shows the state and the interdependencies between services and infrastructures of the city;
- foresee future crisis situations; and
- allow users to learn and improve the resilience of a urban System.

Although these projects in Barcelona seem to be very good concepts, there is no definite relationship or linkage with land use as a tool towards urban resilience as defined in Section 3.5.2.

There is much attention given to resilience in terms of natural or environmental disasters and crises, but urban resilience in terms of the combination of types of land uses is still neglected.

5.3.1.5 The application of urban land use planning

Barcelona's urban development follows the model of a compact and dense city (refer to Section 3.3.4); therefore, it is highly sustainable and efficient regarding the relationship between land occupation and services supply. However, like most historical settlements, it has grown overwhelmed by the pressure of the population due to increasing urbanisation pressures (Opticits, 2015:1).

Opticits (2015:1) states that Barcelona's land uses are influenced by the grid pattern as well as the nature of the goods offered, disruptions that occur in the grid or by planned infrastructures that act as "magnets" such as municipal markets or hospitals, and by the city's cultural particularities. They suggest that in Barcelona's perfect grid, land use patterns seem to be influenced by the operation of agglomeration, base rent and central place principles.

Barcelona is the capital city of the autonomous community of Catalonia in the Kingdom of Spain and therefore the planning policies will consist mainly of those of Catalonia. Viguer (2009:9) states that Catalonia's planning system was laid down by Act 23/1983 of 21 November on Territorial Policy¹⁰ ("TPA"). The TPA was enacted in order to balance out the existing differences in the Catalan territory, which had been caused by the major economic and demographic growth in coastal areas and the larger cities at the expense of inland areas.

The main objectives of the TPA includes to (Viguer, 2009:9):

- balance out the distribution of growth;
- organize developments in order to achieve greater economic efficiency and a better quality of life; and
- promote economic growth and tackle unemployment.

The Catalan system of planning can be summarized as follows:

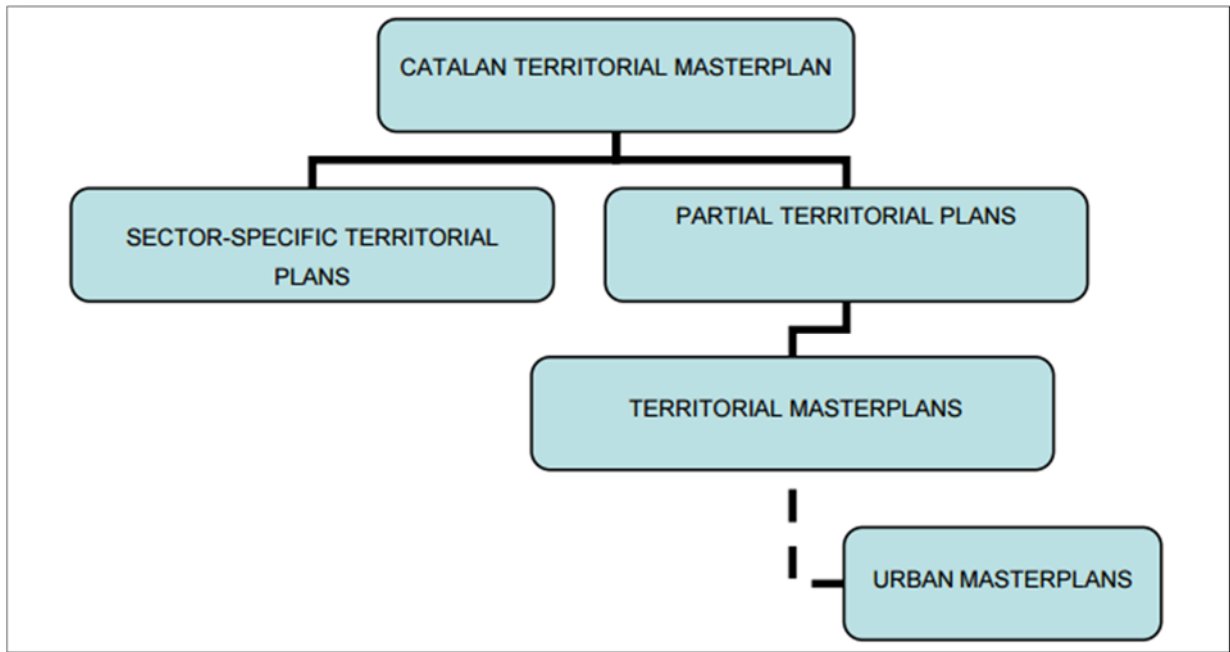


Figure 40: The Catalan Planning System

Source: Viguer (2009:9).

The following sections will provide a brief discussion of the planning system of Catalonia and provide the contribution to land use planning where applicable (Viguer, 2009:9-17).

5.3.1.5.1 Catalan Territorial Masterplan

The Catalan Territorial Masterplan is the overarching plan that lays down the general objectives of territorial policy in Catalonia. The masterplan includes the following:

- A definition of homogenous areas in Catalonia, taking into consideration their potential growth and socioeconomic situation. The homogeneous areas can be defined as: depressed areas, development areas or congested areas.
- Identify those cities that will have a significant role in the development and balancing strategies.
- Identify natural, forest and agricultural areas that should be preserved.
- Define the location of large infrastructures, such as transportation, energy, water treatment and public interest facilities.
- Define areas that should be devoted to specific uses (i.e. large logistics centres).
- Define the scope of the Partial Territorial Plans.

5.3.1.5.2 Territorial Partial Plans

The Catalan Territorial Masterplan defines seven functional areas in Catalonia, which are made up of a central city and its dependant urban settlements. The purpose of the Partial Territorial Plans is to develop the provisions of the Catalan Territorial Masterplan in each functional area, and to define their own territorial objectives. According to the TPA, the Partial Territorial Plans should:

- Define settled areas that may be suitable for the installation of regional facilities.
- Identify natural areas of interest.
- Define agricultural and forest areas that should be preserved or enlarged.
- Identify infrastructures.
- Protect buildings and natural sites of historic or artistic value.
- Estimate socioeconomic growth.
- Propose urban planning guidelines.

5.3.1.5.3 Territorial Masterplans

Territorial Masterplans were introduced in the Catalan regional system in 2002. They are a flexible type of regional plan, since their territorial scope range from supra-municipal to the functional areas that are assigned to the Partial Territorial Plans. The content of Territorial Masterplans is also broadly defined. According to the TPA, they aim to complete the provisions of the Catalan Territorial Masterplan in some specific matters.

5.3.1.5.4 Sector-Specific Territorial Plans

The Catalan planning system foresees an independent category of plans, the so called Sector-Specific Territorial Plans, which sets out the policies of the Regional Ministries that are of territorial significance. Despite their limited perspective, Sector-Specific Territorial Plans have an important role in practice, as they may regulate the structure of territorial elements.

According to the TPA, Sector-Specific Territorial Plans should regulate the available resources, and the requirements and deficiencies in the specific sector throughout Catalonia.

5.3.1.5.5 Urban Masterplans

Urban Masterplans are strictly included in the urban planning system, however their scope and contents are close to those of the regional plans. Urban Masterplans always cover supra-municipal areas, with their range depending on the regional policy aims pursued. According to the Catalan Urban Planning Law¹⁷, Urban Masterplans should set:

- coordination guidelines for local urban planning;
- provisions regarding sustainable development growth and transportation;
- rural land protection rules;
- the location of major infrastructures; and
- supra-municipal social housing policies planning.

The Catalan Government has approved Urban Masterplans in order to promote the development of new urban nodes in certain areas, protect areas with special natural and cultural heritage values, and protect highly urbanised inland and coastal areas.

5.3.1.5.6 The Municipal Urban Plan

This is still the central element of the planning system, since it sets out the detailed land laws for all the municipality. However, the municipal territory can not be planned as an isolated entity with sole reference to local criteria. Urban settlements and natural areas are interdependent and can not be dealt with separately. The limited scope of municipal plans can lead to inefficiencies and territorial tensions.

Municipal urban plans provide for:

- Specific planning provisions concerning land use
- Building rights and specific developments
- the local sustainability strategy

This is the only level of planning which addresses land uses and therefore it is important for the purpose of this study. From this level the focus will be on a specific municipal project in Barcelona which is regarded as a great success within the city.

5.3.1.5.7 22@Barcelona Plan

The 22@Barcelona project which involves the transformation of 200 hectares of land in the centre of Barcelona was approved by the Barcelona City Council Ajuntament de Barcelona (2012:2). The project entails an urban refurbishment plan that aims to transform the industrial land into an innovative productive district. It includes the creation of a diverse and balanced environment with production centres, social housing, facilities and green spaces aimed at improving the quality of life and workplace (refer to Section 3.5.4).

Ajuntament de Barcelona (2012:2) reveals that the urban improvement around the Glories square is transforming 38Ha of land. Through this renovation the city will gain 17,000 m² in green spaces, 50% of the total foreseen government protected housing and eight new public

installations. At the same time, it is being proposed a new road solution that includes tearing down the current overpass and building a new, underground entrance and exit to the city.

The extraordinarily central location of the project, both with respect to the city and its metropolitan area, is one of its main assets. The elements which create centrality and connection (refer to Section 3.5.4) at a metropolitan, national and international level become one of the keys in the attraction of multinational innovative activities Ajuntament de Barcelona (2012:3).



Figure 41: Location and area of the 22@Barcelona Project

Source: Ajuntament de Barcelona (2012:3)

Due to the comprehensive transport network, the 22@Barcelona district offers excellent all round access with various public transport facilities including La Ronda del Litoral (coastal ring road), The Metro, The Tram, The new metropolitan railway station, The High Speed Railway Station and Bicing bicycle services.



Figure 42: La Ronda del Litoral (coastal ring road)

Source: Ajuntament de Barcelona (2012:5)



Figure 43: The Tram

Source: Ajuntament de Barcelona (2012:5)



Figure 44: Bicing bicycle services

Source: Ajuntament de Barcelona (2012:5)

Ajuntament de Barcelona (2012:6) states that in order to create a new city model the 22@ Project is bringing the old industrial fabric into the current era through a progressive transformation, taking place over approximately 20 years, that adapts to both the area's pre-existing elements and its new needs (refer to Section 3.5.1).

They indicate that the 22@Barcelona Project overcomes the low density that characterizes traditional industrial zones and opts for a dense and complex urban space (refer to Section 2.3.3.1), allowing for more efficient land use and creating an environment where different urban agents can interact and exchange information and generate the critical mass necessary to develop an agglomerative economy.

The new city model is based on Ajuntament de Barcelona (2012:9):

- Efficient land uses, overcoming low density

- System of incentives that allow for better exploitation of this sector's urban areas,
- Urban regeneration in order to create new green areas, amenities and subsidized housing.
- High-quality urban model that is compact, diverse sustainable, because the resulting city will be more balanced, more heterogeneous, more ecologically efficient, more cohesive and more economic powerful activity clusters

With key points focusing on density, diversity and complexity, and flexibility as subsequently discussed Ajuntament de Barcelona (2012:9):

- **Density**

A compact city favors synergies between urban agents and allows for more rational land use; for this reason, the transformation of industrial areas includes a higher building index, which attracts real-estate developers and allows them to contribute financially to the sector's new infrastructures. The project overcomes the low density that characterizes

traditional industrial zones and increases the area's building index.



Figure 45: Subsector 9 and 9 (present)

Source: Ajuntament de Barcelona (2012:10)



Figure 46: Subsector 8 and 9 (future)

Source: Ajuntament de Barcelona (2012:10)

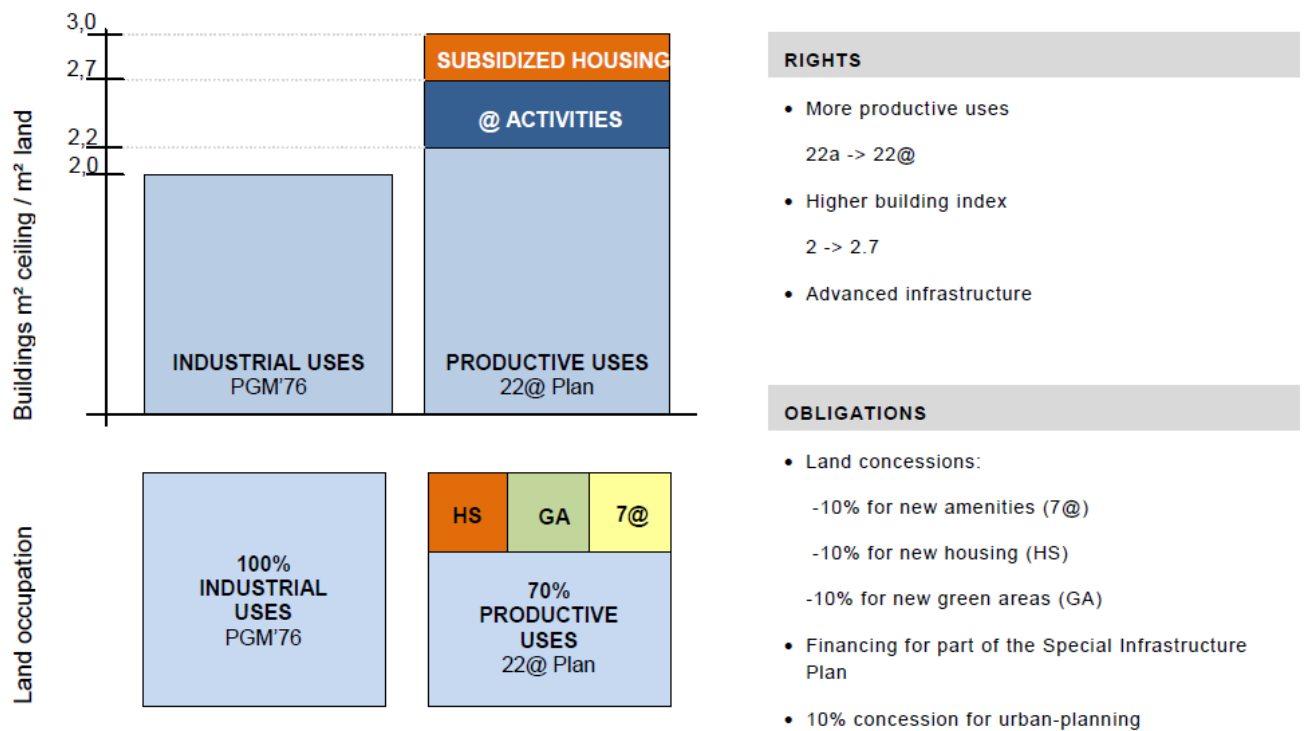


Figure 47: Density rights and obligations

Source: Ajuntament de Barcelona (2012:10)

Figure 47 indicates that precinct area has very specific regulations regarding density rights. Provision is made for subsidized housing, green areas and productive uses, which may contribute to efficiency and resilience.

- **Diversity and Complexity**

Urban complexity favours information exchange and creates a more sustainable city because it allows people to live near their work, fosters social cohesion and guarantees the vitality of public spaces throughout the day. The 22@ project establishes that each plan to renovate industrial land for use in new productive activities must generate space for amenities, subsidized housing and green areas that contribute to the social development of the Poblenou area and improve quality of life.

The coexistence of different uses belongs to the current conception of the contemporary urban planning, unlike the "zoning" carried out during the 50's and 60's around Europe, betting on the specialization of the territory. Nowadays, the mixture of uses is one of the fundamental bases to city-making all around the world, and the 22@ Plan is a precursory Plan in this aspect.



Figure 48: Lluís Companys Poblenou (past)

Source: Ajuntament de Barcelona (2012:11).



Figure 49: Lluís Companys Poblenou (past)

Source: Ajuntament de Barcelona (2012:11).

- **Flexibility**

The 22@ project has been designed to allow for a progressive regeneration of industrial areas so that they can adapt to the different urban-planning, economic and social needs of each part of the area.



Figure 50: Can Framis (past)

Source: Ajuntament de Barcelona (2012:12).



Figure 51: Can Framis (present)

Source: Ajuntament de Barcelona (2012:12).

The project aims to achieve the above through (Ajuntament de Barcelona, 2012:12):

1. *Industrial Heritage*: preserving a total of 114 elements which will help guarantee the preservation of this historical and cultural legacy.
2. *Activities*: the 22@Barcelona project gives incentives to innovative activities that, together with the neighbourhood's traditional activities, create a rich and varied productive fabric that favors competitiveness in all businesses.
3. *Public Amenities*: The @22 project establishes that 10% of the transformed land be reserved for public amenities, called 7@amenities.
4. *New Housing*: The 22@Barcelona project decisively opts for a mix of space dedicated to production and new housing, allowing people to live close to their workplace and favouring the development of local shops and trade, thereby ensuring the vitality of the area throughout the course of the day.
5. *Public Space*: The 22@Barcelona project allocates 10% of what was previously industrial land to new green spaces (114,000 m²), while also establishing the highest standards of quality for the district's streets and public spaces.
6. *Infrastructures*: The 22@Barcelona project allocates 10% of what was previously industrial land to new green spaces (114,000 m²), while also establishing the highest standards of quality for the district's streets and public spaces. The new infrastructure plan represents a total investment of over 180 million and provides the sector with a modern power supply grid, centralized climate control and pneumatic refuse collection systems. The design of such new grids and networks places the emphasis on energy efficiency and the responsible management of natural resources, while also providing for significant improvements to be made to the diverse urban services and utilities.



Figure 52: 22@Barcelona projects aspects

Source: Ajuntament de Barcelona (2012:12)

From the above section it is clear that Barcelona makes provision for several aspects that lead to improved urban resilience. Specific attention is given to smaller precinct areas which encourage effective implementation. This section will contribute to completing a SWOT analysis in chapter 6, which will assist in determining the lessons learnt from Barcelona.

5.3.2 India

India, also known as Bharat, is a Union of States. It is a Sovereign Socialist Secular Democratic Republic with a parliamentary system of government. The Republic is governed in terms of the Constitution of India which was adopted by the Constituent Assembly on 26th November 1949 and came into force on 26th January 1950 (National Portal of India, 2016).

5.3.2.1 Current guidelines in India

India has a unique planning system which can be divided into two types of planning systems (Kulshrestha, 2013: 3). Figure 53 indicates the different levels with its respective aspects.

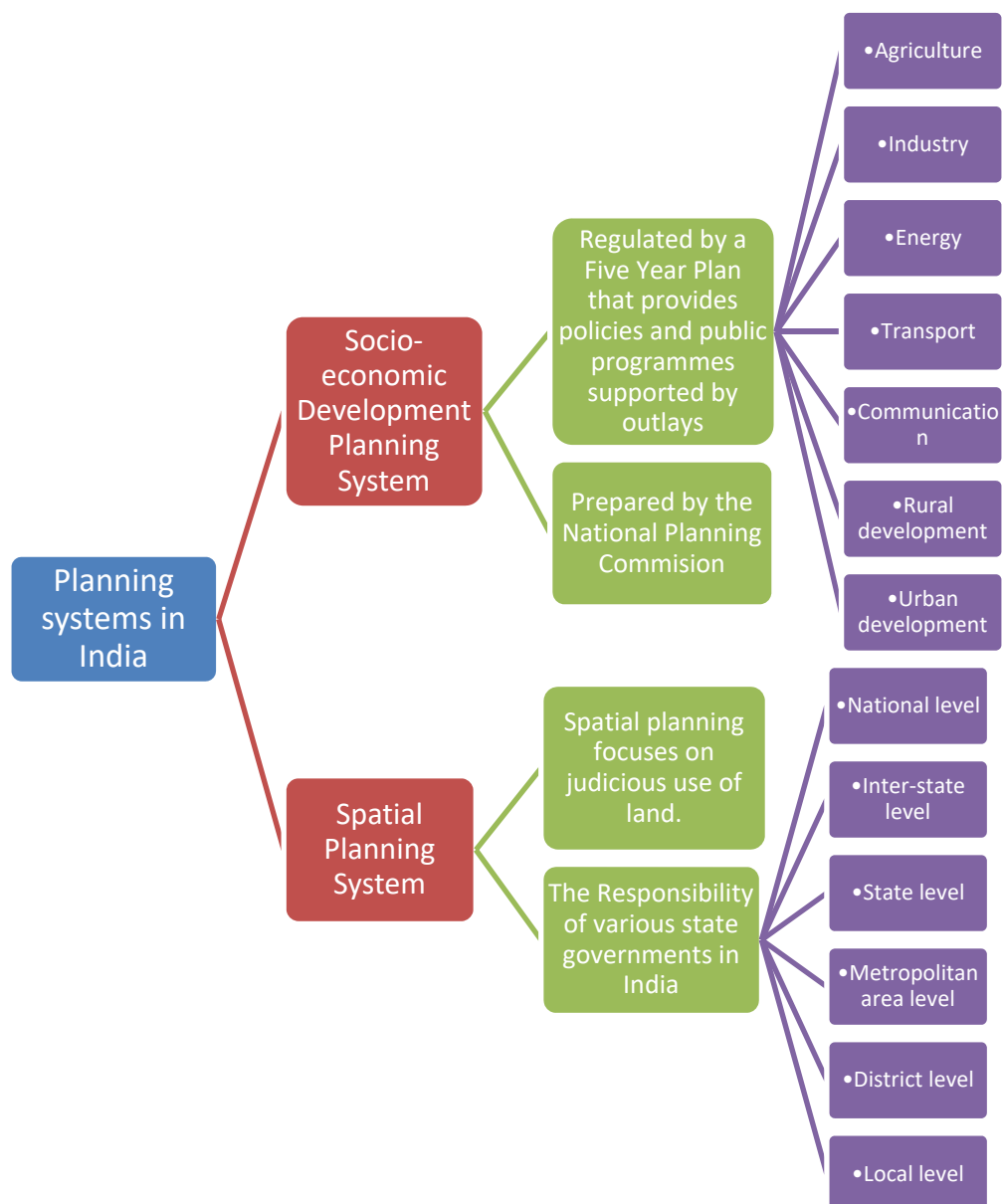


Figure 53: The Planning System of India

Source: Adapted from Kulshrestha (2013).

For the purpose of this study, the Socio-economic Development Planning will be studied and the national planning guidelines will be provided from the analysis.

The strategy for the Twelfth Five Year Plan will be focused on strengthening the five enablers for urbanisation (i) governance, (ii) planning, (iii) financing, (iv) capacity building and (v) innovation (Figure 54).

