

Exploring regional resilience in different urban systems

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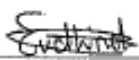
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What a journey it has been



**It's the friends we meet along life's road
who help us appreciate the journey**

ABSTRACT

The majority of the current research on a regional scale is orientated towards individual cities and not on an urban system as a whole and this type of approach neglects the critical influences of urban systems, especially on a regional scale. This study aimed to explore regional resilience in different urban systems by incorporating both regions and nodal developments to achieve a better understanding of the interaction which takes place on different levels of urban systems.

Resilience can be described as the ability to stabilise, adapt and recover from a certain shock and the resilience of an urban system can be improved through strategic policies adopted by different government spheres. Consequently, policies were examined by means of the current design process and the implementation thereof. In the empirical research, the researcher identified both a developed and developing country to explore different design processes and to investigate the implementation of international policies and frameworks. Quantitative methods were used to combine population data and concepts obtained from the literature study to illustrate different ranked size distributions. After international case studies were explored, South Africa and the Northern Cape province were assessed, and numerous concepts of the case studies were used to recommend new guidelines for policy formulation to be followed in order to maximise the development potential of an urban system on a regional scale. The study concludes with the appropriate recommendations to improve regional resilience, which would have a knock-on effect on different levels of urban systems in South Africa.

Key terms:

Regional resilience, urban systems, sustainability, hierarchy, policy.

OPSOMMING

Die meerderheid van die huidige navorsing op streekvlak is gerig op individuele stede en nie op die stedelike sisteem as geheel nie. Hierdie tipe benadering neem nie die kritiese invloede van die stedelike sisteme, veral op streekvlak in ag nie. Hierdie studie het beoog om streek veerkragtigheid in verskillende vlakke van stedelike sisteme te ondersoek deur beide streek en nodale ontwikkelings in te sluit om sodoende 'n beter begrip te kry van die interaksie wat op verskillende vlakke van stedelike sisteme plaasvind.

Veerkrachtigheid kan beskryf word as die vermoë om te stabiliseer, aan te pas en te herstel van 'n sekere skok en die veerkrachtigheid van 'n stedelike sisteem kan verbeter word deur strategiese beliede te ontwikkel en in te stel deur verskillende owerheids sfere. Gevolglik is beleide ondersoek deur middel van die huidige ontwerpproses en die implementering daarvan. In die empiriese navorsing het die navorser 'n ontwikkelde en 'n ontwikkelende land geïdentifiseer en verskillende beleids ontwerpprosesse asook die implementering van internasionale beleide was ondersoek. Kwantitatiewe metodes was gebruik om populasie syfers te kombineer en verskeie konsepte wat in die literatuur verkry was, was toegepas om verskillende rang grootte verspreidings te illustreer. Nadat internasionale gevallestudies ondersoek was, is Suid Afrika en die Noord Kaap provinsie geïdentifiseer en geassesser waar verskeie begrippe van die gevallestudies gebruik was om nuwe riglyne voor te stel vir beleidsformulering om sodoende die ontwikkelingspotensiaal in 'n stedelike sisteem op streekvlak te maksimaliseer. Die studie sluit af met aanbevelings wat toegepas kan word om streek veerkrachtigheid te verbeter wat 'n invloed op verskeie vlakke van die stedelike sisteme van Suid Afrika sal hê.

Sleuteltermes:

Streek veerkrachtigheid, stedelike sisteme, volhoubaarheid, hiërargie, beleid.

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CHAPTER ONE: INTRODUCTION

1.1 Research orientation

Generally, urban systems on a regional scale are dominated by a nodal approach. This results in research on individual cities and therefore, neglects the influences of urban systems within regions. This study, therefore, aims to investigate regional resilience in different urban systems by firstly identifying different types of regions and the interaction which exists within and between regions. Interaction within and between regions is vital for economic growth and these interactions also result in other types of settlements i.e. growth poles and corridor development. Economic growth in return will result in either balanced or unbalanced growth and can also be encouraged by both private and public investment initiatives.

Economic growth in different settlements, which are located within an urban system, creates differently sized settlements (depending on the economic growth and potential of the settlement) and can be categorised into different hierarchical distributions depending on the significance of the settlement. The hierarchical distributions, in turn, can either have a positive or negative effect on the development of adjacent settlements by means of the interaction that takes place. Furthermore, it was evident that different levels of urban systems exist and that each level of the urban system plays an important role with reference to the economic growth for the settlements located within the urban system.

When considering the whole urban system, a more efficient and effective policy can be developed to help counter several influences that weaken settlements in an urban system. The ability to stabilise, adapt and recover can be described as resilience and with reference to this study, it would refer to the ability of the urban system to improve after a negative economic cycle. This study was therefore, initiated to examine if policies implemented will have a positive or negative effect on the regional growth and methods of resilience were incorporated into different policies and strategies.

In addition, the spatial distribution of settlements within an urban system will also be evaluated to determine if the hierarchies located within the urban system have a positive or negative effect on surrounding settlements. The formulation and implementation of policies play an important role as it could either hamper or improve development within an urban system.

The focus of this study will, therefore, be on the resilience of urban systems and policies which are implemented to improve regional resilience. The Northern Cape province was identified as a

case study to determine the effect of spatially targeted investment, initiated by spatial policies on the urban system.

1.2 Problem statement

The following problem statements were identified for the study:

- i. Research on resilience is mainly focussed on isolated individual cities or regions.
- ii. Policy designed for resilience does not analyse the city or regions within the larger urban system.
- iii. Linkages between urban and rural places are neglected.

1.3 Research objectives

The main objective of this study was to propose a systematic approach to improve regional resilience in different urban systems. The following objectives were also identified for this study:

- i. Urban systems, in terms of resilience, will be evaluated as a region and not as a node. Many urban systems are categorised as an individual city and the neglect of an urban system can lead to ineffective research.
- ii. Different policies will be examined to improve a region's resilience. Policies can be categorised as either implicit or explicit and each region should be viewed individually because of their different characteristics.
- iii. Linkages between urban and rural areas will be evaluated. A linkage between urban and rural areas can be defined as any trade or characteristic that assists in the connection between rural and urban areas.

1.4 Hypothesis

A region's resilience can be improved through policy design, based on an integrated urban systems approach.

1.5 Research methodology

1.5.1 Methods of investigation

Research can be described as a systematic and logical search for useful and new information on a specific topic. It can, therefore, be seen as an investigation to find solutions to problems and can also lead to new contributions on existing knowledge (Rajasekar *et al.*, 2013:2). Furthermore,

research can be classified into two main classes; the first being basic research, which is an investigation of basic principles and the investigation of different reasons for processes and phenomenon which occurs. Basic research generally provides a deep and systematic insight into the problem and usually intends to explain and conclude the problem (refer to Sections 2,3 and 4). The second class is applied research and is focussed on solving specific problems by using accepted theories and principles. Applied research is helpful for basic research as it usually includes case studies, experimental research etc. Applied research is focussed on real life research, such as pollution control, increasing the efficiency of a machine etc. and has the potential to be implemented immediately. The following table illustrates the differences between basic research and applied research.

Table 1-1: Differences between basic and applied research

<i>Basic research</i>	<i>Applied research</i>
Seeks generalization	Studies individual or specific cases without the objective to generalize
Aims at basic processes	Aims at any variable which makes the desired difference
Attempts to explain why things happen	Tries to say how things can be changed
Tries to get all the facts	Tries to correct the facts which are problematic
Reports in technical language of the topic	Reports in common language

Source: Rajasekar *et al.* (2013:8)

The table above illustrates the differences between basic and applied research. The main objective of basic research is to find information and to expand or add new concepts to the existing knowledge base, whereas basic knowledge aims to find a solution for a problem and warrants a solution for immediate use.

There are also other types of research, which include (Rajasekar *et al.*, 2013:10):

- i. **Action research:** Finding facts to improve the quality of the action in the social sector.
- ii. **Explanatory research:** Finding answers to why items are the way they are (searching for explanations for a phenomenon).
- iii. **Exploratory research:** Obtaining additional information on a specific topic.
- iv. **Comparative research:** To investigate similarities and differences between methods, events etc.

Both basic and applied research can be either quantitative or qualitative or even both. Quantitative research is based on the measurement of an amount and a process is described for one or more

quantitative methods used and usually results in a number or a set of numbers. The characteristics of quantitative research methods are listed below:

- i. Applies mathematics/ statistics and is non-descriptive.
- ii. An iterative process is followed and evidence is evaluated.
- iii. Results are generally presented in graphs and tables.
- iv. Usually investigates when, where and what of the decision-making.