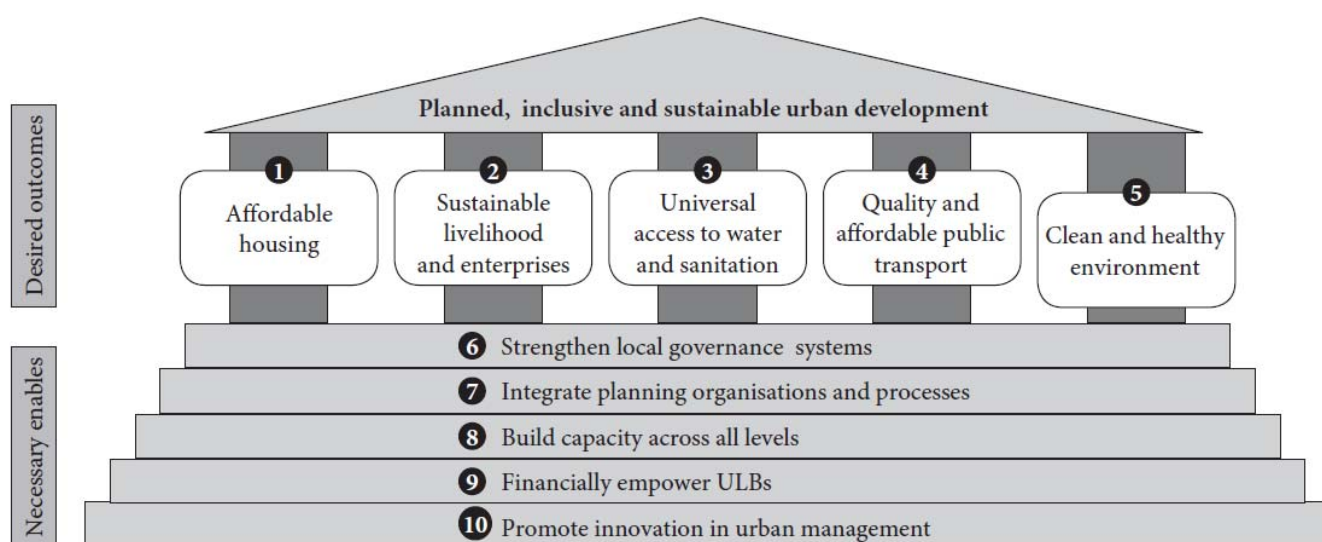


Figure 54: Key Constitutes of India's Urban Future

Source: National Planning Commission of India (2013).

For the purposes of this study, specific focus will be on the planning aspect. The principles applicable are contained in the Twelfth Five Year Plan (2012–2017) under “Urban development”. The following table provides the principles that are found in this document and are applicable to the urban development principles.

Table 13: National Planning Principles of India

Densification	Strategic densification should take place especially along mass transit corridors and mixed land use. This planning strategy should be pursued to accommodate future urbanisation and combat urban sprawl.
City Mobility	This principle is planned with special emphasis of making cities safe for vulnerable groups including women and children, pedestrians and cyclists.
Open spaces	Create public spaces that will promote sport and fitness activities.

Public Participation	Create a core participatory process and address the needs of citizens more holistically.
Growth Corridors and New Cities	New cities may be planned to nurture emerging growth nodes in the urban landscape. The success of new cities is dependent on factors like their proximity to, as well as connectivity linkages, therefore the Ministry of Urban Development should identify such corridors and nodes with potential and facilitate their development.
Zoning	Encourage State and local Governments to define zoning of land and marking them for different uses in order to reduce urban poverty through inclusionary zoning (old age homes, orphanages, working hostels, night shelters and so on).
Sustainable Livelihoods	This refers to proactive and mandatory creation/allocation of spaces within city boundaries to ensure livelihood opportunities to the urban poor and to ensure the provision of basic services to the urban poor, especially through rehabilitation of slums.

Source: Adapted from National Planning Commission of India (2013)

This table presents a background for understanding the national planning aspect of India and also assists in the comparison of the different case studies to one another.

5.3.2.2 New Delhi

New Delhi is the capital of India and it is also a municipality and district in Delhi that serves as the seat of Government of Delhi. Much of New Delhi, planned by the leading 20th-century British architect Edwin Lutyens, was laid out to be the central administrative area of the city as a testament to Britain's imperial pretensions. New Delhi is structured around two central promenades called the Rajpath and the Janpath (Dehli Development Authority, 2007:2).

The Delhi Development Authority (2007:3) maintains that Delhi is the socio-economic and political focus of India. It serves as a symbol of ancient values and aspirations and is the capital of the largest democracy. Growing at an unprecedented pace, the city needs to be able to integrate its sophisticated past as well as the modern developments into an organic whole, which demands a purposeful transformation of the socio-economic, natural and built environment.

- 3) The principle of common but differentiated responsibilities;
- 4) The principle of the precautionary approach to human health, natural resources and ecosystems;
- 5) The principle of participation and access to information and justice;
- 6) The principle of good governance; and
- 7) The principle of integration and interrelationship, particularly in relation to human rights and social, economic and environmental objectives.

There is no further information on the application or integration of these principles in the planning policies of New Delhi.

5.3.2.3.2 Resilience

New Delhi does not focus on the integration of urban resilience, and it does not have any concrete policies and legislation which are directly concerned with the integration and improvement of urban resilience. There are some of other planning principles which may contribute indirectly to urban resilience, however, there are no specific reference to the term. The city is not part of the 100RC neither has it committed itself to any real policies in terms of urban resilience. Although the first developments in this aspect occurred in 2014, it is however very limited and focuses mainly on resilience in terms of disasters and risk management regarding environmental aspects.

5.3.2.4 Mechanisms for moving towards Resilience

New Delhi conducted a Resilience Action Plan in 2014 which consists of ten essentials, each with objectives and actions. The ten essentials include (New Delhi, 2014:1-7):

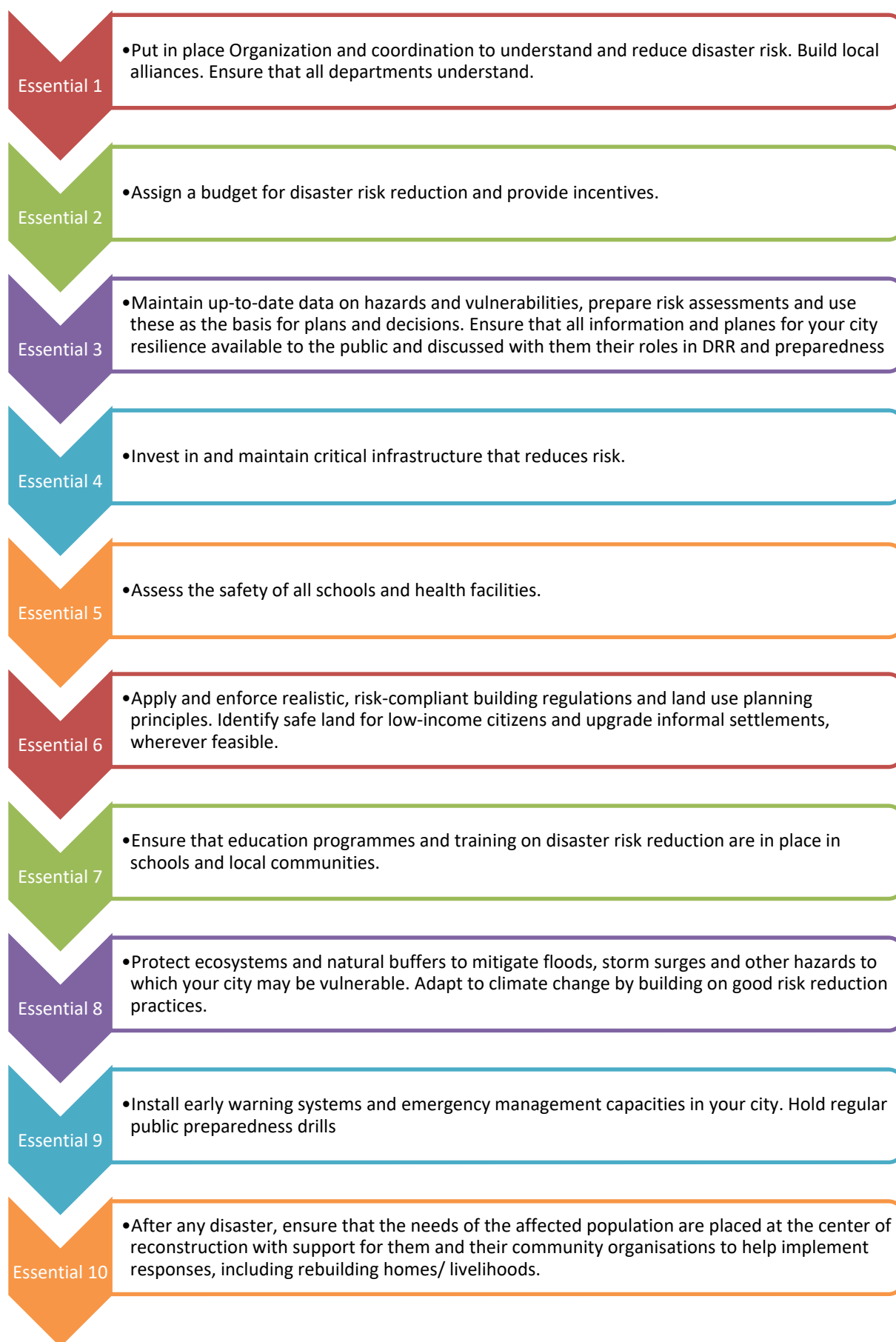


Figure 56: The ten essentials of the New Delhi Resilience Action Plan

Source: Adapted from New Delhi (2014)

As far as the researcher is aware, this appears to be the only resilience strategy of New Delhi. It is clear that this action plan only focuses on resilience in terms of risk management as there is no reference or linkage to urban resilience in terms of the combination of different types of land uses.

5.3.2.5 The application of urban land use planning

The Master Plan for Delhi is supposed to be the main policy document for this purpose, a legally enforceable text which lays down the planning strategies and development controls applicable to the city (Delhi Development Authority, 2007:2).

This plan is divided into several sections. The sections applicable to this study will be discussed in the following divisions. This will assist to determine to which level land use planning is maintained. The sections include:

- Delhi Urban Area-2021
- Urban Design
- Mixed use regulations
- Land use plan
- Development Code

5.3.2.5.1 Delhi Urban Area-2021

This section includes a brief discussion about the land use policy in the city with focus on special areas and the unplanned areas.

The plan includes a three-pronged strategy to deflect in the National Capital Region (NCR) towns, this includes (Delhi Development Authority, 2007:17):

- to encourage the population to deflect in the NCR towns;
- to increase the population holding capacity of the area within existing urban limits through redevelopment; and
- extension of the present urban limits to the extent necessary.

Important aspects that they aim to improve by 2021 include the following (Delhi Development Authority, 2007:21):

- re-densification of housing areas developed at lower densities and along selected sections of the Metro corridor;
- redevelopment strategies will be prepared for targeted areas that need renewal and upgradation; and

- re-densification of low density areas within under-used land as well as dilapidated built-up areas lying vacant in the city.

Densification and urban renewal are two aspects that stand out from this section. These two aspects may contribute to the efficiency and resilience of the Delhi urban area (refer Sections 3.5.1; 3.5.4) .

5.3.2.5.2 Urban Design

This section identified aspects that need to be considered to arrive at the basis of policies affecting the urban design, these aspects include (Delhi Development Authority, 2007:105):

1. visual integration of the city (refer Section 2.3.3.3);
2. policy for tall buildings (refer Section 2.3.3.1);
3. policy on unhindered access movement, parking and pedestrian realm;
4. policy on Hoardings, Street furniture and Signage;
5. urban Design Scheme;
6. policy for design of pedestrian realm;
7. city structure plan and Urban Design objective; and
8. policy for conservation of Heritage precincts Buildings and Zones.

Two other important aspects that are referred to in this section are visual integration and urban corridors (refer to Section 2.3.3.4). They aim to achieve visual integration by identifying features such as appropriately conserved historic buildings and heritage zones, which integrate and provide strong visual identity (refer to Section 3.5.4). They focus on improving urban corridors through imperatives such as more dependency on efficient, convenient and safe modes of public transport, linking large number of work centres with residential areas and overall disincentives for the private vehicle ownership (Delhi Development Authority, 2007:107).

5.3.2.5.3 Mixed use regulations

It includes the following governing principles for mixed use (Delhi Development Authority, 2007:176):

- mixed use means the provision for non-residential activity in residential premises (refer Section to 2.3.3.3).
- the policy aims to balance the socio-economic need for its activities with its environmental impact in residential areas.

- mixed use allows access to commercial activities in the proximity of the residences and reduces the need for commuting across zones in the city.
- the over-riding principles for permitting mixed use are the need to acknowledge and make adequate provision for meeting community needs, mitigating environmental impact and providing for safe and convenient circulation and parking.
- mixed-use, (including small shops) shall not be permitted in the Lutyens' Bungalow Zone

5.3.2.5.4 Land use plan

The Land Use Plan-2021 has been prepared based on (Delhi Development Authority, 2007:191):

- the policies enunciated for different urban activities;
- requirement of additional social and physical infrastructure;
- transportation and work centres; and
- already approved Zonal Development Plans and land use modifications.

In order to control the development, the areas have been designated as one of the 27 use zones identified in the Development Code. These use zones have been classified broadly in nine categories of land uses namely:

- | | |
|--------------------|------------------------------|
| 1. Residential; | 6. Utility; |
| 2. Commercial; | 7. Government; |
| 3. Industrial; | 8. Public Facilities; and |
| 4. Recreational; | 9. Agriculture & Water Body. |
| 5. Transportation; | |

The development in these Use zones would be carried out in accordance with the regulations as laid down in the Development Code and respective chapters.

5.3.2.5.5 Development Code

The purpose of the code is to promote the quality of built environment by organising the most appropriate development of land in accordance with the development policies and land use proposals contained in the Plan.

It is a systematic code to ascertain the use activity (use) at two levels (Delhi Development Authority, 2007:194):

- i. conversion of Use Zone into Use Premises (layout); and
- ii. permission of Use Activities on Use Premises. The code differentiates between the Use Zone and Use Premises.

Although New Delhi does not have any specific policies and principles which are aimed at improving the integration and implementation of urban resilience, it includes various planning policies and tools which may contribute to urban resilience. These tools include mixed land uses, urban renewal, quality environment,, integration and walkability (refer Sections 3.5.1;3.5.4;6..3.1;6.3.2). From the above section it is apparent that India has proper planning principles in place which may lead to efficient and resilient urban areas if implemented effectively.

5.4 South African Case Study

This section will examine Durban as the South African case study. Note that the National legislation of South Africa has been dealt with in Section 4.2, and will therefore not be repeated in this section (refer Section 4.2).

The goal is to determine the national standard of South Africa to measure it in terms of the international standard determined in Section 5.3. The first part will study the existing guidelines in Durban regarding land use planning and resilience.

The main aspects to be studied during the case study include: (i) sustainability and resilience timeframe, (ii) mechanisms for resilience, and (iii) the tools used.

The purpose is to compare South Africa with international developed and developing cities, to determine how advanced South Africa's planning and policies are in terms of urban resilience and land use planning and potentially emanate practices from other cities and countries that can be applied in a South African context.

5.4.1 Durban

eThekweni (Durban) is the largest City in KwaZulu-Natal and the third largest city in the country. It is a sophisticated cosmopolitan city of over 3, 442 398 people. It is known as the home of Africa's best-managed, busiest port and is also a major centre of tourism because of the city's warm subtropical climate and extensive beaches (eThekweni Municipality, 2016a).



Figure 57: Map of Durban

Source: Google Maps (2016c)

5.4.1.1 Spatial Planning Background

The Durban metropolitan area is characterized by high levels of unemployment and poverty due to historical marginalization of the poor. The country's legacy of apartheid or separate development of the various race groups, resulted in highly racialized socio-economic segregation. and led to various social and spatial problems. Today this city is challenged by various spatial planning inefficiencies in terms of unintegrated separated and segregated areas. Certain areas, services and facilities are highly inaccessible and ineffective. Similarly, there is a lack of connectivity, integration and unity. Long travel distances to work and other amenities result in increased traffic, increased costs and increased pollution. Public transportation is not accessible to all, therefore, contributing to inefficiency and non-resilient cities. Migration to the city leads to a lack of space and housing that causes urban sprawl to increase. It is important that these issues are addressed by solutions that will lead to increased efficiency and urban resilience. The eThekweni has set up frameworks and guidelines to address these problems. By 2030, eThekweni aims to be a socially equitable, environmentally sustainable and functionally efficient Municipality that bolsters its status as a gateway to Africa and the world.

5.4.1.2 The origin of the paradigm shift towards sustainability and resilience

The following section provides a brief overview of the history of sustainability and resilience within Durban. It serve as a basis to determine how advanced this city is in terms of these two aspects.

5.4.1.2.1 Sustainability

In the past 20 years Durban has been shaped by both globalisation and post-apartheid restructuring, through processes of pro-growth urban regeneration and social transformation. Simultaneously, sustainability has emerged as a critical concept in the development and management of the city (Hannan & Sutherland, 2015: 207).

A sustainability agenda emerged in the city in the late 1990s, which was taken up in the early 2000s by the then city manager. In 1994, Durban appointed its first environmental manager who, with the Urban Strategy Department initiated a sustainable development process by increasing local support for Local Agenda 21 and securing the involvement of the World Bank. The main objectives of the sustainable development process were to develop sustainable development strategies and action plans for the city and to use Local Agenda 21 as a policy framework to guide metropolitan development and decision making (eThekweni Municipality, 2016b). This agenda has been incorporated and re-shaped in the Municipality over the past 18 years and is evident in its Integrated Development Plan (IDP).

Patel (2000:389) proffers that sustainability has become a central concept in urban planning in many South African cities, albeit a politically challenging one, being used as a means to holistically address complex urban challenges. Urban planners in Durban argue that it is crucial for this concept to be integrated into development and planning initiatives in the city, however, it is difficult to achieve due to its complexity, and the context of the city's social history (Rothaug, 2006:?). Over the past decade, the city has witnessed dramatic changes in its landscape due to urban regeneration initiatives driven by the local, provincial and the national state (Robbins, 2014:?).

Today, Durban is well known internationally for its development and sustainability of the environment. The Energy Department at eThekweni Municipality runs numerous initiatives towards sustainable living such as the Sustainable Living Exhibition, and grassroots agricultural enterprises in Umbumbulu. Durban is a city committed to creating a climate friendly and sustainable environment. Numerous projects have been conducted to ensure that we remain responsible and environmentally friendly in our approaches to doing business (eThekweni Municipality, 2016b).

5.4.1.2.2 Resilience

At the end of 2013, Durban was selected as one of the first 32 cities to be included in the Rockefeller Foundation's international 100 Resilient Cities Programme (100 RC). The development of a 'Resilience Strategy' is a key output from Durban's participation in 100RC (eThekweni Municipality, 2016b). This programme is being coordinated by eThekweni Municipality.

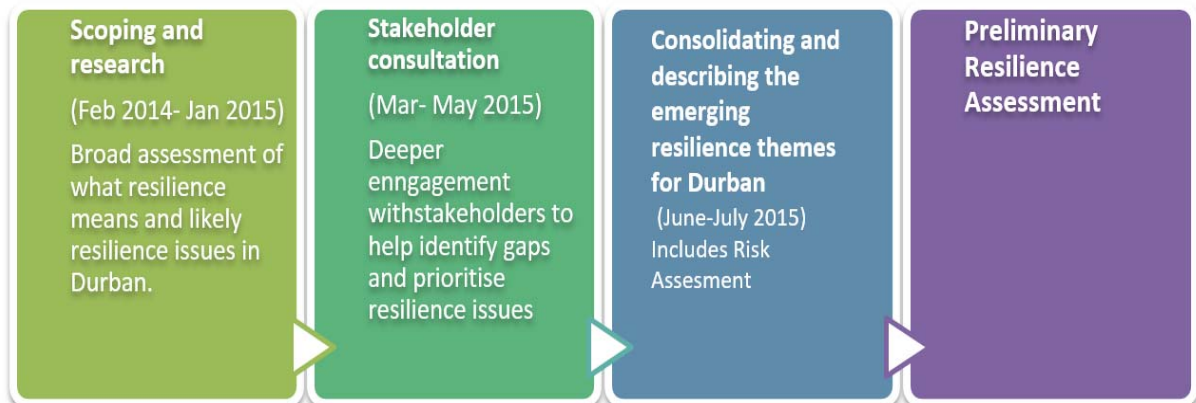


Figure 58: Durban's process towards developing a Preliminary Resilience Assessment

Source: Adapted from eThekweni Municipality (2015b)

Durban's resilience journey (Figure 58 and 59) began with a scoping and research phase in 2014 to understand some of the key resilience challenges in Durban. Durban stakeholders identified a number of issues which will play a critical role in either enhancing or undermining resilience (eThekweni Municipality, 2015:2b). Given the importance and interconnectedness of the key resilience issues, it was decided that all sixteen resilience issues should be taken forward into the Phase 2 and serve as the focus areas. This was done through the identification of 'clusters of issues' based on linkages that exist between the various resilience issues. Section 5.4.1.3 elaborates on the focus areas.