In short, statistics are widely used when a quantitative method of investigation is followed. It can be applied in several fields and this type of method usually starts by collecting data on a specific theory or hypothesis, whereafter an experiment is followed by processing the data (Rajasekar *et al.*, 2013:9).

Qualitative research is largely concerned with a qualitative phenomenon. The characteristics of the qualitative research method are listed as follows:

- i. The research is descriptive, non-numerical and applies reasoning and uses words.
- ii. The objective is to describe the situation, feeling and meaning of the study.
- iii. Data cannot be graphed.
- iv. This method is exploratory.
- v. The method usually investigates the how and why in decision-making.

A qualitative method can, therefore, not be tested by conducting chemical or physical tests but rather examine why and how a phenomenon act. Qualitative methods can be used to understand the statistics obtained through quantitative research methods.

Furthermore, the following research paradigms were considered in the study to achieve the research objectives set out in Section 1.3, each being discussed and ending with a chosen paradigm best suited to evaluate the study at hand.

- i. Positivist Paradigm

This type of paradigm is known as a scientific method of investigation and is largely used to search for the causes and effects of certain phenomenon. It is largely used in a worldview of research as it attempts to interpret observations by means of facts or measurable entities (Kivunja & Kuyini, 2017:30). Research in this type of paradigm relies on the formulation of hypotheses, testing the hypotheses and offering recommendations and conclusions. The objective of this paradigm is to provide explanations and to predict a phenomenon based on the outcomes measured.

ii. Interpretivist Paradigm

This paradigm aims to understand the subjective field of Social Sciences. This type of methodology focusses on the way an individual thinks and how they interpret different concepts, and effort is made to understand the viewpoint of the individual who is being investigated rather than the viewpoint of the researcher (Chalmers *et al.*, 2005).

iii. Critical Paradigm

The critical paradigm can be described as research which is focussed on social challenges and seek to address economic, social and political issues. The challenges as mentioned above usually lead to political conflict and the aim of this paradigm is to seek change in the political environment while confronting social oppression and to improve spatial justice through participatory research (Kivunja & Kuyini, 2017:35).

iv. Pragmatic Paradigm

This paradigm was developed by theorists which argued that a mono-paradigm orientation is inefficient. They argued that research should be more pluralistic and practical-driven and should allow for a combination of methods which will contribute to the objectives of the study. Therefore, this paradigm includes a number of mixed methods in order to understand human behaviour (Kivunja & Kuyini, 2017:35). This type of paradigm is relevant when a researcher determines their own relationships as they see fit to reach the objectives of the study. There is also no single reality and this paradigm allows the researcher to compile their own interpretations of reality while combining both quantitative and qualitative research methods.

A pragmatic paradigm approach was used by the researcher for this study as research will mainly be built with various methods which will address the objective of the study as efficiently as possible.

The following methods were used to investigate the objectives achievable for this study from both the literature and the empirical study:

1.5.2 Literature study

Literature will be used to identify different regions and to determine how regions are demarcated into different categories where the main theorists are (Rodoman, 1972; Haggett *et al.*, 1977; Glasson, 1978; Haila & Levins, 1992). After different regions were identified and described, the focus will be intensified by investigating different nodal developments located within regions (central and non-central places) and the interaction which takes place between them (interaction

generally results in growth poles and corridor development which can be either be through balanced or unbalanced economic growth) which is vital for economic growth within regions. Economic growth also passes through several stages (Rostow, 1960) which will play an important role in the recommendations of this study. The economic growth of settlements will contribute to different settlement sizes and can be classified into different hierarchical orders (Zipf, 1949; Hirschman, 1958) which in turn leads to interaction of different hierarchical orders, as not all of the orders can provide the same services (Berry & Horton, 1970; Friedman, 1973).

In addition, literature will be used to identify and examine an urban system (definition, importance, impacts etc.) and how the interaction between these systems takes place. The main theorists that will be used in urban systems are Christaller (1966), Bourne (1975) and Harris (2007). The final Section of the literature will also include the explanation of regional resilience (what resilience is, why resilience is important, what effect it has on economic, political, environmental and social sectors etc.) and will include theorists, such as Holling (1996) and Meerow *et al.* (2016).

1.5.3 Empirical study

The empirical study included both qualitative and quantitative analysis. The first section of the empirical study consists of qualitative research, where the specific focus will be on policies implemented in South Africa with specific reference to regional development, spatial distribution and resilience included in the policies.

The second part of the empirical study will include both qualitative and quantitative methods for several case studies that were evaluated on an international level, combined with population data which will be processed to produce illustrations of the rank-size distribution as described in the literature study (Section 3.2). Furthermore, the study will focus on a South African scale with case studies and population figures as conducted for the international case studies. Several scenarios will be suggested and investigated to determine the effects of policy intervention on spatial planning. These observations will be used to examine and to propose the most effective policy approach for South Africa.

The researcher, therefore, followed an applied research approach. This was used to identify and examine several spatial challenges which urban systems generally face, and to recommend the most effective design and implementation of policies to be implemented on a South African level, with a specific focus on the Northern Cape province.

1.6 Structure of the study

The structure of the study can be summarised as follows:

- Chapter One: Introduction

This chapter will include a brief introduction that includes the problem statement, objectives and the layout of the study. The researcher also identified the methods used to achieve the objectives set out in the study.

- Chapter Two: Regional and Nodal Development

Region is an important part of the study as Objective One aims to evaluate a region as a whole and not only as a node. The first section of this chapter will, therefore, determine what a region is and what different characteristics are used to demarcate regions. The second part of this chapter will investigate different types of nodal development and why they develop in a certain manner. The last section will focus on the interaction between different nodes and the different economic growth stages a country faces. Specific focus will be placed on the result of the interaction between nodes within regions as they form growth poles and corridors through both balanced and unbalanced growth.

- Chapter Three: Exploring the Urban System

This chapter will be important to the study as it aims to examine different hierarchies of settlements which developed through interaction between settlements. The effectiveness of different hierarchies will be investigated to evaluate the link between hierarchy and efficiency. The rank-size rule will also be investigated as it will be applied in Chapter Six and Seven. Furthermore, different hierarchical orders were investigated to understand a universal type of hierarchy. As mentioned, regarding Chapter Two above, the interaction between settlements facilitates economic growth and therefore, interaction in close proximity to a large settlement was also investigated (rural and urban linkages will be identified as set out in Objective Three of this study). In the last section of this chapter urban systems will be evaluated to determine the different levels of urban systems and how they interact with one another. The investigation of urban systems is vital for the study as the study's main objective is to improve regional resilience in different urban systems.

- Chapter Four: The role of resilience in a region

Resilience will be examined and defined according to different specialist fields within a regional context. Concepts of resilience will be evaluated with a specific focus on how to achieve equilibrium and to adapt over a period of time. The focus will then be moved to regional resilience and how to improve regional resilience by means of recovery adaption and transformation. Lastly, resilience will be investigated in terms of an urban system where different types of relationships

will be explored. This chapter will assist with the recommendations and conclusion in Chapter Eight as it will provide the researcher with the necessary understanding of how to improve regional resilience in different urban systems.

- Chapter Five: Policy and regional resilience

Different policies will be explored on the national and international level. The focus will be on the impact of implicit and explicit policies with emphasis on South African regions. The success of a policy will be evaluated in terms of the economic growth and well-being of a region. The chapter will also include indicators and characteristics of an effective policy. International examples will be used to examine the effects and explore additional options to ensure the policy will suit South African government spheres.

- Chapter Six: International Case studies

Different urban systems on an international level will be analysed and assessed to determine which interaction will contribute to a higher resilience within an urban system. The case studies will examine the spatial distribution of the countries identified and the policies which are implemented to structure their spatial distribution. Furthermore, the policy design will be evaluated as well as the implementation of these policies to assist the researcher with recommendations in Chapter Eight. The case studies will include both a developed and developing country to provide different perspectives on regional development with countries who experience different challenges. The case studies will enrich the study with examples of several areas and its effect on the region's resilience.

- Chapter Seven: National Case study

Specific focus will be placed on the South African economy as well as the spatial distribution, together with the policies implemented to improve regional resilience (South African policies were used as examined in Chapter Five). After the spatial distribution of South Africa is evaluated, the focus will be shifted to a smaller scale i.e. on a regional level. The Northern Cape province will be evaluated in terms of its key economic sectors, spatial distribution, as well as the policies, implemented to improve regional development and regional resilience overall. The outcomes of these spatial distributions and policy formulation and implementation will play a vital role in the concluding Chapter.