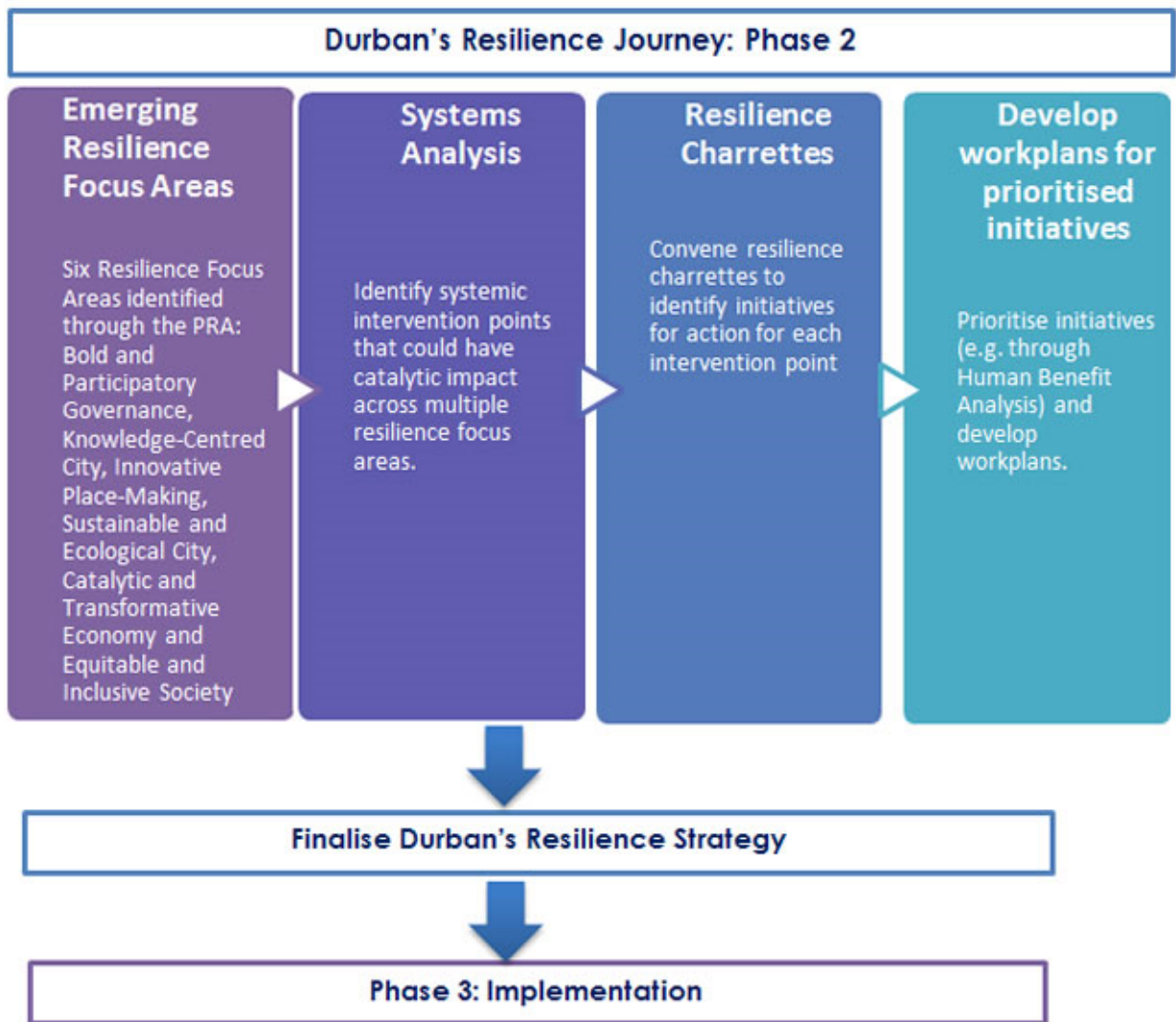


Figure 59: Durban's resilience journey for Phase 2

Source: eThekweni Municipality, 2015b

During the key steps identified in the project the resilience focus areas and issues raised will require systemic interventions and should be broad and systemic in nature. The first step for Phase 2 of 100RC in Durban is to conduct a systems analysis to deepen the understanding the resilience focus areas and issues and their underlying causes (eThekweni Municipality, 2015). This will assist in identifying key intervention points for action and in the development of a range of solution options to address each of the key intervention points (Figure 60).

The eThekweni Municipality (2016) states that the systems analysis work started in January 2016 and an introductory workshop was held on the 20th January 2016.

5.4.1.3 Mechanisms for moving towards Resilience

The Resilience Focus Areas and Issues (identified in the first phase) will form the basis for the resilience strategy development. Durban's resilience focus areas and issues are shown below:

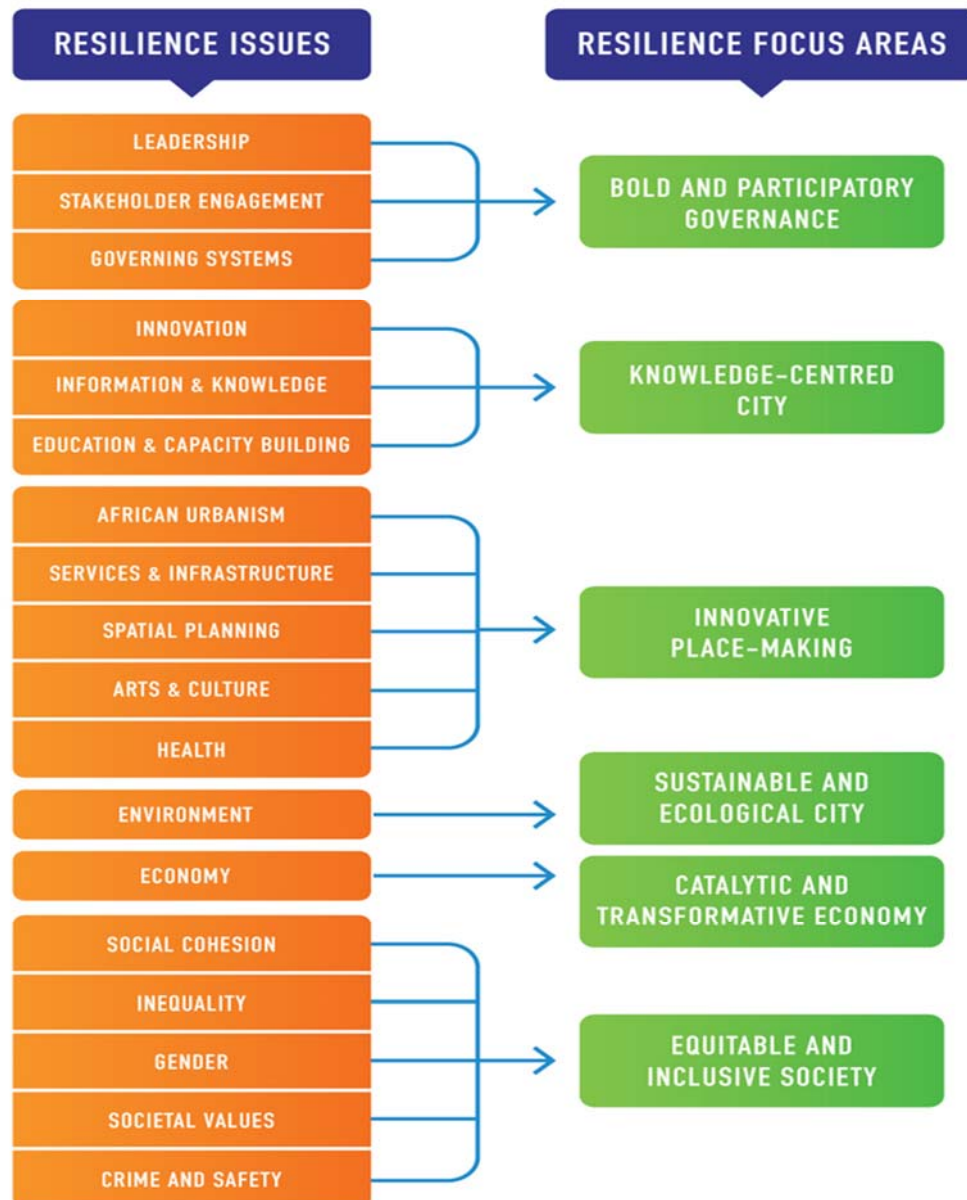


Figure 60: A summary of the resilience issues emerging for Durban

Source: eThekweni Municipality 2015a

Although there are six identified focus areas or mechanisms (see Figure 60), only two are applicable for the purpose of this study. These two include: (i) Innovative place-making, and (ii) Sustainable and ecological city. The subsequent section provides a discussion of the two applicable focus areas:

(i) Innovative place-making

Five subsystems are identified within this focus area (as shown in Figure 61).



Figure 61: Innovative place making and its subsystems

Source: eThekwin Municipality 2015a

It is necessary to realise the unique opportunity provided by Africa's urban transition to build cities that are integrated, promote equality and also link sustainability with their rural hinterlands. The eThekwin Municipality (2015:85) that a key part of this involves finding ways to address informality in such a way that it responds to its challenges and builds on its opportunities, as well as acknowledging the need to create a financially and environmentally sustainable development path.

Key questions raised within this area include:

- What does this new African urbanism look like when we translate it into spaces and plans?
- What are the mechanisms to facilitate creativity and human expression through urban design?
- What is the new financial model that facilitates sustainability and equity in service delivery?

Together with these key questions, the need arose to recognize that innovative place-making is not just about physical space, but also about facilitating spaces for creativity and human expression. Place-making is regarded as one of the aspects contributing to sustainability and urban resilience and will be referred to again in Chapter 6 (refer Sections 3.4; 3.5; 6.3.2).

(ii) Sustainable and ecological city.



Figure 62: Sustainable and ecological city

Source: eThekwin Municipality 2015a.

Key challenges for Durban involve recognizing the central role that the natural environment plays in the new African urbanism, centralizing challenges like climate change in the development debate and harnessing the opportunities provided by the environment to improve wellbeing, build social and economic resilience, and provide cost-effective and sustainable responses to global changes (eThekweni Municipality, 2015a). This may lead to the attainment of the central role that the natural environment plays in the different aspects stated above, thus its role in improving urban resilience and efficiency.

5.4.1.4 The application of urban land use planning

According to Hannan and Sutherland (2015:206), planning in eThekweni Municipality is shaped by a range of strategic framework documents which provide guidelines for the way in which development is undertaken in the Municipality. The IDP and its associated Spatial Development Framework (SDF) constitutes the main development framework for Durban. The SDF is the primary spatial response to the development context, needs and vision of the Municipality as set out in the IDP, providing strategic planning guidance. The following section will focus on planning tools contained in the above mentioned documents. This will be done with emphasis on land use management planning, since it reflects the main purpose of this study. As a result, reference will also be made to the Land Use Management Scheme (LUMS) of Durban (refer to Section 2.3).

The eThekweni Municipality's IDP's Eight Point Plan outlines the short term strategies and outcomes intended at addressing the key challenges and achieving the long term vision. The eight point plans are the Municipality's delivery plan, which despite being separate plans are supportive of each other to ensure effective delivery. The eight plans are (eThekweni Municipality, 2015a:173):

1. develop and Sustain our Spatial, Natural and Built Environment (focus on infrastructure);
2. developing a Prosperous, Diverse Economy and Employment Creation (focus on opportunity and choice);
3. creating a Quality Living Environment (focus on environment and place-making);
4. fostering a Socially Equitable Environment (focus on opportunity and accessibility);
5. creating a Platform for Growth, Empowerment and Skills Development (focus on opportunity);
6. embracing our Cultural Diversity, Arts and Heritage (focus on identity and change);
7. good Governance and Responsive Local Government (focus on implementation and efficiency); and
8. financially Accountable and Sustainable Municipality (focus on efficiency and economy).

Given the fact that the Spatial Development Framework is a spatial translation of the Municipality's IDP, consequently, the eight point plans; the spatial vision, strategies and outcomes are linked to both the short and long term strategies outlined within the IDP and the Long Term Development Plan. The following section provides information regarding the SDF of the eThekweni Municipality.

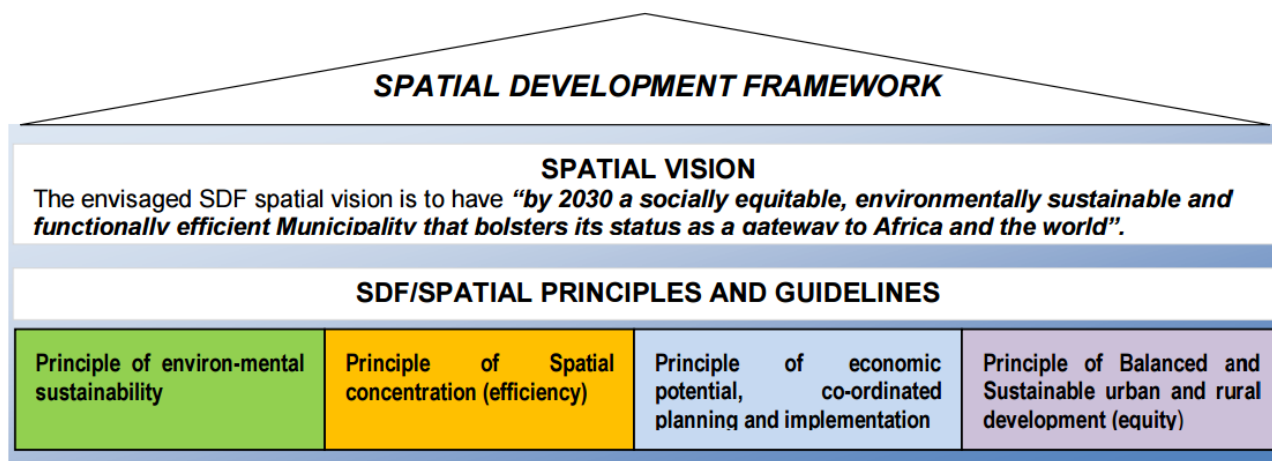


Figure 63: Spatial Vision and Principles informing eThekweni Municipal SDF

Source: eThekweni Municipality (2013:34).

The four main principles of the SDF (as seen in Figure 63) include eThekweni Municipality (2013:34):

- principle of environmental sustainability;
- principle of Spatial concentration (efficiency);
- principle of economic potential, co-ordinated planning and implementation; and
- principle of Balanced and Sustainable urban and rural development (equity).

Table 14 provides more detail regarding these four principles. This study focuses only on some of the aspects which are applicable to and contribute to the purpose and goals of the study. These aspects correspond with planning principles which are internationally approved (refer Section 3.5)

Table 14: The SDF spatial proposals

ANALYSIS LAYER	GUIDING PRINCIPLES	SPATIAL PROPOSALS	INTENDED OUTCOMES
1.ENVIRONMENT	Principle of environmental planning	1.1 Open Space System	- Promote Sustainable Environmental Management - Create a network of green open spaces - Support sustainable catchment management and stormwater practices. - Protect important environmental areas - Delineating an Urban Development Line
2.LAND USE	Principle of Spatial concentration (efficiency)	2.1 Improving Accessibility	- Supporting an Efficient Movement System in an effort to Support a viable public transport. - Promote accessibility of communities to employment, recreation and social opportunities. - Protect the mobility function of major roads (such as the N2 and N3) - Promote appropriate densities at Strategic Locations
3.TRANSPORT		- Route Hierarchy - Public Transport Nodes and Corridors - Infill and Densification	
4.BUILT ENVIRONMENT& HOUSING	Areas of need	4.1 Areas of need	- Managing Urban Growth - Combat urban sprawl and support infill development - Facilitating Sustainable Housing location - Promote adequate provision of social and economic amenities
5.UTILITIES & INFRASTRUCTURE	Strategic Infrastructure Planning & Strategic Investment Areas	5.1 Strategic Investment Areas	- Facilitate utilisation of municipal resources in an efficient manner - Ensure adequate provision of services infrastructure to support densification and infill. - Promoting balanced development - Ensure strong viable nodes - Clustering of various activities at appropriate locations - Reduce Unemployment - Reduced income and spatial inequality and poverty - Creating sustainable economic growth and development - Becoming a global metropolis over the next 20 years
6.ECONOMY		Economic Nodes and Corridors	

Source: Adapted from: eThekweni Municipality (2013:119):

The aspects include eThekweni Municipality (2013:119):

- Promoting Spatial Concentration / Efficiency
- Infill and Densification
- Development Corridors

1. Promoting Spatial Concentration / Efficiency

According to the eThekweni Municipality (2013:121), the principle of Spatial concentration / efficiency is intended at ensuring the optimal use of existing resources and infrastructure, discouraging urban sprawl, encouraging residential & employment opportunities in close proximity, streamlining development application procedures and decision-making procedures aimed at sustainable development. Based on this principle the EMA must strive to:

- promote a more compact development (refer to Section 3.3.4);
- encourage higher densities where appropriate (refer to Section 2.3.3.1);
- reduce the need to travel (refer to Section 3.5.4.1);
- increase accessibility (refer to Section 3.5.4.1); and
- reduce the separation between places where people work and live (refer to Section 3.5.4.1);
- optimize development in areas of greatest opportunities (refer to Section 3.5.4.1);
- encourage efficient use of infrastructure and facilities (refer to Section 3.5.4.1);
- promote optimal use of remaining land opportunities
- encourage urban infill (refer to Section 2.3.3.1);
- foster a socially equitable environment where the resources, opportunities and amenities offered by the Municipality are easily accessible to all (refer to Section 3.5.4.1).

2. Infill and Densification

The eThekweni Municipality (2013:125) indicates that the key elements of densification are the promotion of compact, integrated and efficient city form. The municipal authority further states that this can be achieved by limiting urban sprawl, promoting higher densities, infill and re-development in and around the urban core and other activity nodes, and through the promotion of mixed use activity corridors linking otherwise isolated and non-functional areas with a focus of public transport.

The different methods for achieving densification can occur through: Infill development on vacant or under-utilized parcels of land at higher densities (eThekweni Municipality, 2013:125). They propose that a range of infill processes may include:

- new development on vacant or under-utilized land at higher densities (refer to Section 2.3.3.1);
- cluster development on large parcels of land through a consolidation process (refer to Sections 2.3.3.2; 5.4.1)
- conversion of existing building (sometimes vacant/derelict) to other uses
- subdivision of large pieces of land to encourage higher densities (refer to Section 2.3.3.1);
- allowing additional units to be developed on a single piece of land
- redevelopment of poorly functional areas to encourage and facilitate infill (refer to Section 2.3.3.1);
- transfer of development rights may lead to areas available for infill planning and densification,
- land consolidation which creates greater areas of land which may be used to apply densification and infill planning, and
- public housing projects which maintains higher densities.

Infill and densification as proposed above are key strategies contributing to the restructuring of urban environment. These aspects are also regarded as international approved spatial principles (refer Section 3.4.5).

3. Development Corridors

Corridors of development are viewed as growth or development axes that spatially structure development. Development corridors comprise of a mix of activities making them intense robust and diverse environments that service the Municipality. Corridors of development also lead to the establishment of links between districts and neighbourhoods that ensure cohesiveness and integration of activity and communities. Development corridors within the Municipality include (eThekweni Municipality, 2013:131):

- Urban Service Nodes and Corridors supporting mixed use urban activities (refer to Sections 2.3.3.1; 2.3.3.4);
- Rural Service Nodes and Corridors supporting local level services (refer to Sections 3.5.3; 3.5.4);
- Coastal Corridor consist of high quality natural coastal assets and consist of mixed uses including mixed density residential, recreation, entertainment and tourist oriented activities (refer to Section 3.5.4);
- Tourism Corridors supporting tourism activities (refer to Section 3.5.3);
- Industrial Corridor supporting primarily industrial activities (refer to Section 3.5.3);
- Agriculture Corridor (refer to Section 3.5.3); and

- Airport Noise Zone.

The LUMS of the eThekweni Municipality further elaborates on creating an environment that is pedestrian friendly and contributes towards the precinct operating as true mixed land use development (eThekweni Municipality, 2014:7). It aims to promote integrated and sustainable development; promote sustainable environmental management, conserve and protect environmentally sensitive areas; and promote all forms of development and growth through sound Planning Principles that would support a mix of land-uses managed in an appropriate manner. The LUMS further focuses on practical regulations regarding zoning which is not directly relevant to this study.

5.5 Conclusion

The purpose of this chapter was to determine the integration and application of urban resilience through the different types of land uses. It engaged in an analysis of both international and national case studies to fulfil this purpose.

From the foregoing empirical study, it is evident that there are certain degrees of integration and application of resilience strategies and policies, however, it is clear that not much provision is made for urban resilience in terms of different types of land uses. The focus is generally placed on natural disasters and shocks and how it prepares for and recovers from it. Many strategies have been developed and implemented to ensure that infrastructure and services are resilient to this kind of disasters, but unfortunately that is where it ends. This is because, although some of the planning policies lightly touch on the aspects that could contribute to resilience, they are not considered as part of the resilience policies. From the three cities discussed, it is clear that New Delhi is the least advanced in terms of urban resilience. Durban has surprising policies and strategies as it forms part of a developing country. However, it is also important to remember that South Africa is presently at the early stages of implementing resilience therefore, there is not much in practice yet, but mostly in writing.

Apparently, there is an overall lack of clarity and confusion in terms of urban resilience as it is often restricted by planning policies and planning authorities. Consequently, there is a gap in this aspect, and opportunities abound for improvement and integration of urban resilience and land use types into planning policies and legislation.

This chapter forms an important link and makes a large contribution to the next chapter which focuses on proposals and possible solutions to the problems and gaps that were identified within this study.

CHAPTER 6: SYNTHESIS AND RECOMMENDATIONS

6.1 Introduction

The previous chapter explored the empirical study which focused on the respective case studies. The aim of the chapter was to determine the integration and application of urban resilience through the different land use types on an international and national level. This chapter presents the synthesis and recommendations of this study. The first section of this chapter restates the purpose of the study and an overall discussion of the study and its findings, from which the proposals will be developed. The proposals consist of two main aspects: the proposals regarding legislation on three different levels and secondly the practical tools for implementing urban resilience through different land use types at the different levels of planning. The policy proposals refer to South Africa, while the practical tools for implementation refer to a generic model or tool which could be applicable to any country or city. This chapter aims to present an integrated summary of the findings of the study, as well as proffer potential recommendations to apply on policy and implementation levels.

6.2 Synthesis

The synthesis aims to assess the most prominent theoretical principles from the study. Therefore, it is important to clearly define the findings to simplify the procedure. The synthesis will firstly include an introductory part as a contextualisation to the study and also a statement of the overall purpose of the study. Afterwards, the section discusses the various findings and how they impact the various aspects of the study.

6.2.1 Purpose

The main purpose and objectives of this study were to (i) explore the different spatial components which influence the capacity of a city to respond to rapid changes and to (ii) propose a multi-faceted approach that leads to urban resilience and efficiency through the implementation of mixed land uses and thus more resilient settlements. This will further assist in creating a tool to enhance urban resilience and urban efficiency and guide development through existing policy and legislation.

It is pertinent to acknowledge that there were several limitations to this study. It is a time-bound process, therefore, a certain level of depth and detail could be attained. It is for similar reasons that the case study focuses on only three case studies. The study does not propose solutions for a specific town or city. Rather it posits a more generic solution that could be applied either

nationally or internationally. The primary objectives of this study as concluded within this chapter are as follows;

- to explore the different spatial components influencing the capacity of a settlement to respond positively to rapid changes (Refer Figure 64),
- to propose a multi-faceted approach that leads to urban resilience and efficiency through the implementation of mixed land uses and subsequently more resilient settlements (refer Section 6.3.2), and
- to create a tool for local government to enhance resilience and efficiency and guide development through existing policy and legislation (refer Section 6.3.1).

6.2.2 Background

To achieve the objectives of this study, a certain level of literature and empirical investigation were instrumental to the process of drawing the necessary conclusions. The literature study revealed that urban models have an impact on the urban form (see Section 2.1). These in turn influence aspects such as sustainability, accessibility, flexibility, uniqueness and resilience of a city (see Sections 2.1; 3.3; 3.4). Research was also conducted on land use planning (see Section 2.2) and its application in terms of management, processes, stakeholders and relevant objectives and principles (see Sections 2.3; 2.4). This was followed by an in-depth research on resilience and its application to urban areas (see Sections 3.2-3.5). In order to determine whether resilience is implemented in cities, it was necessary to look at policies and legislations on both international (see Section 4.1) and national levels (see Section 4.2). During the empirical study, the three case studies evaluated included two International case studies (see Sections 5.3.1; 5.3.2) and a South African case study (see Section 5.4). These case studies played an essential role in determining the potential correlations between practice and theory.

6.2.3 Findings

This section provides the core findings of this study. These findings are discussed with reference to how they correlate with the influential principles found in the literature. This serves as the final linkage between the overarching series of links within and between the chapters. Throughout the study (Chapter 2- Chapter 5), some concepts were emphatically reiterated and discussed in relation to the urban models (Section 2.1); the application of land use management (Section 2.3.3); resilience and related terms (Section 3.3); resilience and urban planning mechanisms (Section 3.5); spatial planning principles (Section 3.5.4); international policies and legislation (Sections 4.1); national policies and legislation (Section 4.2) as well as the international- (Section 5.3) and national case studies.

The land use principles and concepts that were mostly utilised within these sections will essentially serve as a basis, as they will potentially determine a final set of tools for improving urban resilience. These concepts include:

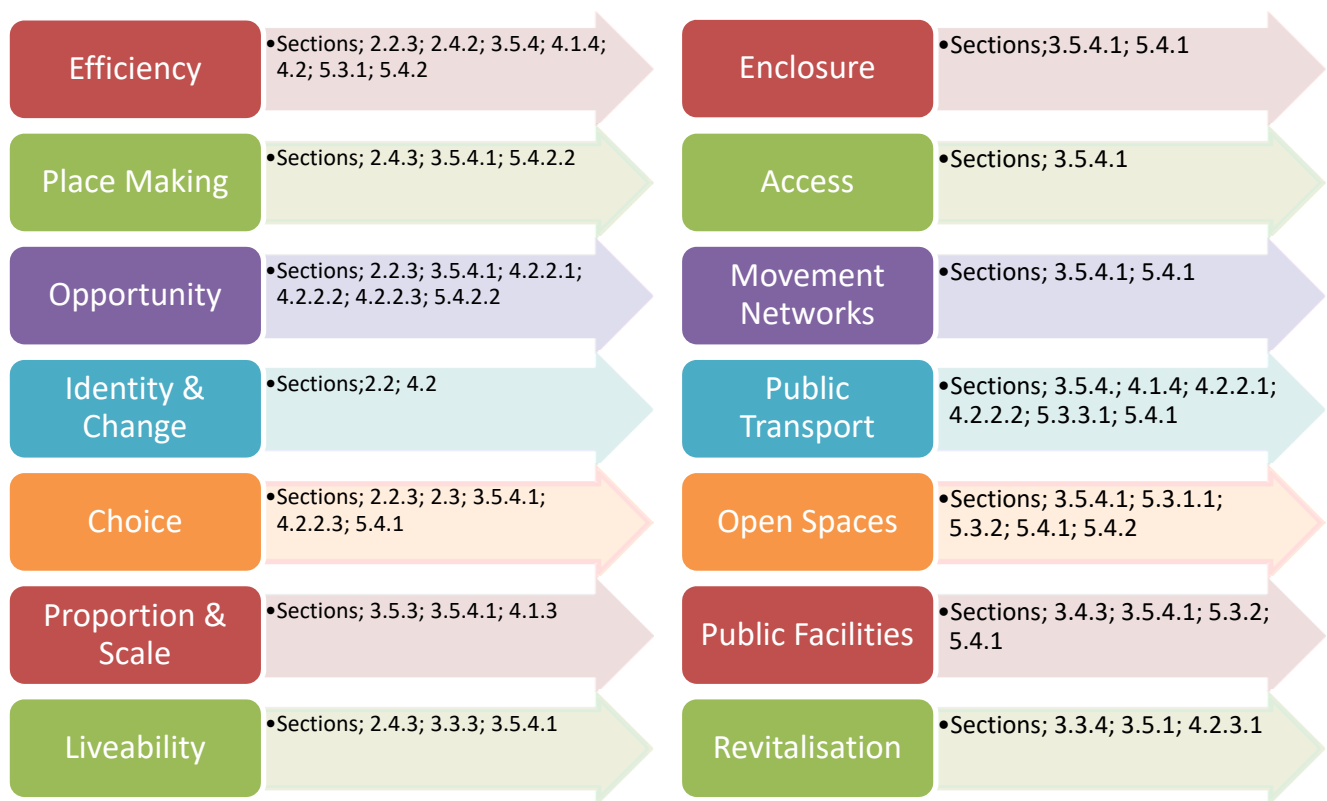


Figure 64: Land use principles and concepts

Source: Own compilation (2016).

This study finds that there are various opinions and views regarding the morphology of urban models, and their sustainability and resilience (see Section 2.1). Given the fact that spatial aspects ought to be combined from the different urban models, it is implausible to proclaim a specific model as being more resilient and more sustainable than another. Rather an integrated approach which assimilates the positive aspects of the various models should be followed (see Sections 2.1; 2.4; 3.3; 3.4), as such an approach is more likely to improve the resilience and sustainability of an urban area.

Obviously, the Apartheid city (see Section 2.1.6) led to a physical gap between the city and the informal settlements (twin city). This is exemplified by the city form of Durban (see Section 5.4.2) where people travel long travel distances to work and have poor access to other amenities in the city, which is segregated from the informal settlements. This situation is not only obtainable in South African cities, it is also found in other international cities (see Section 5.3). This contributes to the development of slum areas and urban decay within the CBD area (see Sections 2.1.1; 5.3.2). Based on the theory of urban models (see Section 2.1) and the case studies (see Section

5.3), it is clear that New Delhi has an overall concentric urban form (see Section 2.1.1). Barcelona is based on a more rigid, superblock form, which includes aspects of a more compact, sustainable and liveable city (see Sections 3.3.1; 3.3.3; 3.3.4). Although Barcelona did not initially pursue this form, however, due to the city's various shocks and experiences, it adopted and started implementing ways to strengthen itself against these shocks and make the city more resilient.

The urban morphology (see Section 2.1) of the mentioned cities may have a significant impact on various aspects of a city. In the case of Durban, it limits the efficiency of the city because of high levels of traffic, unplanned informal settlements which contribute to urban sprawl and limited access to basic services (see Sections 3.5.4; 5.4.2) as the settlements are not formally integrated into the existing node. The urban morphology of New Delhi contributes to the accessibility of the city, but it limits other aspects such as open spaces, choice and efficiency (see Sections 3.5.4; 5.3.2), due to over populated areas with urban sprawl, and the existence of slum areas. The urban morphology of Barcelona improves the sustainability of the city (see Sections 3.3.1; 3.5.4; 5.3.1), as it leads to an accessible environment with choice of transport, access to movement networks and opportunities and sufficient open spaces. This study finds that these aspects can influence the resilience of a city (see Section 3.5.4).

Land use management as a regulatory tool is one of the aspects that strongly influences the urban resilience of a city (see Sections 2.2; 2.3; 3.4; 3.5). The application mechanisms of land use management (see Section 2.3.3) directly refer to tools that can improve urban resilience. These tools will be reassessed in Section 6.3. It may be concluded from the study that even though there are various amounts of guidelines and policies regarding land use management (see Sections 2.2; 2.3; 2.4) and how to improve resilience and sustainability through these policies and guidelines, there are still unsuccessful attempts of implementation (see Sections 4.1; 4.2; 4.3; 5.3; 5.4). There is an apparent gap between the different levels of planning and policies which lead to inefficiency and poor implementation with specific reference to the local and urban levels. The illustration below attempts to represent this gap, showing no integration or cooperation between the spheres of government.

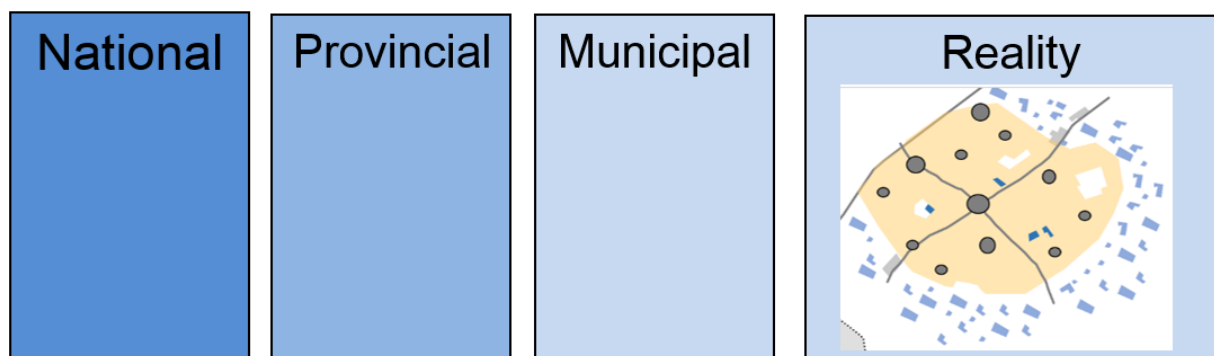


Figure 65: The gap between the levels of planning

Source: Own compilation (2016)

The communication and integration at the three spheres of government is inefficient (refer Section 4.2.2). Consequently, it impacts on various urban nodes in the national urban system (refer Section 3.2.1.1) and reflects on the limited policies and guidelines provided for in the legislation. These urban areas are seemingly non-resilient, unsustainable in certain levels, inaccessible due to non-integrated nodes and corridors, and inefficient as a result of urban sprawl. Similarly, dilapidated areas are apparent in many settlements and the inefficient land uses directly affect the end-user. As a result, it is pertinent to find tools to improve communication, integration and application of guidelines and policies across all levels of government.

The study finds that resilience is an extensive concept which is applied on different levels and professions (refer Section 3.2.1.2). In terms of urban planning, policies and guidelines exist worldwide, but with an overall natural disaster oriented focus (refer Sections 3.2.1; 3.3; 3.4; 3.5; 5.3; 5.4). Little information exists on urban resilience in terms of the combination of land use types (refer Sections 3.2.1; 3.3; 3.4; 3.5; 5.3; 5.4). Therefore, it is clear that a gap exists which needs to be improved upon through precise and practical guidelines and ways of implementation. Urban resilience is often confused with concepts such as the sustainability, smart cities, liveable cities and compact cities (refer Section 3.3). The tables below indicate the differences and similarities between these concepts as is apparent from the literature (refer Section 3.3):

Table 15: The comparisons between resilience and related terms

Concept	Resilience	Sustainability	Smart Cities	Compact Cities	Liveable Cities
Physical appearance	Growth and development in networks	Linear growth and development	Not provided in literature	Clustered growth and development	Not provided in literature
Focus	Focus on self-renewal and survival	Deals with long term consumption and continuity	Focus on technical aspects	Not provided in literature	Focus on sense of place
Purpose	Cope with sudden disturbances	Cope with continuous change	Cope with continuous change	Cope with continuous change	Cope with continuous change

Application	Prepare and plan for the un-projectable	Plan possible futures	Planning for the future	Planning for the future	Planning for the future
Flexibility	Dynamic concept	Static concept	Not provided in literature	Not provided in literature	Not provided in literature
Inter-relationship	Leads to sustainability	Requires resilience	Leads to sustainability	Leads to sustainability	Leads to sustainability
Cost Effectiveness	Cost effective	Partially cost effective	Needs a large capacity, less cost effective	Needs a large capacity	Expensive to implement
Developed/Developing	Applicable to developing and developed countries	Applicable to developing and developed countries	More applicable to developed countries	Mostly applicable to developing countries	Mostly applicable to developed countries

Source: Own compilation (2016)

From the above table, it can be concluded that despite the differences (this includes cost effectiveness, planning for the future or dealing with disturbances and capacities and resources needed) between resilience and other related terms, there are also some points of agreement (for example, all the concepts lead or contribute to sustainability). Therefore, one can argue that although most of the related terms do not directly correspond to resilience from an urban land use perspective, certain aspects are more likely to contribute to urban resilience. In this regard, this table will contribute to the formulation of the proposals.

From the case studies a number of meaningful lessons were assimilated. These lessons serve as a basis for the proposals for improving cities in terms of resilience through land use types and urban efficiency. The following section includes a SWOT analysis for each case study. This will assist in determining the advantages and disadvantages of each in order to contribute to the lessons learnt from the case studies.



Figure 66: SWOT Analysis of Barcelona

Source: Own compilation (2016)

From the SWOT analysis of Barcelona (refer Section 5.3.1), that they have more advantages than disadvantages. Barcelona has numerous innovative ideas and projects, such as the 22@Barcelona Plan (refer Section 5.3.1.5) which lead to a great amount of opportunities. Their projects, policies and legislation integrate a number of significant planning principles regarding density, diversity, complexity and flexibility. These policies also seem to have an on-going focus on resilience and sustainability and it was deduced that these aspects have been a part of their policies (refer Section 5.3.1.2). This leads to opportunities where even more focus can be placed on sustainability and resilience, specifically regarding land use. Barcelona's planning system seems complicated and fully inaccessible on an international level as it consists of many regions and municipalities that could be confusing .

From the SWOT analysis of New Delhi (refer Section 5.3.2) it is apparent that their policies are well organized and understandable. Their policies comprise very specific guidelines regarding development and planning with reference to density, mobility, open spaces, development codes and zoning (refer Section 5.3.2.1). This may to more effective implementation of mixed land uses, if guided correctly. Conversely, the policies and guidelines for sustainability and resilience seem inadequate and lead to several challenges and gaps regarding sustainability and resilience.



Figure 67: SWOT Analysis of New Delhi

Source: Own compilation (2016) These attendant challenges include inadequate services, slum areas, inefficient ways of dealing with disturbances and inefficient and non-resilient land use planning. These policies (refer Section 5.3.2.1) could potentially reduce the slum areas that continue to grow and lead to various social, environmental and economic problems.

Durban has an overall focus on sustainability and the proper accompanying mechanisms for resilience (refer Section 5.4.2), and these aspects work in unision with proper planning principles. More focus could be provided to elaborate on resilience in terms of land use types. Some Apartheid features such as the segregated informal settlements (twin city) are still visible in the city, which may be seen as a disadvantage or challenge as it leads to more segregated areas, urban sprawl, long travel distances and poor integration.

It was observed that legislation and policies include proper planning principles, but in practice they are not implemented. It consists of various ideals which are sometimes confusing because of a shortage of practical solutions and guidelines for the application thereof.



Figure 68: SWOT Analysis of Durban

Source: Own compilation (2016)

Whether the case studies are developed or developing countries, there is a common prevalence of an overall awareness in terms of adequate planning principles (refer Sections 5.3; 5.4). However, the availability of resources (financial, human and physical) and knowledge are often the common limitations that prevent these principles from being applied in practice. It is clear that there is a relationship between sustainability and resilience (refer Section 3.3.1), but these two aspects are often confused with one another because of their openness to numerous interpretations. The accessibility and transparency of laws and policies are essential and contribute to improved implementation. Too much detail regarding regions and municipalities and the associated levels of planning can be confusing.

Resilience is mostly interpreted in terms of natural disasters and shocks (refer Section 3.2; 5.3; 5.4). Little emphasis is laid on urban resilience and how it could be improved through different types of land uses and how it may contribute to the urban resilience and urban efficiency of a city.

Table 16: Relationship between concepts and principles

	Zones of Public Transport	Infill Planning	Open Space Systems	Mixed Land uses	Densification	Urban Edge
<i>Place Making</i>			X	X		
<i>Opportunity</i>	X	X	X	X	X	
<i>Efficiency</i>	X	X		X	X	X
<i>Choice</i>	X	X		X	X	
<i>Identity and Change</i>		X	X			X
<i>Proportion and Scale</i>		X	X			X
<i>Liveability</i>	X		X	X	X	
<i>Enclosure</i>			X	X		X
<i>Access</i>	X	X		X	X	
<i>Movement Networks</i>	X			X		
<i>Public Transport</i>	X					
<i>Open Spaces</i>			X			
<i>Public Facilities</i>	X		X	X	X	
<i>Economy</i>	X	X		X	X	X

Source: Own compilation (2016)

From the above table, it is obvious that all the recurrent aspects treated in the study can be addressed through more concentrated, integrated and combined principles. This will lead to improved implementation as it is simpler and has less aspects or requirements to adhere to. These six principles (x-axis) were selected on the basis of a vigilant and transparent process to ensure that it touches all the fourteen aspects (y-axis) which theorists and the legislation (refer

Sections 2.1; 2.2; 2.3; 3.4.3; 3.5; 4.1; 4.2) argue have the greatest contribution towards urban efficiency and urban resilience. These six concepts are a comprehensive summary of the fourteen principles (y-axis). The table confirms the comprehensiveness of the six aspects, and further illustrates that all the principles as argued by theorists and the legislation will be addressed by the six comprehensive concepts. The six concepts are a simplified, comprehensive and inclusive version of the fourteen principles. The following section discusses how the six concepts affect each of the fourteen aspects.

Zones of Public Transport will address the following principles:

- | | |
|---------------|---------------------|
| ✓ Opportunity | ✓ Access |
| ✓ Efficiency | ✓ Movement Networks |
| ✓ Choice | ✓ Public Transport |
| ✓ Liveability | |

Public transport will increase the amount of opportunities in communities. With the availability of more alternatives and different modes of transport, people will have improved choices and access to work places and other amenities. This would in turn lead to more efficient and liveable cities with less traffic, improved accessibility and less pollution.

Infill planning will address the following principles:

- | | |
|---------------|------------------------|
| ✓ Opportunity | ✓ Identity and Change |
| ✓ Efficiency | ✓ Proportion and Scale |
| ✓ Choice | ✓ Access |

Infill planning will increase opportunity and choice in terms of housing and other amenities as it will lead to areas with higher densities and mixed land uses. This will create areas that are more efficient and accessible and consequently the development of nodes that provides a number of facilities and services. Infill planning will also assist in regenerating urban areas which will improve safety and identity of these areas.

Open Space Systems will address the following principles:

- | | |
|------------------------|---------------------|
| ✓ Place making | ✓ Liveability |
| ✓ Opportunity | ✓ Enclosure |
| ✓ Identity and Change | ✓ Open Spaces |
| ✓ Proportion and Scale | ✓ Public Facilities |

Open space systems contribute to the quality of an area; more open spaces will lead to improved social and environmental opportunity. It will create an improved balance between the proportion of built areas leading to aesthetically attractive and more liveable areas.

Mixed land uses will address the following principles:

- | | |
|----------------|---------------------|
| ✓ Place making | ✓ Enclosure |
| ✓ Opportunity | ✓ Access |
| ✓ Efficiency | ✓ Movement Networks |
| ✓ Choice | ✓ Public Facilities |
| ✓ Liveability | |

Mixed land uses will lead to multi-purpose areas with improved opportunities, choice and access to housing, services, work and other amenities. It may lead to places that are aesthetically more attractive with an improved sense of place where people can live work and play. Therefore, resulting in liveable, resilient and efficient urban areas.

Densification will address the following principles:

- | | |
|---------------|---------------------|
| ✓ Opportunity | ✓ Liveability |
| ✓ Efficiency | ✓ Access |
| ✓ Choice | ✓ Public Facilities |

Densification will provide more opportunity and choice in terms of different densities and types of housing, leading to more affordable housing. Access to public facilities and other amenities will improve due to proximity of services, amenities and the development of nodes. This will lead to overall improved efficiency of the city.

Urban Edge will address the following principles:

- | | |
|-----------------------|------------------------|
| ✓ Efficiency | ✓ Proportion and Scale |
| ✓ Identity and Change | ✓ Enclosure |

An urban edge will limit urban sprawl and therefore lead to improved efficiency due to the efficient use of land. The proportion and scale of an area will also be protected and enhanced.

This table buttresses the main argument of the study which states that the implementation of an appropriate land use and densification model will lead to more resilient and efficient cities.

6.3 Recommendations

This section consists of two main aspects, firstly the proposals in terms of policy on three levels of planning with specific reference to the impact on the urban level. The second aspect will provide the practical tools for the implementation and enhancing of urban resilience in terms of different land use types. This section also consists of a set of proposed tools compiled from the core findings of this study.

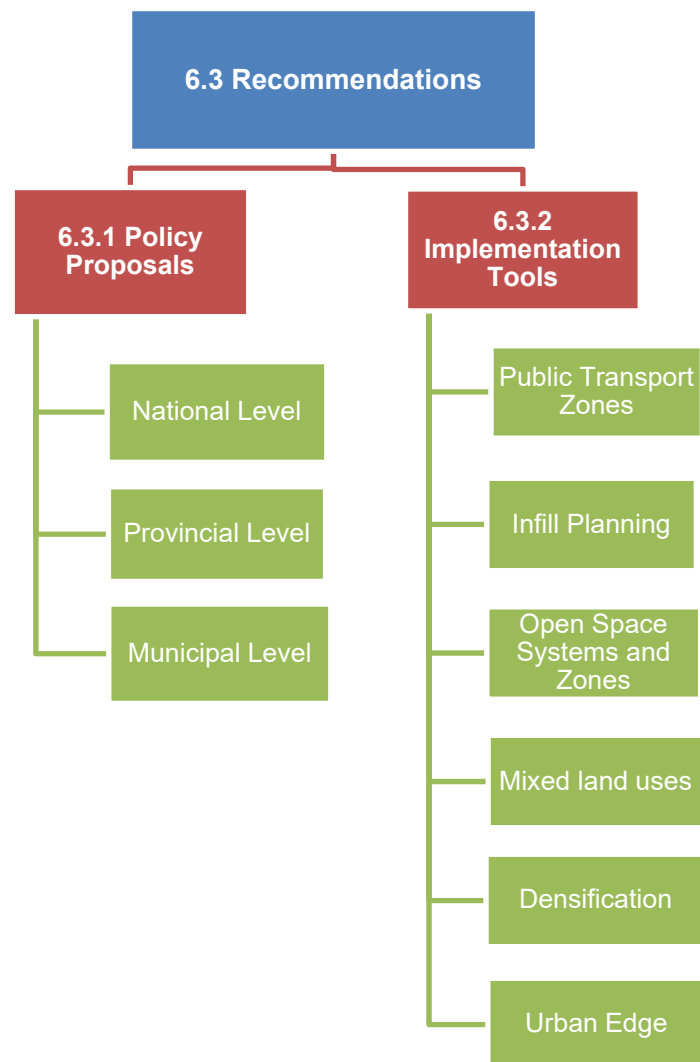


Figure 69: Section Division

Source: Own compilation (2016)

This part is focussed on a possible solution to improve the implementation of urban resilience in terms of different types of land use.

6.3.1 Policy proposals

Proposals will be addressed at the three levels identified in the SMART model (refer Figure 15)- macro-, meso-, micro- level (which is associated with three levels of government). The policy proposals will be dealt with across the three levels of planning legislation as visible in most countries. For the purpose of this study an in-depth focus will be placed on the potential impact that the different levels of planning may have on an urban level and ultimately the degree of urban resilience and urban efficiency. This will include proposals that can potentially be integrated into existing legislation and policies in order to promote the implementation and maintenance of urban resilience.