- Chapter Eight: Synthesis and recommendations

This chapter will include a summary of the core literature findings as well as concepts which were obtained through the empirical investigations. This chapter aims to address the main objective of the study i.e. to improve regional resilience in different urban systems by means of policy intervention. Several recommendations will be proposed by incorporating all the concepts retrieved from the literature and case studies to increase the effectiveness of policies in South Africa to further regional resilience within the greater urban system.

CHAPTER TWO: REGIONAL AND NODAL DEVELOPMENT

2.1 Introduction

In the following Chapter, several theories will be examined in order to understand regional and nodal development. For this study, it is important to understand regional and nodal development, as research objective one is to evaluate urban systems as part of a region and not only as a node. The examination of these theories will assist in understanding the spatial occurrence and growth of regions. In addition, regions can be defined and delineated by their unique characteristics, for instance, physical, economic or political and these characteristics will, in turn, determine the type of growth and development patterns of the region. The following figure illustrates the composition of this chapter (Figure 2-1).

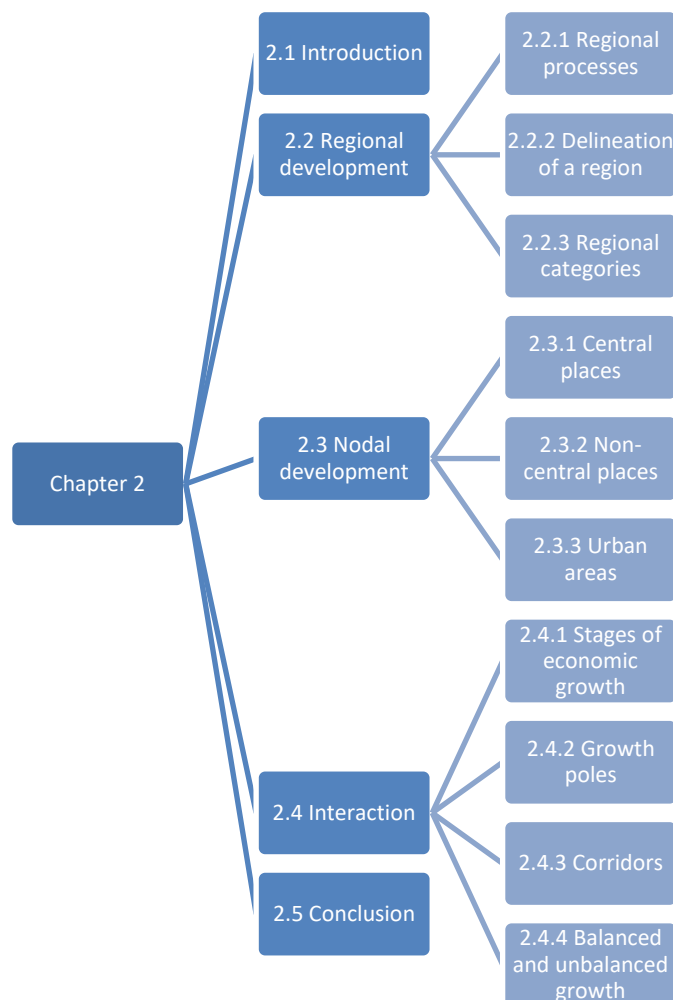


Figure 2-1: Structure of Chapter Two

Source: Own compilation

This chapter will aim to describe how a region is delineated as well as the different regional categories that exist. Furthermore, the focus will be intensified by examining both central and non-central places to understand the focal points which develop within a region. Lastly, interactions within and between regions will be examined to determine how regions develop by focussing on the five different stages of growth, corridor development and growth poles, which all contribute to economic growth; either through balanced or unbalanced growth.

The purpose of this chapter is, therefore, to provide a theoretical platform to understand how and why regions develop. Urban systems essentially consist of nodes connected to one another by means of physical or abstract networks within a certain space (refer to Section 2.3 & Section 3.4). Subsequently, this chapter will guide attention to each of the following; (i) space (region); (ii) nodes and (iii) interaction/ growth as illustrated in Figure 2-2 (central places), Figure 2-6 (growth poles) and Figure 2-8 (corridor development).

The above-mentioned is essential for the study to understand how regions function to assist in the identification of regions as well as urban systems which will be applied later in the study (refer Section 3.4).