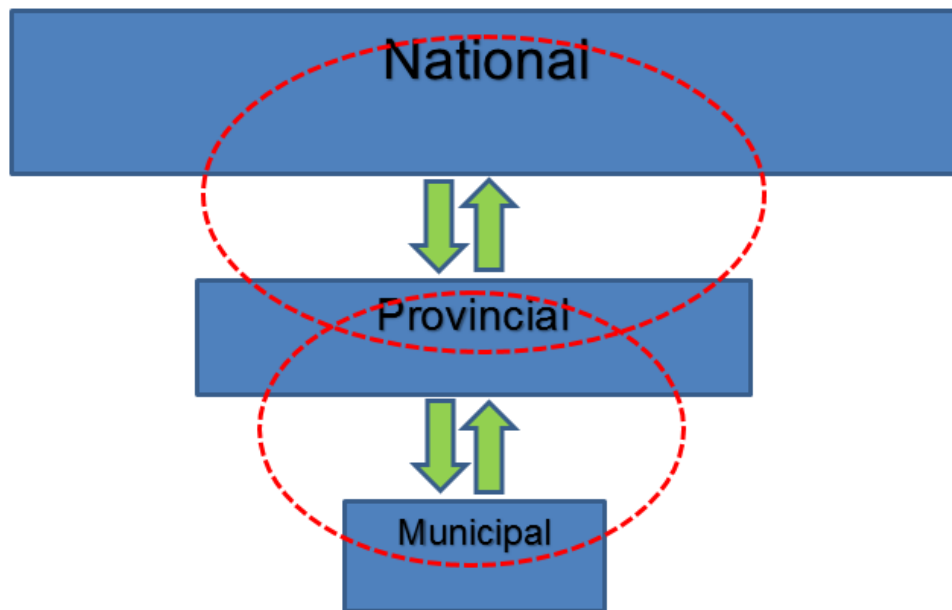


Figure 70: Integrated levels of planning

Source: Own compilation (2016)

The overall integration, participation and communication between the three planning levels need to improve. Based on the South African case study, it is apparent that planning on the three levels of government takes place in a closed manner with gaps of isolation between them (see Figure 65). This results in poor implementation of strategies, policies and legislation due to a lack of ownership, responsibility being assigned or delegated to a specific level of government. There should be continuous, mutual cross-sectoral (between various applicable departments) and vertical (between the national, provincial and local government) integration and alignment between these levels which promotes participation and implementation (see Figure 62). Desouza and Flanery (2013:90) argue that the conceptual and practical goal of resilience is part of the evolution of planning, whereas Wilkinson (2011:148) adds that ecology, urban planning and urban

design may be reframed and reintegrated through reimagining resilience in the context of complexity (refer Table 3).

6.3.1.1 National Level

National policy and legislation which can potentially be used to improve resilience on an urban level in South Africa are the NDP, NSDF and SPLUMA (refer Section 4.2).

The NDP could make provision for the implementation of pilot projects in various urban settlements. These projects should aim to implement the tools (refer Section 3.5.4.1) which lead to the continuous growth of urban resilience. The NDP could set out overall guidelines (such as requirements which identified areas for implementation should adhere to) on how to go about these projects and how they could form part of a national urban resilience network.

The NSDF is a framework that is currently in the early stages of development, with overall guidelines, but no detailed principles yet. This framework should ideally provide for national spatial goals and principles which could facilitate improved implementation of the strive towards better urban resilience on a national level. Clear guidelines should be part of the NSDF such as tools and principles that could be used to identify potential areas where urban resilience and efficiency could be kick-started. It should identify primary nodes of development and competitiveness, which could serve as basic guideline for the lower planning levels.

Although SPLUMA makes provision for the resilience concept (refer Section 4.2.2.1), it is proposed that this Act should set clearer land use guidelines and focus more on the enforcement and promotion of resilience within land compilations. The implementation of mixed land use types should feature more prominently, as this is the main legally enforceable tool available to town planners. More clear guidelines could be set in terms of the approval of applications. An overall measure with an overall set of guidelines could be provided which may serve as a basis for the selection of applications on an urban level.

Another aspect that could be used on the national level is the Medium Term Strategic Framework (MTSF). The MTSF base document is meant to guide planning and resource allocation across all spheres of government. This framework assists in creating and allocating the National Budget. This framework may be used to make provisions for funding that could be applied to improve urban resilience, by allocating the resources to identified and allocated projects. Re-focussed funding may lead to increased amounts and diversity of projects focusing on and improving urban resilience and urban efficiency in the long term.

It is essential that the national level of government and planning sets an efficient framework which could serve as a basis for lower levels of governance, but still leave space for customization. From this level a two-pronged approach should be sustained, a top-down and bottom-up combined approach. The overall guidelines and framework should still be set on the national level, however, it should be informed in terms of feedback provided from municipal and provincial levels.

It is essential that there is sufficient cooperation from the different applicable departments (cross-sectoral). Departments that should especially be involved include; the Department of Transportation; Department of Human Settlements; Department of Housing; Department of Economic Development; and the Department of Environmental Affairs. There should be continuous cross-sectoral integration between the departments, combined with vertical alignment between levels of government (refer Figure 69).

The various departments should provide the lower levels of governance with adequate guidelines and requirements to enable the identification of areas to implement the principles. This in turn would lead to improved implementation of urban resilience and efficiency. The requirements for identifying cities from a national level could include but is not limited to projects that are focussed on:

- fast growing economic cities;
- secondary cities;
- cities already showing tendencies of efficiency and resilience; and
- cities with the highest segregation.

These requirements could be further elaborated on, but since the focus of this study is on an urban level, it will not be discussed in detail at this level.

6.3.1.2 Provincial level

The provincial level may be seen as the essential link between the national level and the municipal level. As stipulated in the Municipal Structures Act, the provincial level should convert the principles and guidelines from the national level into practical possibilities for the municipal level. This level is also responsible for effective communication and feedback between the national and municipal levels. In a similar vein, this level decides how and where funding from the national level will be allocated and applied within the various municipalities in its jurisdiction.

Policy and legislation that could be used on a provincial level includes the Provincial Spatial Development Framework (PSDF). The PSDF, corresponding with the NSDF, should provide guidelines and principles for spatial development on the provincial level. It provides more detail

than the NSDF does for the national level. Guidelines should also be provided for the identification of cities or municipal areas where the pilot projects can be launched. Guidelines should also include aspects to identify the cities or areas that have the most potential in terms of improving urban resilience and efficiency, rather than cities or areas that have the most urban problems on backlogs. This will contribute to the success of implementation, as improvements will occur much faster, which will result in the learning of more lessons, which could subsequently be applied to other problems areas.

A specialised provincial committee should be appointed to assist in the enforcement and monitoring of urban resilience. Again it is pertinent that the various departments are involved to maintain cross- sectoral integration and cooperation.

6.3.1.3 Municipal level

This level will play a key role in the implementation of urban resilience and efficiency. The municipality and its relevant legislation can apply various tools in order to lead to improved urban resilience and efficiency. On a municipal level, certain areas can be identified as potential areas for launching pilot projects. The focus should first be placed on smaller precinct areas (see Section 2.1), rather than the municipal area as a whole. This will lead to more efficient implementation due to accelerated progress which will result in more effective lessons that can be learnt and applied to other areas in the municipality.

Legislations that could be used include the IDP, SDF and LUMS. The SDF should be influenced by principles such as urban edge, sprawl, mixed land uses and densification. Specific zones and areas should be identified where these principles could be applied to improve urban resilience.

Supporting the SDF, the LUMS should link and correspond to the principles and identified zones and areas within the SDF. Applications for land development that limits urban sprawl, is within the urban edge and promotes mixed land uses should be approved, while other applications that do not meet these requirements should be declined. More detail on the different tools will be discussed in Section 6.3.2.

One of the major challenges and gaps identified within the study (refer Sections 4.1; 4.2; 4.3) relates to the poor implementation of principles and legislation. Emphasis should be placed on improving implementation and enforcement through identifying opportunities for projects and providing incentives to launch and implement projects and tools for improved urban resilience and efficiency. To do so, focussed funding is required to appoint responsible persons to ensure that these principles are correctly applied and implemented.

For instance, the local department of transportation as integral part of the SDF and LUMS, should identify primary corridors and movement networks. In conjunction with these networks, the department of transportation should supply sufficient, affordable and sustainable public transportation. It is essential that these transport networks integrate the CBD and other secondary nodes with all areas of the city in order to eliminate the gap between the city and the twin city (refer Figure 79).

The local department of housing and the department of human settlements should work together to implement efficient and affordable housing with adequate services in areas where it will improve densification, infill planning and is within the urban edge (refer Figure 71 & 79). The local department of environmental affairs in consolidation with the other departments and the SDF and LUMS should assist in identifying key areas where open spaces will serve an optimal purpose, while contributing to the sense of place (refer Figure 71 & 79). The department of economic development should assist in identifying areas with great economic potential. These areas could be used to integrate mixed land uses and densification which will improve and encourage economic activities (refer Figure 71 & 79).

This will allow for both vertical and horizontal (cross-sectoral) alignment of budgets and responsibilities – all which could ultimately lead to improved resilience and urban efficiency. It is noteworthy that this is only used to illustrate the principle, therefore, only the most prominent departments are chosen. Departments change from time to time but in principle this should consist of a team of departments working with human settlements, housing, transport, environmental aspects, and economic development.

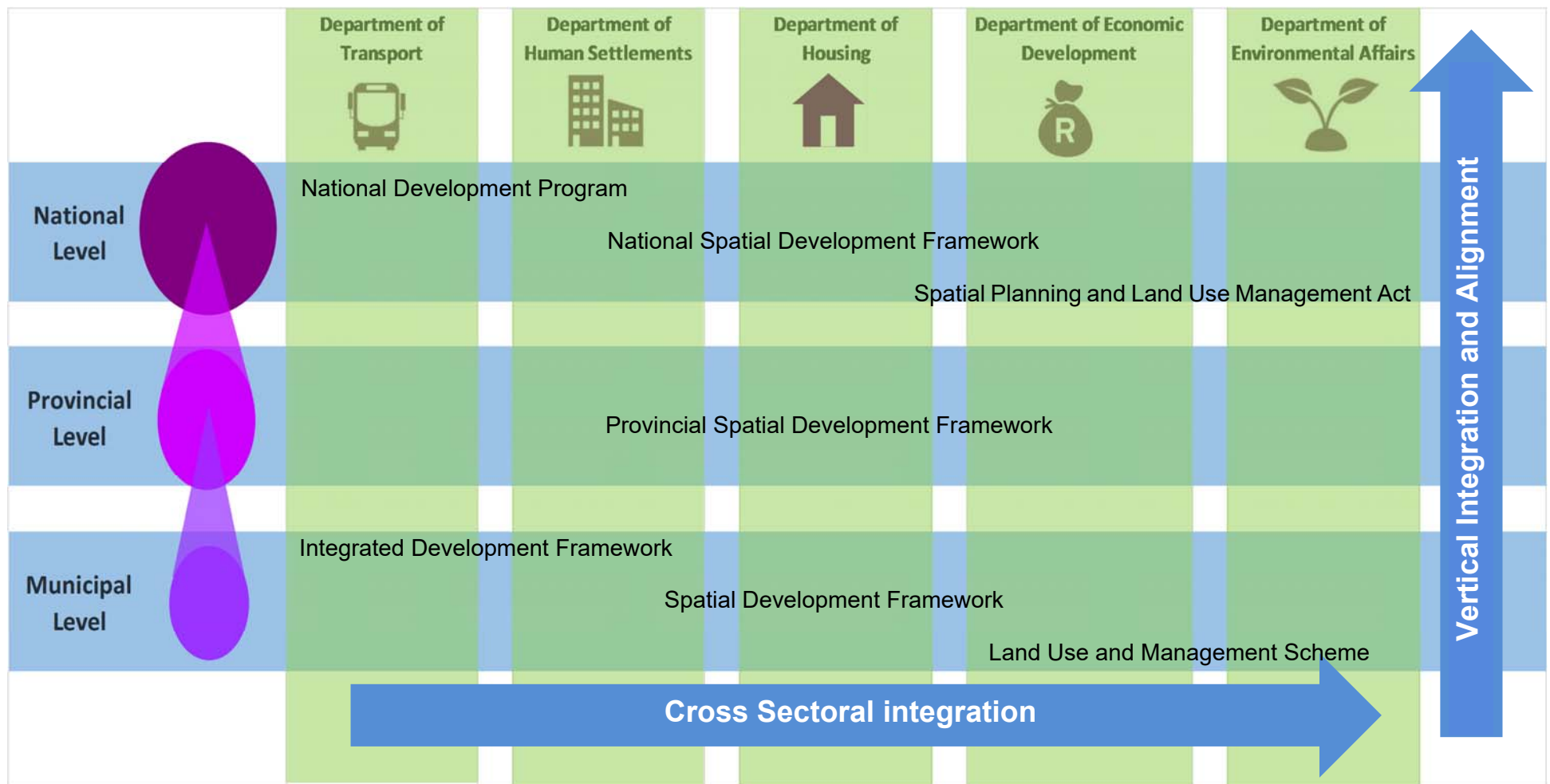


Figure 71: Vertical and cross-sectoral integration and alignment

Source: Own compilation (2016)

6.3.2 Implementation tools for resilience

The findings throughout the study reveal that contemporary cities are faced with several challenges (refer Section 2.4). For example, cities are dispersed with urban sprawl outside the urban edge (refer Sections 5.3.2; 5.3.3). Cities are segregated with informal settlements that are separated from the urban area (refer Sections 5.3.2; 5.3.3). Services and public facilities are inaccessible and inefficient (refer Sections 4.1; 4.2; 5.3.2; 5.3.3). Communities are too dependent on automobiles due to long travel distances, no walkability and unaffordable and inadequate public transport (refer Sections 5.3.2; 5.3.3). Open areas are insufficient, abandoned and inaccessible to all residents (refer Sections 5.3.2; 5.3.3). Cities have under-utilised economic activities due to ineffective and dispersed nodes with low densities and ineffective combinations of land uses. Evidently, there is a lack of practical policy and tools that can address these problems. This section is based on the principles which were continuously reiterated during the literature- and empirical study and makes them applicable to an urban area through graphical illustrations (Figure 72 – Figure 79). This includes practical solutions and ways of implementation on an urban level. These figures are based on a generic South African city with a typical Apartheid city morphology where there is a rigid separation between the city and the informal settlements (twin city). The twin city is a smaller replica of the city, but with spontaneous development with no town planning principles and tools applied to this area. This morphology and its related problems lead to non-resilient and inefficient cities.

The above-mentioned challenges and inefficiencies could be addressed by using the suggested tools. Urban sprawl will be addressed by implementing the urban edge and applying densification within the boundaries of the city with specific focus on important nodes and around corridors. Segregation will be eliminated through the integration of corridors enhancing efficient transport systems and integration between the city and twin city, eradicating the invisible boundary between the city and its twin city. Economic inefficiency will be transformed through enhancing and developing nodes and corridors that lead to improved competitiveness. Land use inefficiencies will be addressed through densifying primary and secondary nodes, setting an urban edge and planning for mixed land uses. Within the study, it was stated that land use planning is one of the main measures that contribute to resilience and that it is an integral part of creating a resilient society (refer Section 3.5.2). These tools are selected and suggested in order to create a continuous strive towards achieving the objectives of land use planning (refer Section 2.2.3).

The six objectives of land use planning are as follows (refer Section 2.2.3):

1. create safe and healthy environments;
2. convenience through land use and the relationship that each functional area bears;

3. efficiency and energy conservation;
4. create environmental quality;
5. social equity and social choice in terms of opportunity; and
6. create a pleasant urban environment.

This following section will firstly include an schematic illustration of the current situation in contemporary cities and secondly the tools based on the most prominent principles the study. It will include practical suggestions and graphical illustrations.

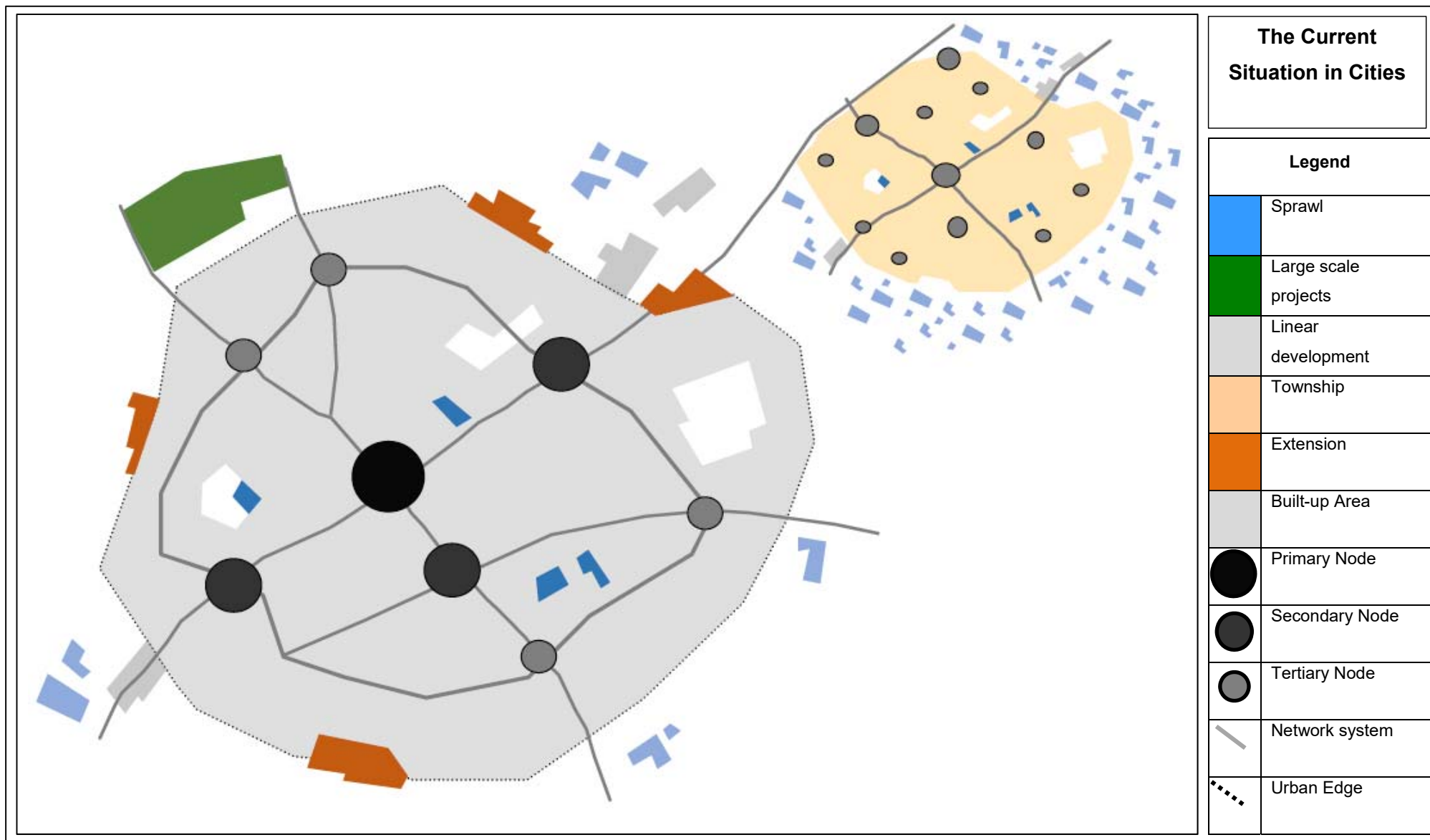


Figure 72: The current situation

Source: Own compilation (2016)

6.3.2.1 Public Transport Zones

Public transport has significant potential to contribute to the urban resilience of a city (refer Sections 3.5.4.1; 4.2.1.1; 5.4.1.4). It helps foster a sense of community by connecting people and providing accessible transport for people regarding their social or demographical status. It encourages people to have a healthier lifestyle with more available options regarding walking or cycling. Public transportation also reduces the need for building car parks, leading to more efficient use of land. It also leads to a better natural environment with less pollution.

Important movement corridors and networks should be identified within the urban area. These networks and corridors should be divided into certain zones due to the capacity and daily movement. Efficient ways of public transport should be implemented within the identified zones. Transport modes may vary from bus transport systems, railway systems and bicycle systems according to the distance from the CBD.

Although focus should be placed in and around the central area of the city, it is essential that the “twin city” forms part of this system to eliminate the gap or zone of segregation. Efficient, effective and affordable public transport options are essential in this area. Refer Figure 73 for graphical illustration.

Public transport zones, as illustrated in Figure 73, will increase the amount of opportunities in communities by having improved access to social, economic and environmental facilities. With more alternatives and different modes of transport people will have better choices and access to work places and other amenities. This will in turn will have a positive impact on the economy of the city and lead to more efficient and liveable cities with less traffic, improved accessibility and less pollution.

This tool should be implemented on municipal level, with the cross-sectoral integration of the Department of Transport and the Department of Human Settlements. These two departments should cooperate and conduct feasibility studies in order to determine the areas with the greatest need for public transport. The Department of Transport should then determine which public transport modes would be most effective and most efficient within the various areas

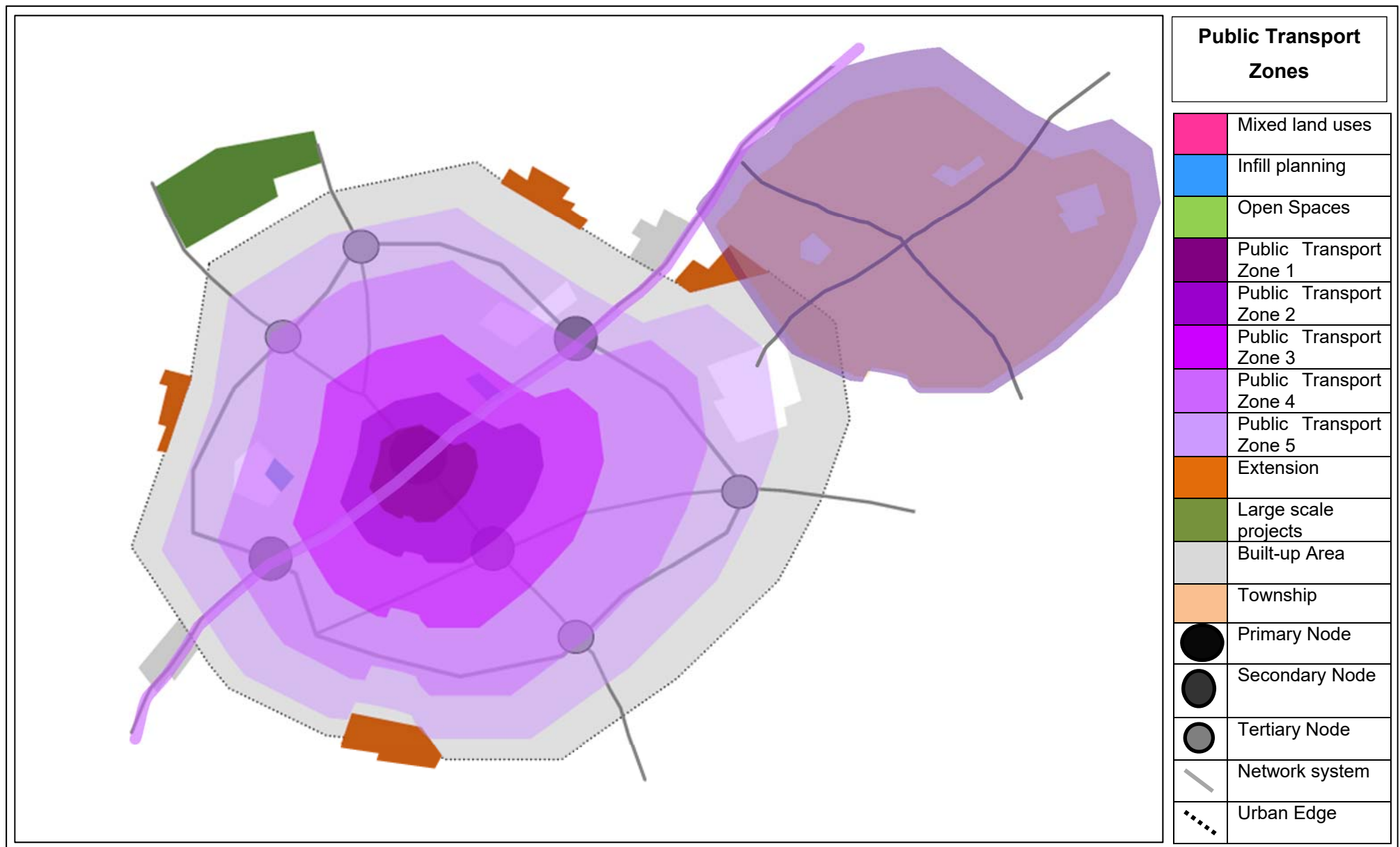


Figure 73: Public Transport Zones

Source: Own compilation (2016)

6.3.2.2 Infill Planning

Infill planning will assist in regenerating areas and prevent urban decay, and by doing so, contribute to improved urban resilience. It will improve the air quality through improved transportation and shorter travel distances (refer Section 5.4.1.4). Daily needs and services are more accessible to the community. Infill planning encourages quality affordable housing which improves choice, opportunity and efficiency.

Areas within the urban edge should be identified where infill planning can be implemented. These areas may include open or unplanned areas (note that this does not include open space or protected areas), and areas with ineffective use. The areas identified should have the necessary potential to contribute to urban resilience. Within these areas specific focus should be on other principles that improve resilience, it should accommodate mixed land uses, zones of public transport, open space systems and densification. Refer to figure 74 for graphical illustration.

As Figure 74 illustrates, infill planning will lead to areas with higher densities and mixed land uses. This will increase opportunity and choice in terms of housing and other social and economic amenities and improve efficiency and accessibility through the development of nodes which will provide the community with various facilities and services. Infill planning will improve the safety and identity of urban areas by regenerating these areas.

This tool should be implemented on municipal level, with the cross-sectoral integration of the Department of Human Settlements, Department of Housing, Department of Economic Development and the Department of Transport. These departments should cooperate to assist in determining potential areas for infill planning. They should assist in determining these areas so that it has sufficient economic potential, movement networks and access to services. The department of Housing will play a key role in determining the need for housing and accordingly plan the density and types of housing.

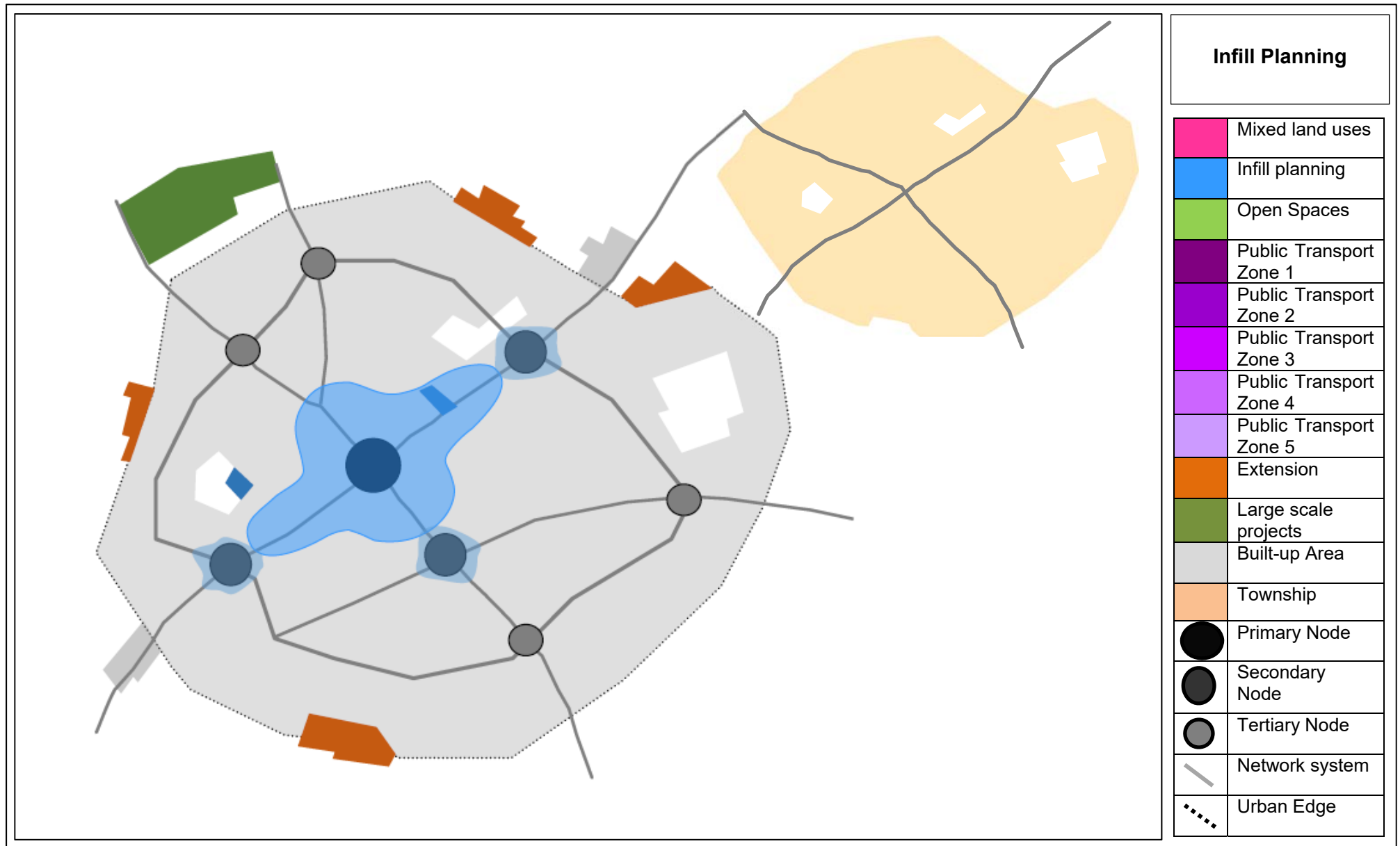


Figure 74: Infill Planning

Source: Own compilation (2016)

6.3.2.3 Open Space systems and zones

Open spaces are a key part of any urban system. Open spaces should not only provide for the physical and social needs of a community, but should also increase the overall quality of the environment through accommodating natural systems, by protecting and conserving the biodiversity. It improves the physical and psychological health of people and strengthens communities (refer Section 2.2.3; 3.3.4; 4.2.3). Open spaces makes cities and neighbourhoods attractive and liveable with adequate proportion and scale. It encourages people to socialise and integrate irrespective of race or demographic status.

Zones and systems should be identified and planned for. Instead of creating one or two single large open spaces, cities should rather plan for more open spaces, which are smaller areas, but serve part of a larger system of continuity. This will not only improve urban resilience, but will also contribute to easier access to these areas. Refer to figure 75 for graphical illustration.

As illustrated in Figure 75, open space systems improve the quality of an area; more open spaces will lead to improved social and environmental opportunities and choices. This will assist in creating an improved balance between the proportion of built areas thereby leading to aesthetically attractive and more liveable cities.

This tool should be applied on municipal level, with cross-sectoral integration with the Department of Environmental affairs. This department should assist in identifying and allocating environmental sensitive areas and areas with environmental potential. Studies should also be conducted to determine whether areas have sufficient open spaces in relation to the amount of people and built up area.

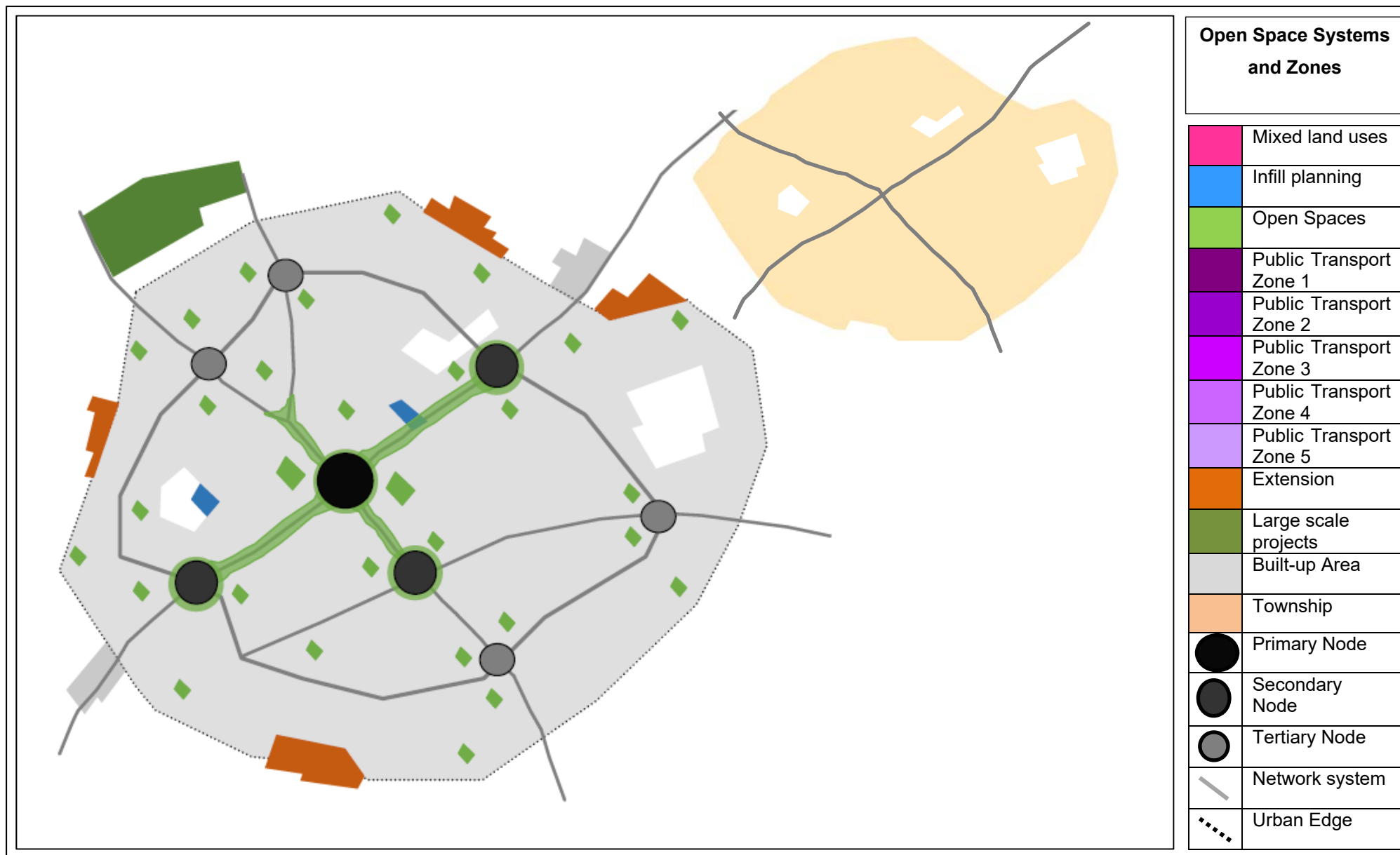


Figure 75: Open Space Systems and Zones

Source: Own compilation (2016)

6.3.2.4 Mixed land use

Mixed land uses directly contribute to urban resilience (refer Section 2.3.3.3; 4.2.1.3). Mixed land uses also lead to improved efficiency, sustainability, liveability and sense of place by enhancing the area's unique identity and development potential. Areas will have continuous movement, which will decrease crime and prevent urban decay by enhancing revitalization. Mixed land uses encourage high quality design by providing greater flexibility and more control. It increases opportunities and choices regarding housing, retail, public transport and recreation. It promotes pedestrian and bicycle travel and reduces auto dependency, roadway congestion, and air pollution by co-locating multiple destinations. Mixed land use nodes will also promote efficient use of land and infrastructure and guide development towards established areas, protecting outlying rural areas and environmentally sensitive resources.

Implementation of mixed land uses should be implemented next to main corridors and main focus areas. This will enable the development of mixed use nodes which may extend to surrounding areas, creating a spread effect (refer to figure 76 for graphical illustration).

As Figure 76 indicates, mixed land uses would result in multi-purpose areas with improved opportunities, choice and access to housing, services, work and other amenities. It could also lead to places that are aesthetically more attractive with an improved sense of place where people can live, work and play. This will ultimately accelerate the creation of liveable, resilient and efficient urban areas.

This tool should be applied on municipal level, with cross-sectoral integration with the Department of Human Settlements, Department of Housing, Department of Economic Development and the Department of Transport. Potential areas should be identified through the cooperation of the various departments. These areas should have sufficient movement networks, public transport options and economic potential and the departments should cooperate in mixing and integrating the different uses.

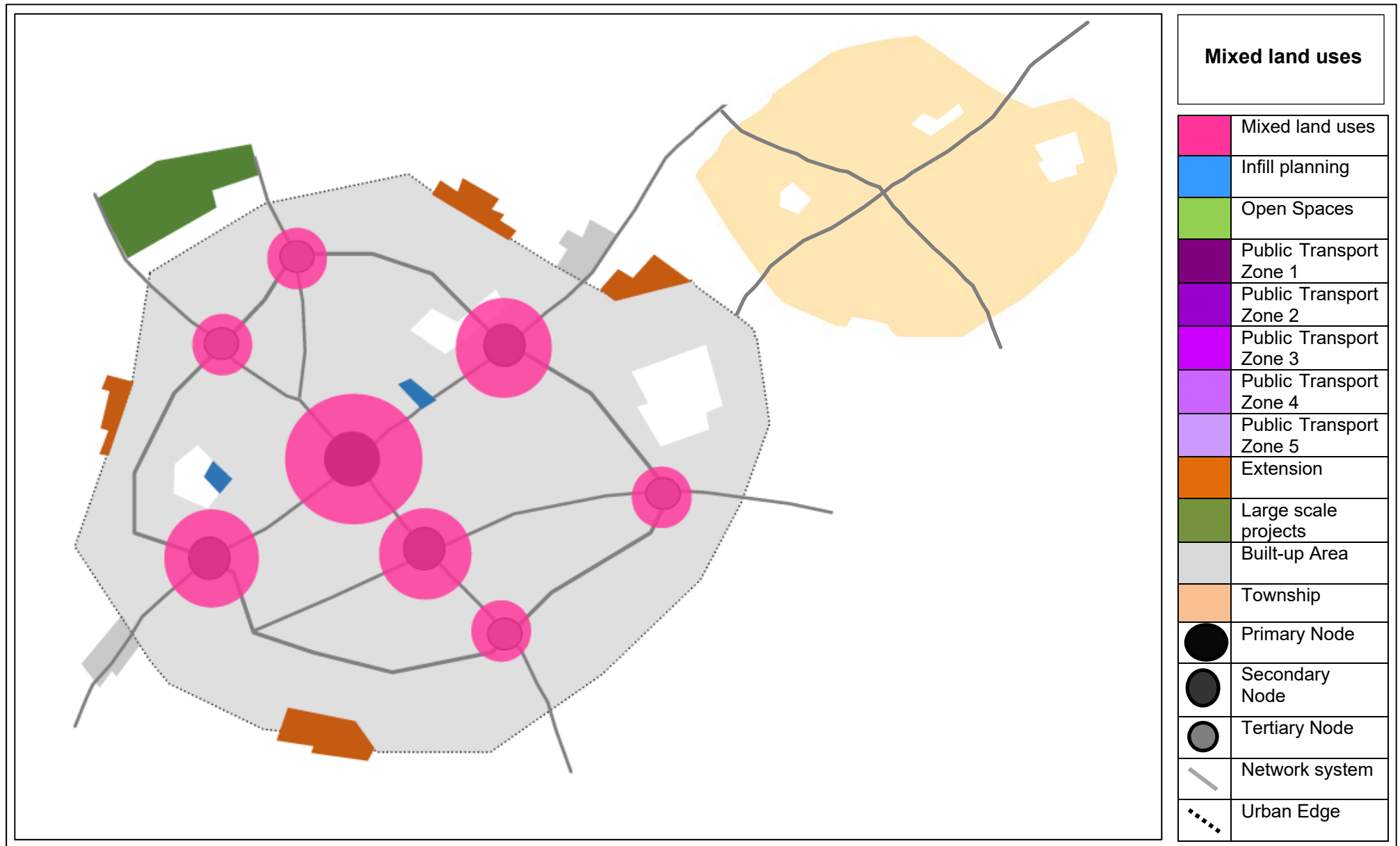


Figure 76: Mixed land uses

Source: Own compilation (2016)

6.3.2.5 Densification

If implemented appropriately, densification is arguably one of the most powerful tools that a municipality or city can adopt to achieve resilient, sustainable, competitive and liveable cities (refer Section 2.3.3.1; 4.1.5; 5.4.2.3). Well- designed density has the ability to shift transportation away from automobiles to other modes of transport and possibilities. It makes retail, recreation and business more efficient and supports daily services close to residential areas; this also improves walkability and makes it more enjoyable. Densification requires more high density residential areas, which can be more affordable and more efficient. Furthermore, it fosters a public realm with activities and facilities that encourage interaction between residents. Densification also limits urban sprawl, thereby motivating improved preservation of farmlands and other heritage areas.

Densification should be applied along main corridors, within the CBD and other secondary nodes. Different intensities of densification could be developed, descending from the primary focus areas outwards to the surrounding areas. This will make a significant contribution to the overall urban resilience (refer to figure 77 for graphical illustration).

As Figure 77 demonstrates, densification will assist in creating more sustainable and affordable housing options which will in turn expedite improved opportunities and choices in terms of different densities and types of housing. In a similar vein, access to public facilities and other amenities will be enhanced due to the proximity of services, amenities and the development of nodes and resulting in overall efficient cities.

This tool should be applied on municipal level, with cross-sectoral integration with the Department of Human Settlements, Department of Housing, Department of Economic Development and the Department of Transport. Areas should be identified where densification could be implemented, without threatening the environmental quality. These areas should have sufficient access to services and public transport.

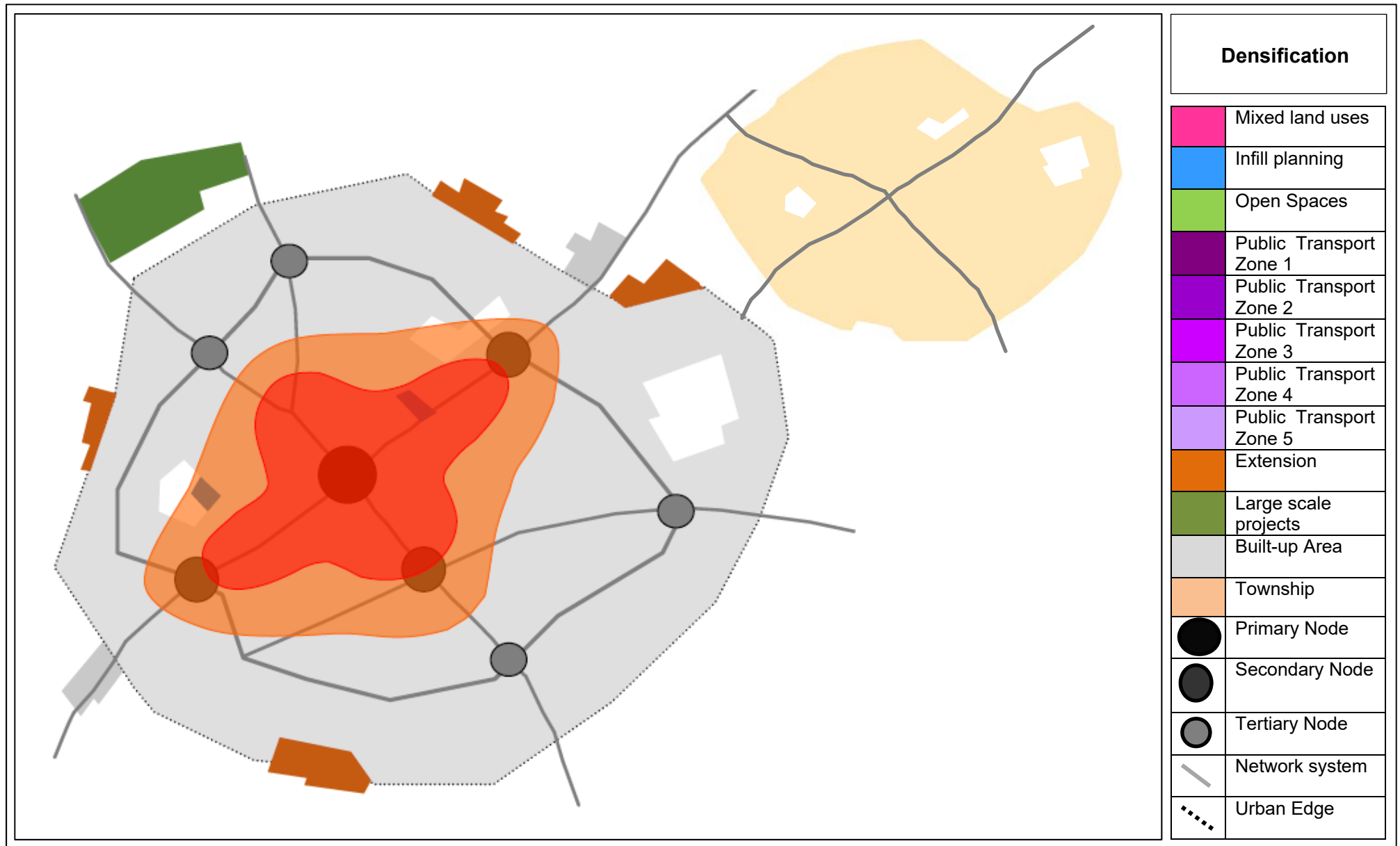


Figure 77: Densification

Source: Own compilation (2016)

6.3.2.6 Urban Edge

The urban edge is regarded as a primary strategy to counter urban sprawl, encourage densification and protect natural resources (refer Sections 2.3.3.1; 4.1.5; 5.4.2.3). It facilitates efficient use of land and urban services within the boundary of the urban edge. This will signal future spatial locations and developments. The urban edge will prevent market failures and the misallocations of resources that lead to urban sprawl and developmental advantages in suburbs by internalizing and limiting externalities that may arise through shopping malls, office parks and residential development.

The urban edge should include and integrate the city and the township. It must be as limited as possible to contain development. The edge must be strictly adhered to, with no development outside the edge. As an attempt to make the urban edge more efficient and resilient, it could be operated for longer periods. For instance, if a boundary is currently set for a period of five years, it may be increased through setting it as the urban edge for the next ten years (see figure 78 for graphical illustration).

Figure 78 elucidates the argument that an urban edge will limit urban sprawl and will therefore lead to improved efficiency through the efficient use of land. The proportion and scale of an area will also be protected and enhanced.

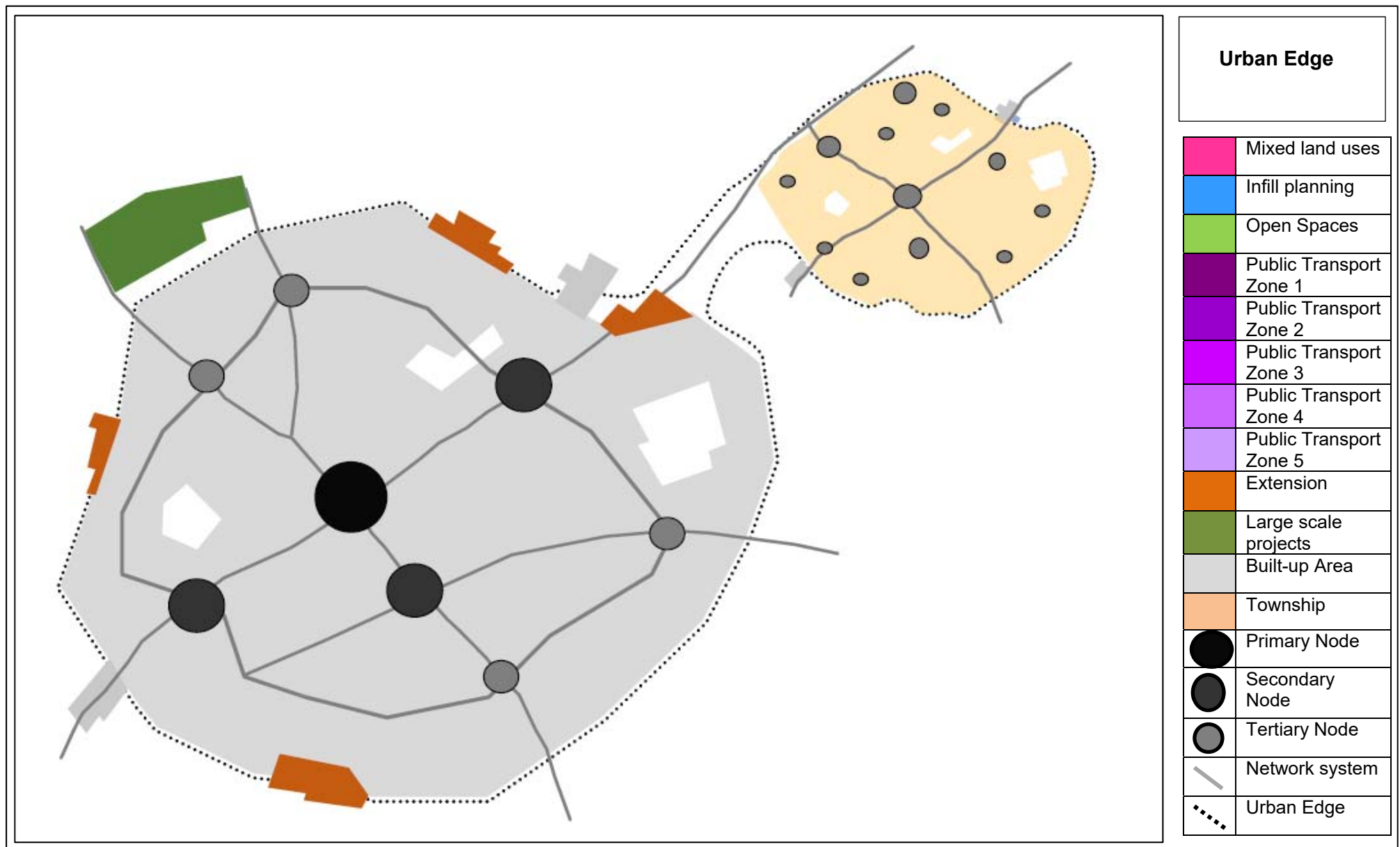


Figure 78: Urban Edge

Source: Own compilation (2016)

Figure 79 clearly illustrates the fact that all these tools are interdependent of one another and form part a cohesive network of urban resilience and efficiency, as has been extensively discussed in the study. Each of these tools contributes towards a renewed urban form that demonstrates a continuous strive to be more resilient and more efficient. It is necessary for resilient planning to be based on systems analysis, which enables it to define the points and issues of vulnerability of urban systems and focus on the key issues such as the gap or the zone of inaccessibility between the city and the twin city. This will provide possibilities and improve opportunities in terms of access to work places, social amenities and other facilities which make the city more efficient. Relatively, the use of public transport will reduce the dependence on oil and other fossil fuels and lead to a more self-sufficient and energy efficient city. Based on Ahern's (2011:?) resilience principles (refer Section 3.2.1.2), when a function or service is provided by a central entity of urban infrastructure it is more vulnerable and likely to fail. However, when the same function is provided by a distributed or decentralized system it becomes more resistant to disturbance. Green infrastructure allows for redundancy and modularization – that is, spreading risks across geographical areas, time and multiple systems. This is a result of the social, physical and economic diversity of green infrastructure that forms part of an effective strategy for supporting urban resilience. Densification and infill planning need to be accompanied by a diversification of land uses, increased access to both social and physical infrastructure, better links to public transport, and integration with public and green spaces. This should eventuate in a more efficient, equitable, sustainable and resilient growth trajectory. The urban edge will further propel the growth trajectory even more resilient and efficient by combating urban sprawl through limiting growth within a reasonable and effective urban edge.

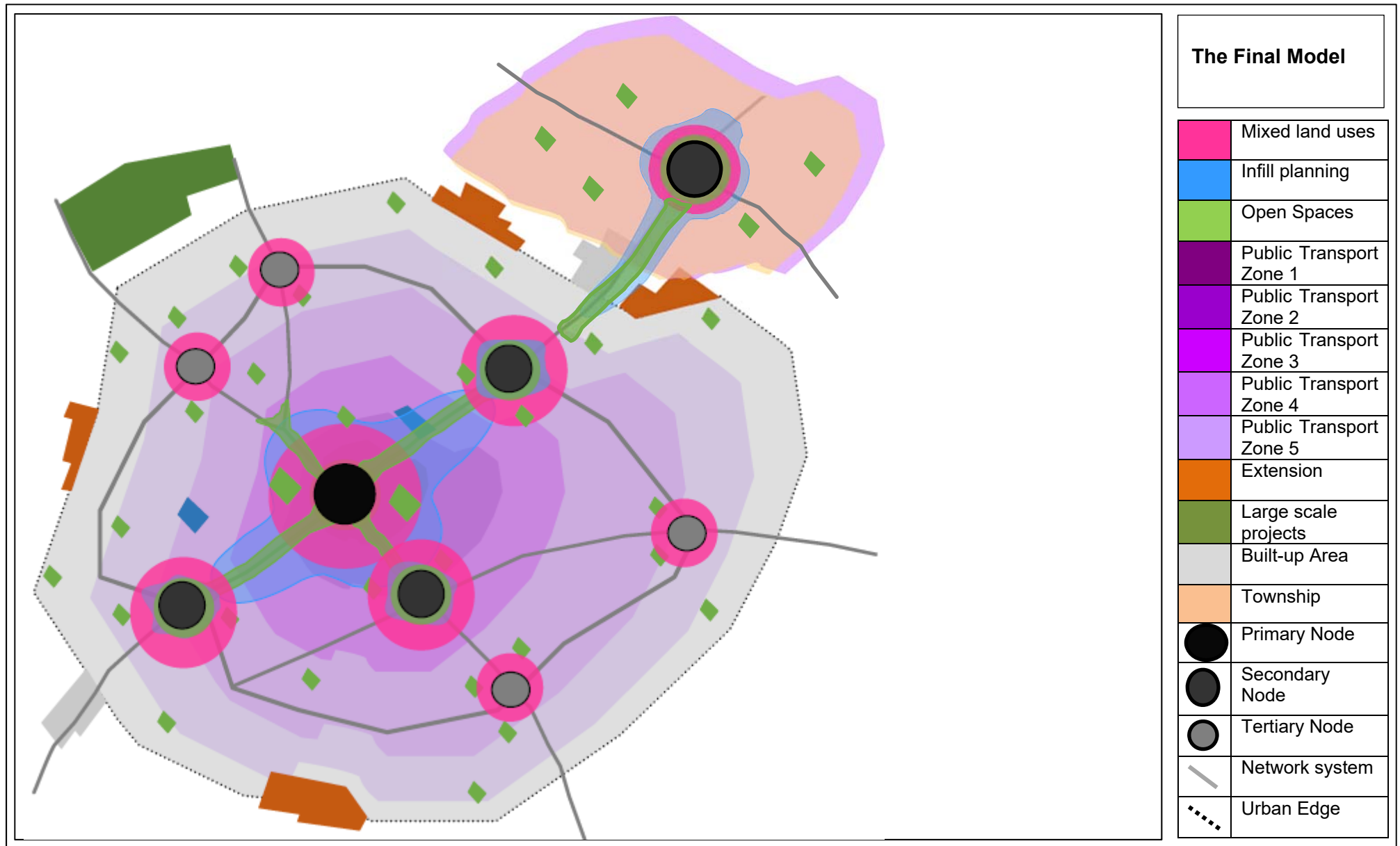


Figure 79: The Final Model

Source: Own compilation (2016)

6.4 Conclusion

This study determined that:

*Urban resilience refers to the ability of a **daily urban system** and all its constituent **socio-ecological** and **socio-technical** networks across **temporal** and **spatial** scales to maintain or rapidly return to desired functions in the face of a **disturbance**, to **adapt** to change, and to quickly transform systems that limit current or future **adaptive capacity** (refer Section 3.2.1.2).*

The following components and aspects contribute to the key aspects of the definition as set out in the study. The **daily urban system** and its different constituents were discussed and its importance was thoroughly integrated into the study (refer Section 3.2.1.1). The proposals made and the tools identified refer directly to the urban area covered by the daily urban system, as identified by Bourne (refer Section 3.2.1.1). The **socio-ecological** aspect was highlighted, analysed and integrated into the implementation tools for resilience. Tools that specifically relate to this aspect are open space systems and public transport zones. Many of the other tools also affect certain aspects of this term. The **temporal scale** was addressed by the different legislation that focuses on different time periods, such as the NDP, which focuses on the long-term, the MTSF on the medium term and the SDF which deals with the short term. The spatial scale was addressed by the different levels of government and its cooperation and integration (national, provincial and municipal level). The tools were chosen and created so that they assist in the process of adaption. For instance, it plans for future shocks, so that in the event of shocks, the consequences are minimized therefore, the system **adapts** quickly. The accelerated and more effective adaption process results in more urban resilient and urban efficient nodes. The tools also adhere to the four subsystems (refer to Figure 14), therefore, they simplify and ease the implementation of resilience and efficiency into the various systems. These four subsystems include Governance Networks, Networked Material and Energy flows, Urban Infrastructure and Form, and Socio-economic Dynamics. The Governance Networks are addressed by the integration and role of the different government levels and departments in the cross-sectoral integration and vertical alignment. Improved access to services and amenities will improve the flow of consumer goods and services, increasing Networked Material and Energy flows. Urban infrastructure and form will be enhanced by more efficient and effective transport systems and access to public transport, open space systems, densification, infill planning and an urban edge. The Socio-economic dynamics are addressed by improved mobility, equity and integration, narrowing the effects of the gap between the city and its twin city. The five W's (refer Section 3.2.1.2) formed part in the development of the chosen set of tools. Resilience for *whom*, *what*, *when*, *where* and *why* were considered. The tools were chosen in such a way that they include

the city, the different structures and systems and its residents (whom), resilience in terms of land uses and urban efficiency (what), over a long term (when), specifically focusing on the urban area (where), in order to lead to a more efficient and resilient urban area (why). Figure 16 represents an essential part of this study and the proposed tools. The set of planning and design tools are combined and chosen in such a way that they contribute to the management of the flexibility and adaptability of an urban area. The tools address the natural (open space systems), economic (infill planning and mixed land uses), technological (public transport zones) and human (public transport zones and open space systems) aspects, which finally limits the impact of shocks on an urban area leading to improved resilience and efficiency.

This study concludes that the implementation of an appropriate land use and densification model will lead to more resilient cities. It was the objective of this study to achieve three succinct goals; firstly, to explore the different spatial components influencing the capacity of a settlement to respond positively to rapid changes. Secondly, to propose a multi-faceted approach that leads to resilience through the implementation of mixed land uses and therefore more resilient settlements., Finally, to create a tool for local government to enhance resilience and guide development through existing policy and legislation. These objectives have been dealt with in sections 2.2; 2.3; 3.2; 3.4; 3.5; 4.2; 4.3 and 5.1- 5.4 and illustrated using the theories of Young (1993), Nel (2011), Chapin and Kaiser (1979), ICLEI (2012), Saunders and Becker (2015) and Paton *et al.*, (2015) which all agree that land use planning is one of the main measures that contribute to resilience and efficiency. It was proposed that the recommendations made in this chapter could improve urban efficiency and urban resilience within urban areas by providing possible solutions which could be integrated into policy and legislation, and by providing local government with a practical set of tools. It is hoped that the utilization of urban efficiency and urban resilience will broaden cities' and government's views on resilient and efficient urban planning and development.

BIBLIOGRAPHY

Acts see South Africa

Ahern, J. 2011. From fail-safe to safe-to-fail: sustainability and resilience in the new urban world. *Landscape and urban planning*, 100(4):341–343.

Ajuntament de Barcelona. 2012. 22@Barcelona plan: a program of urban, economic and social transformation.
http://www.22barcelona.com/documentacio/Dossier22@/Dossier22@English_p.pdf Date of access: July 2016.

Alberti, M., Marzluff, J. M., Shulenberger, E., Bradley, G., Ryan, C. & Zumbrunnen, C. 2003. Integrating humans into ecology: opportunities and challenges for studying urban ecosystems. *BioScience*, 53(12):1169–1179.

Alonso, W. 1964. Location and land use. Cambridge: Harvard University Press.

American Planning Association. 2006. Planning and urban design standards. 1st ed. New Jersey: John Wiley & Sons.

Anon. 2015. Land use management. (*In Encyclopedia of Science*, 5).

Appleyard, D., 1981. Livable streets. Berkeley, USA: University of California Press.

Bandarabad, A. & Shahcheraghi, A. 2012. Livable street in urban environment: an adaptive design approach. *Advances in environmental biology*, 6(3):1063-1067.

Barcelona City Council. 2016. Environment and sustainability.
<http://ajuntament.barcelona.cat/websmunicipals/en/subject/environment-and-sustainability/>
Date of access: August 2016

Behrens, R., Watson, V. 1996. Making urban places. Cape Town: Credo Press.

Ben-Joseph, E., 2005. The code of the city: standards and the hidden language of place-making. Cambridge, Mass.: MIT.

- Berkowitz, M. 2014. Announcing our next round of resilient cities!
http://www.100resilientcities.org/blog/entry/announcing-our-next-round-of-resilient-cities#/_-_/
 Date of access: July 2016.
- Bhatta, B. 2010. Analysis of urban growth and sprawl from remote sensing data.
http://link.springer.com.nwulib.nwu.ac.za/chapter/10.1007%2F978-3-642-05299-6_2 Date of access: May 2016
- Blundell, E. 2010. Document analysis as a qualitative research technique.
<http://www.dal.ca/content/dam/dalhousie/pdf/dentistry/ICOH2010/DocAnalysisSchool.pdf> Date of access: July 2016.
- Bourne, L.S., 1975. Urban systems: strategies for regulation: a comparison of policies in Britain, Sweden, Australia, and Canada. Oxford: Clarendon Press.
- Bourne, L.S. & J. Simmons. 1978. Systems of cities. New York: Oxford University Press.
- Bowland, C. & Otto, L. 2012. Implementing development corridors: lessons from the Maputo corridor. <http://www.mcli.co.za/mcli-web/downloads/docs/PB54-MaputoCorridor.pdf> Date of access: May 2016.
- Bretagnolle, A., Pumain, D. & Vacchiani-Marcuzzo, C. 2010. The organisation of urban systems. <https://hal.inria.fr/halshs-00459713/document> Date of access: April 2016.
- Brodeur, M. 2003. Ten tips for designing consumer friendly downtown. *Planning*, 69(4):24-27.
- Brown, A., Dayal, A. & Rumbaitis Del Rio, C. 2012. From practice to theory: emerging lessons from Asia for building urban climate change resilience. *Environment and urbanization*, 24(2):531–556
- Brugmann, J. 2012. Financing the resilient city. *Environment and urbanization*, 24(1):215–232.
- Brunner, H. 2014. What is economic corridor development and what can it achieve in Asia's subregions? <http://www10.iadb.org/intal/intalcdi/PE/2013/12562.pdf> Date of access: May 2016.

- Brunner, J., Cozens, P. 2013. 'Where have all the trees gone?' Urban consolidation and the demise of urban vegetation: a case study from Western Australia. *Planning practice res.*, 28:231–255.
- Bunker, R., Gleeson, B., Holloway, D. & Randolph, B. 2002. The local impacts of urban consolidation in Sydney. *Urban policy res.*, 20:143–167.
- Burchell, R.W., Shad A.N, Listokin, D., Phillips, H., Downs, A., Seskin, S., Davis, J.S., Moore, T., Helton, D. & Gall, M. 1998. The costs of sprawl – revisited. Washington, DC: National Academy Press. (Report 39, Transportation Research Board).
http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_39-a.pdf Date of access: 04 May 2016.
- Burgess, E.W. 1930. The new community and its future. *The annals of the American Academy of Political and Social Science*, 149(236):157-164
- Campanella, T.J. 2006. Urban resilience and the recovery of New Orleans. *Journal of the American Planning Association*, 72(2):141–146.
- Campbell, S. 1996. Green cities, growing cities, just cities? Urban planning and the contradictions of sustainable development. *Journal of the American Planning Association*, 62:296-312.
- Cartalis, C. 2014. Toward resilient cities – a review of definitions, challenges and prospects. *Advances in building energy research*, 8(2):259-266.
- Chapin, F.S., Jr. & Kaiser, E.J. 1979. Urban land use planning. USA: University of Illinois Press.
- Chelleri, L. 2012. From the resilient city to urban resilience: a review essay on understanding and integrating the resilience perspective for urban systems. *Documents d'Anàlisi Geogràfica*, 58(2):287–306.
- Christaller, W. 1966. Central places in southern Germany. Translated by Baskin, C.W. New Jersey: Prentice-Hall.
- Christopherson, A.J. 1984. South Africa: the impact of past geographies. Kenwyn: Juta.

Christopherson, S., Michie, J. & Tyler, P. 2010. Regional resilience: theoretical and empirical perspectives. *Cambridge journal of regions, economy and society*, 3(1):3-10.

Circles of Sustainability Organisation. 2015. New Delhi, India.

<http://www.circlesofsustainability.org/cities/new-delhi/> Date of access: July 2016.

Coaffee, J. 2013. Towards next-generation urban resilience in planning practice: from securitization to integrated place making. *Planning practice and research*, 28(3):323–339.

Constitution see South Africa

Cowell, R. & Owens, S. 2002. Land and limits: interpreting sustainability in the planning process. London: Routledge.

Crowhurst, S.H. & Lennard, H.L.. 1987. Livable cities. New York, USA: Gondolier.

CSIR (Council for Scientific and Industrial Research). 2000. Guidelines for human settlement and design. Pretoria: Capture Press.

CSIR (Council for Scientific and Industrial Research). 2012. Guidelines for the provision of social facilities in South African settlements. 1st ed. Pretoria: Capture.

Cumming, G.S. 2011. Spatial resilience: integrating landscape ecology, resilience, and sustainability. *Landscape ecology*, 26(7):899–909.

Daneshpour, A. & Shakibamanesh, A. 2011. Compact city; does it create an obligatory context for urban sustainability? *International journal of architectural engineering & urban planning*, 21(2):110–118.

Davies, R. 1981. The spatial formation of the South African city. *GeoJournal*, 2:59-72.

Dehli Development Authority. 2007. Master plan for Delhi – 2021.

<https://dda.org.in/ddanew/pdf/Planning/reprint%20mpd2021.pdf> Date of access: July 2016.

Deitrick, S., & Ellis, C. 2004. New urbanism in the inner city: a case study of Pittsburgh. *Journal of the American Planning Association*, 70(4):426–442.

Department of Cooperative Governance see South Africa. Department of Cooperative Governance.

Department of Cooperative Governance and Traditional Affairs see South Africa. Department of Cooperative Governance and Traditional Affairs.

Department of Housing see South Africa. Department of Housing.

Desouza, K. C. & Flanery, T. H. 2013. Designing, planning, and managing resilient cities: a conceptual framework. *Cities*, 35:89–99.

Deutsche Gesellschaft für Internationale Zusammenarbeit. 2012. Land use planning: concept, tools and application. <https://www.giz.de/fachexpertise/downloads/Fachexpertise/giz2012-en-land-use-planning-manual.pdf> Date of access: August 2016.

Dewar, D. & Uytendogaardt, R. S. 1991. Cape Town: University of Cape Town, Urban Problems Research Unit.

Dictionary.com. 2010. Resilience. <http://www.dictionary.com/browse/resilience> Date of access: 12 April 2016.

Dowall, D. & Clark, G. 1997. Urban land policies for the uninitiated. Economic and Social commission for Asia and the Pacific. http://www.unescap.org/huset/land_policies/ Date of access: May 2016.

Drescher, A.W. 2015. Technical tools for urban land use planning. http://www.ruaf.org/sites/default/files/Discussionpaper%203%20Tools%20for%20integrating%20UPA%20in%20urban%20land%20use%20planning_1.pdf Date of access: April 2016.

Du Plessis, D.J. 2015. Land-use mix in South African cities and the influence of spatial planning: Innovation or following the trend? *South African geographical journal*, 97:3, 217-242.

Education and Training Unit. 2016. Integrated development planning for local government. <http://www.etu.org.za/toolbox/docs/localgov/webidp.html> Date of access: June 2016.

Ernstson, H., van der Leeuw, S. E., Redman, C.L., Meffert, D.J., Davis, G., Alfsen, C., *et al.* 2010. Urban transitions: on urban resilience and human-dominated ecosystems. *Ambio*, 39(8):531–545.

eThekweni Municipality. 2013. Spatial development framework.

http://www.durban.gov.za/Resource_Centre/public_notices/March%202013/Final%20SPATIAL%20DEVELOPMENT%20FRAMEWORK%20for%20public%20comment.pdf Date of access: September 2016.

eThekweni Municipality. 2014. Land use and management scheme.

http://www.durban.gov.za/Resource_Centre/Current%20Projects%20and%20Programmes/LUMS%20Consolidated%20and%20Revised%20Town%20Planning%20Scheme/Durban%20Scheme%20Review%20Final%20Draft%2029.pdf Date of access: September 2014.

eThekweni Municipality. 2015a. Preliminary resilience assessment.

[http://www.durban.gov.za/City_Services/development_planning_management/environmental_planning_climate_protection/About%20Durban%E2%80%99s%20Resilience%20Programme/Phase%20One/Documents/DurbansPreliminaryResilienceAssessment%20\(long_version\)November2015.pdf](http://www.durban.gov.za/City_Services/development_planning_management/environmental_planning_climate_protection/About%20Durban%E2%80%99s%20Resilience%20Programme/Phase%20One/Documents/DurbansPreliminaryResilienceAssessment%20(long_version)November2015.pdf) Date of access: July 2016

eThekweni Municipality. 2015b. What you told us about resilience in Durban.

http://www.durban.gov.za/City_Services/development_planning_management/environmental_planning_climate_protection/Projects/100RC/Documents/100RCStakeholderEngagementPublicDocument.pdf Date of access: July 2016

eThekweni Municipality. 2016a. About Durban

http://www.durban.gov.za/Discover_Durban/Pages/default.aspx Date of access: July 2016.

eThekweni Municipality. 2016b. Durban is committed to creating a climate friendly and sustainable environment.

http://www.durban.gov.za/Resource_Centre/new2/Pages/welovedurban2.aspx Date of access: July 2016.

European Commission. 1999. European spatial development perspective: towards balanced and sustainable development of the territory of the European Union.

http://ec.europa.eu/regional_policy/sources/docoffic/official/reports/pdf/sum_en.pdf Date of access: August 2016.

European Commission. 2014. Resilience Marker.

European Commission. 2015a. Environment: Sustainable Development.

<http://ec.europa.eu/environment/eussd/> Date of access: August 2016.

European Commission. 2015b. Resilience Compendium.

European Union. 2016. Spain. https://europa.eu/european-union/about-eu/countries/member-countries/spain_en#spain-in-the-eu Date of access: August 2016.

Evans, P. 2002. Livable cities? Urban struggles for livelihood and sustainability. California: University of California Press.

Farrington, J. & Kuhlman, T. 2010. What is sustainability? *Sustainability*, 2:3436-3448.

Filion, P., Hoering, H., Trudi, B. & Sands, G. 2004. The successful few: healthy downtowns of small metropolitan regions. *Journal of the American Planning Association*, 12:383-401.

Fischel, W.A. 2004. An economic history of zoning and a cure for its exclusionary effects. *Urban studies*, 41:317–340.

Folke, C. 2006. Resilience: The emergence of a perspective for social–ecological systems analyses. *Global environmental change*, 16(3):253–267.

<http://dx.doi.org/10.1016/j.gloenvcha.2006.04.002> Date of access: April 2016.

Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanovic, N. & Meijers, E. 2007. Smart cities- ranking of European medium-sized cities. Vienna University of Technology.

http://www.smart-cities.eu/download/smart_cities_final_report.pdf Date of access: 4 April 2016.

Godschalk, D.R. 2003. Urban hazard mitigation: creating resilient cities. *Natural hazards review*, 4(3):136–143.

Godschalk, D.R. 2004. Land use planning challenges. *Journal of the American Planning Association*, 70(1):5-13.

Google Maps. 2016a. Map of Catalonia.

<https://www.google.com/maps/place/Catalonia,+Spain/data=!4m2!3m1!1s0x12a45bdc8530f5f3:>

0x100fae021a3c850?sa=X&ved=0ahUKEwjryLnCwdfOAhVL2mMKHQCjA9wQ8gEIHTAA Date of access: August 2016.

Google Maps. 2016b. Map of New Delhi.

<https://www.google.com/maps/place/New+Delhi,+Delhi+110001,+India/@28.5272181,77.0688996,11z/data=!3m1!4b1!4m5!3m4!1s0x390cfd5b347eb62d:0x52c2b7494e204dce!8m2!3d28.6139391!4d77.2090212> Date of access: August 2016.

Google Maps. 2016c. Map of Durban.

<https://www.google.com/maps/place/Durban,+South+Africa/@-29.8483609,30.9223188,12z/data=!3m1!4b1!4m5!3m4!1s0x1ef7aa0001bc61b7:0xcca75546c4aa6e81!8m2!3d-29.8586804!4d31.0218404> Date of access: August 2016.

Gordon, P. & Richardson, H. W. 1997. Are compact cities a desirable planning goal? *Journal of the American Planning Association*, 63(1):96–106.

Gruis, V., Kleinhans R. & Visscher, H. 2006. Sustainable urban areas. Amsterdam: IOS Press BV.

Guba, E.G. & Lincoln, Y.S. 1981. Effective evaluation. San Francisco: Jossey-Bass.

Hamilton, W.A.H. 2009. Resilience and the city: the water sector. *Proceedings of the Institution of Civil Engineers Urban Design and Planning*, 162(3):109–121.

Hannan, S. & Sutherland, C. 2015. Mega-projects and sustainability in Durban, South Africa: convergent or divergent agendas? *Habitat international*, 3(43):205–212.

Harasawa, H. 2002. Compact city project.

<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.606.5192&rep=rep1&type=pdf> Date of access: July 2016.

Harris, C. & Ullman, E.L. 1945. The nature of cities.

Hernandez, T. & Jones, K. 2005. Downtowns in transition: emerging business improvement area strategies, *International journal of retail & distribution management*, 33(11):789-805.

Holling, C.S. 1996. Engineering resilience versus ecological resilience. (*In* Schulze, P. ed. Engineering within ecological constraints. Washington, DC: The National Academies Press.)

Houston. 2016. Urban corridor planning.

https://www.houstontx.gov/planning/_urban/description.htm_ Date of access: June 2016.

Houston, M.J. & Nevin, J.R. 1980. Retail shopping area image: structure and congruency between downtown areas and shopping centers, *Advances in consumer research*, 8:677-81.

Hoyt, H. 1939. The structure and growth of residential neighbourhoods in American cities. Washington: Federal housing administration.

Hurlston, L. & Thompkins, E. 2012. Public-private partnerships in the provision of environmental governance: a case of disaster management. Adapting institutions: governance, complexity and social-ecological resilience. Cambridge: Cambridge University Press.

ICLEI (Local Governments for Sustainability). 2012. Integrated land use planning for resilient urban communities. http://resilient-cities.iclei.org/fileadmin/sites/resilientcities/files/Resilient_Cities_2012/Digital_Congress_Proceedings/RC2012_Storch.pdf_ Date of access: May 2016.

ICLEI (Local Governments for Sustainability). 2016. Durban, South Africa. <http://archive.iclei.org/index.php?id=1214> Date of access: July 2016.

Isard, W. 1975. Introduction to regional science. Englewood Cliffs: Prentice Hall. Johnson, H. 1972. Urban geography: an introductory analysis. 2nd ed. Oxford, NY: Pergamon.

Oryani, K., Greiner, U.R.S. & Harris, B. 1996. Review of land use models: theory and application. <http://ntl.bts.gov/lib/7000/7500/7505/789761.pdf> Date of access: March 2016.

Kearsley, G.W. 1983. Teaching urban geography: the Burgess model. *New Zealand journal of geography*:10-13.

Kotharkar, R., Bahadure, P. & Vyas, A. 2012. Compact city concept: it's relevance and applicability for planning of Indian Cities.

https://www.researchgate.net/publication/265915492_Compact_City_Concept_It's_Relevance_and_Applicability_for_Planning_of_Indian_Cities Date of access: June 2016.

- Kulshrestha. 2013. Planning systems in India.
<http://www.landuseindia.in/live/hrdpmp/hrdpmaster/hrdp-aseam/content/e48335/e48799/e48940/e54451/e54457/PlanningSysteminIndiaWS19Mar2013Kulshrestha.pdf> Date of access: August 2016.
- Lamond, J. E. & Proverbs, D.G. 2009. Resilience to flooding: lessons from international comparison. *Proceedings of the Institution of Civil Engineers Urban Design and Planning*, 162(2):63–70.
- Lees, E. & Vinuales, J. 2016. European Union Planning Law.
<http://www.ceenrg.landecon.cam.ac.uk/research/european-union-planning-law> Date of access: August 2016.
- Leichenko, R. 2011. Climate change and urban resilience. *Current opinion in environmental sustainability*, 3(3):164–168.
- Letaifa, S. 2015. How to strategize smart cities: revealing the SMART model. *Journal of business research*, 68:1414-1419.
- Lewis, M. 2005. An appropriate land use management system for present-day South Africa: how roles could change.
http://www.academia.edu/210909/An_Appropriate_Land_Use_Management_System_for_Present-Day_South_Africa_How_Roles_could_change Date of access: July 2016.
- Lhomme, S., Serre, D., Diab, Y. & Laganier, R. 2013. Urban technical networks resilience assessment, resilience and urban risk management. London: CRC Press.
- Liao, K.H. 2012. A theory on urban resilience to floods – a basis for alternative planning practices. *Ecology and society*, 17(4):48.
- López, M.V., Fernandez, M., Masio, A.G. & Fornos, J.R. 2015. Barcelona: building resilience strategies. <http://podcast.tisp.org/index.cfm?pk=download&pid=10261&id=12972>. Date of access: September 2016.
- Losch, A. 1954. The economics of location. London: Geoffrey Cumberlege, Oxford University Press.

Lu, P., & Stead, D. 2013. Understanding the notion of resilience in spatial planning: a case study of Rotterdam, The Netherlands. *Cities*, 35:200–212.

Lynch, K. 1984. *Good city form*. 2nd ed. Massachusetts, London: MIT.

Lynch, K. & Hack, G. 1998. *Site planning*. 3rd ed. London: MIT.

Mahriyar, M. Z. & Rho, J. H. 2013. The compact city concept in creating resilient city and transportation system in Surabaya.

<http://www.sciencedirect.com/science/article/pii/S1877042814042517> Date of access: June 2016.

Marsal-Llacuna, M. & Lo´pez-Ibanez, M. 2014. Smart urban planning: designing urban land use from urban time use, *Journal of urban technology* 21(1):39-54.

Matyas, D. & Pelling, M. 2014. Positioning resilience for 2015: the role of resistance, incremental adjustment and transformation in disaster risk management policy. *Disasters*, 39(SI):S1–S18.

McMahon, T. 2012. Why sense of place is worth caring about.

<http://www.planetizen.com/node/56165> Date of access: May 2016.

Meerow, S., Newell, J.P. & Stults, M. 2016. Review: defining urban resilience: a review. *Landscape and Urban Planning*, 147:38-49

Mills, D.E. 1989. Is zoning a negative-sum game? *Land economics*, 65(1):1.

Moffatt, S. 2014. Resilience and competing temporalities in cities, *Building research & information*, 42(2):202–220.

Moss, M. 1997. Reinventing the central city as a place to live and work. *Housing policy debate*, 8(2):471-90.

Mullin, J. & Kotval, Z. 2003. Measuring the effectiveness of downtown revitalization strategies. http://scholarworks.umass.edu/larp_faculty_pubs/23 Date of access: May 2016.

National Development and Planning Commission. 1999. Green paper on development and planning. http://www.gov.za/sites/www.gov.za/files/devplan_1.pdf Date of access: August 2016.

National Planning Commission of India. 2013. Twelfth five year plan (2012–2017) economic sectors. http://planningcommission.gov.in/plans/planrel/12thplan/pdf/12fyp_vol2.pdf Date of access: August 2016.

National Portal of India. 2016. Profile. <https://india.gov.in/> Date of access: September 2016.

Nel, V. 2011. Land-use management system as a tool towards achieving low-carbon cities in South Africa. <http://www.ajol.info/index.php/trp/article/download/77203/67654> Date of access: August 2016.

New Delhi. 2004. International law on sustainability development- Berlin conference. <http://www.ila-hq.org/download.cfm/docid/917ADCC2-76B0-4D5B-889D9BA9AFD2BB95>. Date of access: July 2016.

Nicol, L.A. & Knoepfel, P. 2014. Resilient housing: a new resource-oriented approach. *Building research & information*, 42(2):229-239.

Octaviano, T. 2014. Economic corridors boost markets, living conditions. <http://research.bworldonline.com/popular-economics/story.php?id=350&title=Economic-corridors-boost-markets,-living-conditions> Date of access: May 2016.

Opticits. 2015. Hazur resilient systems: Barcelona case study. http://resilient-cities.iclei.org/fileadmin/sites/resilientcities/files/Resilient_Cities_2013/Presentations/A2_Fontanals_RC2013.pdf Date of access: September 2016.

Pacione, M. 2001. Models of urban land use structure in cities of the developed world, 97.

Padilla, C. & Eastlick, M. 2008. Exploring urban retailing and CBD revitalization strategies. *International journal of retail & distribution management*, 37(1):7-23.

Patel, Z. 2000. Rethinking sustainable development in the post-apartheid reconstruction of South African cities. *Local environment*, 5(4):383–399.

Paton, D., Mamula-Seadon, L. & Selway, K. 2013. Community resilience in Christchurch: adaptive responses and capacities during earthquake recovery. *GNS science report*, 37:28-39.

Pendall, R., Foster, K. A. & Cowell, M. 2010. Resilience and regions: building understanding of the metaphor. *Cambridge journal of regions, economy and society*, 3:71–84.

Pickett, S.T.A., Cadenasso, M.L. & Grove, J.M. 2001. Resilient cities: meaning, models, and metaphor for integrating the ecological, socio-economic, and planning realms. *Landscape and urban planning*, 69(4):369–384.

Pister, J.L. 2004. Using landscape metrics to create an index of forest fragmentation for the State of Maryland. Master Thesis, Towson University.

https://tigerweb.towson.edu/morgan/files/thesis_pfister.pdf Date of access: 04 May 2016.

Qazi, N. & Qazi, S.A. 2006. Population geography. New Delhi: APH.

Robbins, G. 2014. The Dube Trade Port/King Shaka International Airport mega-project: exploring impacts in the context of multi-scalar governance processes.

https://www.infona.pl/resource/bwmeta1.element.elsevier-84a98968-4417-3fca-b0ea-7b279a10742f_ Date of access: July 2016.

Rodrigue, J. 1998. Urban land use models [http:// people. hofstra. edu/ geotrans/ eng/ ch6en/ conc6en/ ch6c2en. Html](http://people.hofstra.edu/geotrans/eng/ch6en/conc6en/ch6c2en.html) Date of access: March 2016.

Rolf, D. & Carol, A. 2015. Land-use management. Salem Press Encyclopedia of Science.

<http://eds.a.ebscohost.com.nwulib.nwu.ac.za/eds/detail/detail?sid=5de9d228-5b37-4328-9df7-a5c4bc76f179%40sessionmgr4010&vid=2&hid=4102&bdata=JnNpdGU9ZWRzLWxpdmU%3d#AN=89250503&db=ers>

Romero-Lankao, P. & Gnatz, D.M. 2013. Exploring urban transformations in Latin America. *Current opinion in environmental sustainability*, 5(4):358–367.

Rothaug, I. 2006. Planning and urban design assessment: executive summary.

<http://www.durbanpoint.co.za/> Date of access: July 2016.

Saunders, W. & Becker, J.S. 2015. A discussion of resilience and sustainability: land use planning recovery from the Canterbury earthquake sequence, New Zealand, *International journal of disaster risk reduction*, 14:73–81.

Shafie, F.A. 2014. Urban sustainability in Barcelona: living and learning the experience. *Procedia - social and behavioral sciences*, 168:381-388. 2015.

Siek, A. 2015. Smart cities: a detailed look at land use planning techniques that are aimed at promoting both energy and environmental conservation, *Albany law environmental outlook journal*, 7:46-66.

Silvestre, D.M. 2009. Barcelona July 1909: a city in flames. Tragic week and the murder of Ferrer i Guardia. <http://www.katesharpleylibrary.net/n8pm38> Date of access: July 2016.

Simon, D. 1989. Crisis and change in South Africa: implications for the apartheid. *City*:189.

South Africa. 2013. Spatial Land Use and Management Act 16 of 2013.

South Africa. 1996. Constitution of the Republic of South Africa.
<http://www.justice.gov.za/legislation/constitution/SACConstitution-web-eng.pdf> Date of access: August 2016.

South Africa. 1998. National Environmental Management Act 101 of 1998.

South Africa. 2006. National spatial development perspective. Pretoria.

South Africa. 2011. National development plan: vision for 2030. Pretoria.

South Africa. 2013. Spatial Planning and Land Use Management Act No. 16 of 2013.

South Africa. 2014. SDF guidelines: guidelines for the development of provincial, regional and municipal spatial development frameworks and precinct plans. Pretoria.

South Africa. Department of Cooperative Governance. 2009. National urban development framework. Pretoria.

South Africa. Department of Cooperative Governance and Traditional Affairs. 2016. Integrated urban development framework. Pretoria.

South Africa. Department of Housing. 1997. Urban development framework. Pretoria.

Stump, E. 2013. Viewpoint: new in town? On resilience and “resilient cities”. *Cities*, 32:164-166.

Sustainable Cities Institute. 2012. Land use and planning.

<http://www.sustainablecitiesinstitute.org/topics/land-use-and-planning> Date of access: May 2016.

Taaffe, E. J., Morrill, R. L. & Gould, P. R. 1963. Transport expansion in underdeveloped countries: a comparative analysis. *Geographical review*, 53:503–529.

The Barcelona Field Study Centre. 2016. Barcelona: sustainable city management.

<http://geographyfieldwork.com/BarcelonaPollutionManagement.htm> Date of access: July 2016.

The Planning Initiative Team. 2005. Guidelines for the preparation and implementation of schemes. [http://sapi.org.za/sites/default/files/document-library/KwaZulu-](http://sapi.org.za/sites/default/files/document-library/KwaZulu-Natal%20Quick%20Overview%20Guidelines%20for%20Preparation%20and%20Implementation%20of%20Schemes,%20April%202005.pdf)

[Natal%20Quick%20Overview%20Guidelines%20for%20Preparation%20and%20Implementation%20of%20Schemes,%20April%202005.pdf](http://sapi.org.za/sites/default/files/document-library/KwaZulu-Natal%20Quick%20Overview%20Guidelines%20for%20Preparation%20and%20Implementation%20of%20Schemes,%20April%202005.pdf) Date of access: August 2016.

The World Bank. 2015. Urbanisation REVIEWS.

<http://www.worldbank.org/en/topic/urbandevelopment/publication/urbanization-reviews> Date of access: March 2016

Thornbush, M., Golubchikov, O. & Bouzarovski, S. 2013. Sustainable cities targeted by combined mitigation–adaptation efforts for future-proofing. *Sustainable cities and society*, 9:1–9.

Thrall, G.I. 2002. Business, geography and new real estate market analysis. New York: Oxford University Press.

Turok, I. 2012. Urbanisation and development in South Africa: economic imperatives, spatial distortions and strategic responses. <http://pubs.iied.org/pdfs/10621IIED.pdf> Date of access: March 2016.

Tyler, S. & Moench, M. 2012. A framework for urban climate resilience. *Climate and development*, 4(4):311–326.

United Nations. 2000. Millenium development goals. <http://www.un.org/millenniumgoals/> Date of access: June 2016.

United Nations. 2012a. How to make cities more resilient- a handbook for local government leaders.

United Nations. 2012b. UN-habitat at a glance. <http://unhabitat.org/about-us/un-habitat-at-a-glance/> Date of access: August 2016.

United Nations. 2013. The city resilience profiling programme.

United Nations. 2015. Sustainable development goals.
http://www.undp.org/content/dam/undp/library/corporate/brochure/SDGs_Booklet_Web_En.pdf
Date of access: July 2016

United Nations. 2016. The new urban agenda. <http://habitat3.org/the-new-urban-agenda> Date of access: September 2016.

Viguer, J. 2009. Regional planning as an instrument for sustainable urban growth: a practical example of Catalonia.
<http://www.uria.com/documentos/publicaciones/2234/documento/081catUrban.pdf?id=1962>
Date of access: July 2016.

Von Thünen, J.H. 1966. Von Thünen's isolated state: an English translation of Der Isolierte Staat. Oxford: Pergamon.

Wagner, I. & Breil, P. 2013. The role of eco-hydrology in creating more resilient cities. *Eco-hydrology & hydrobiology*, 13(2):113–134.

Wamsler, C., Brink, E. & Rivera, C. 2013. Planning for climate change in urban areas: from theory to practice. *Journal of cleaner production*, 50:68–81.

Wardekker, J.A., de Jong, A., Knoop, J.M. & van der Sluijs, J.P. 2010. Operationalising a resilience approach to adapting an urban delta to uncertain climate changes. *Technological forecasting and social change*, 77(6):987–998.

- Washburn, D., Sindhu, U., Balaouras, S., Dines, R.A., Hayes, N.M. & Nelson, L.E. 2010. Helping CIOs understand “smart city” initiatives: defining the smart city, its drivers, and the role of the CIO. Cambridge: Forrester Research.
- Weber, A. 1929. Theory of the location of industries. Chicago: University of Chicago Press.
- Weisi, F., & Ping, P. 2014. A discussion on smart city management based on meta-synthesis method. *Management science and engineering*, 8(1):68–72.
- White, M.J. 1987. American neighbourhoods and residential differentiation. New York: Russell Sage Foundation.
- Wilkinson, C. 2011. Social–ecological resilience: insights and issues for planning theory. *Planning theory*, 11(2):148–169.
- Williams, K. 2000. Does intensifying cities make them more sustainable? (*In Williams, K., Burton, E. & Jenks, M., eds. Achieving sustainable urban form. London: Spon Press. p. 30–45).*
- World Commission on Environment and Development, 1987. Our common future. Oxford: Oxford University Press.
- Young, A. 1993. Guidelines for land use planning.
<http://www.fao.org/docrep/t0715e/t0715e00.htm> Date of access: April 2016.