2.2 Regional development

2.2.1 Regional processes

The surface of the earth encompasses several features which form interrelated complexes that differ from different areal parts and can, therefore, be categorised into regions (Hartshorne, 1959:286). Thus, regions can be defined according to a criterion depending on what defines them (Glasson, 1974). For instance, some of the regional development theories analyse the social-economic phenomena of regions while other theories offer opportunities for development strategies. These theories are generally focussed on either natural, economic, political, social or cultural factors or a combination of them (Dawkins, 2003:134). Regions can, therefore, be described to consist of three main natures; the first being the natural environment which can be described as the climate, landform etc.; the second nature being complex physical elements which were constructed by individuals; and the third being the nature of socio-cultural complex where the area cannot be replaced by other individuals (Dawkins, 2003:136). According to Glasson and Marshall (2007:8), a region can be summarised as a large area of land which consists of geographic, cultural or political characteristics which differentiate it from other areas.

A region develops due to different processes that occur over time. The following processes were responsible for the origin of regions (Haggett *et al.*, 1965:56):

- i. Physical processes: could influence the geology, topography etc.
- ii. Chemical processes: develops gasses and other environmental related products which affect the geology, vegetation and climate.
- iii. Social processes: develops over a shorter time period than other processes and can be identified by the grouping of people in the same area who interact socially.
- iv. Biological processes: all the ecological processes, such as the vegetation and natural life in an area which are vital to survive.
- v. Economic processes: this process encompasses all the processes mentioned above and most likely determines the development of a region.

All the processes mentioned above will have an influence on the boundary determination of a region and therefore, all the processes should be examined carefully before a region is delineated. Consequently, space (regions) should not be categorised as a neatly fixed hierarchy but should rather be envisioned as a more complex union of spaces, which will result in vague regional boundaries (Glasson & Marshall, 2007:7).

2.2.2 Delineation of a region

As described in Section 2.2, regions exist out of three main natures i.e. the natural environment, political and social (economic) and are generally delineated accordingly. Numerous theorists challenged the theory by arguing that an area has been bound to much wider forces; for instance, as physical boundaries are inconsequential due to the fluctuation of the significance of the physical feature (Haila & Levins, 1992:165). Other theorists (Wilson & Hastings, 1998:31) later argued that delineating a region politically should be the basis of creating regions. The challenge of delineating a region in this manner is that all the factors of interaction, such as land use and transportation are not considered. Furthermore, other difficulties, such as resource competitiveness or population density arise and therefore a new constructive regional shaping was necessary (Dawkins, 2003:138). Several disciplines, including geographers, delineated regions according to their physical features, such as mountains, rivers, soils etc. (Glasson & Marshall, 2007:8). This type of regional delineation originated in the 1970's (Brunckhorst, 2005) and provided an optimal basis to delineate regions in a comprehensive and ecologically sensitive way.

A large number of regional development theorists across the world struggled with an ideal approach of regional delineation due to complex agglomeration and spatial arrangements. The demarcation of regions baffled theorists up to the 1990's, until Glasson and Marshall (2007:10) provided a theoretical platform for regions by incorporating numerous characteristics in order to identify and delineate a region into a democratic form. Glasson and Marshall (2007:11) claimed

that society and the economy are the basis of regional planning as they enclose the basic purpose of human life.

Activities in spaces, transportation channels as well as living spaces can be described as socio-economic processes which form part of planned spaces (McLoughlin, 1969; Chadwick, 1971). The above-mentioned characteristics i.e. the society and economy, were the foundation of regional planning in the twentieth century, where the focus was on the labour and movement between living and production areas. The density and intensity of the interaction generated by the growing transportation systems of the twentieth century resulted in larger functional areas and larger regional planning units (Glasson & Marshall, 2007:11).

Even though socio-economic processes are important in the delineation of regions, other characteristics which contribute to the development, organisation and uniqueness of a region should not be set aside (Latham, 1963:195). For instance, a number of regions still use physical features, e.g. a boundary, such as rivers and mountain ranges. Other physical features which can be used to delineate a region are mountains, other landforms, soil types etc. Haila & Levins (1992:162) emphasised the importance of including geological factors when determining regional boundaries.

In conclusion, when a region is accurately delineated, it will improve the interaction, organisation, cohesion and development of the region. Therefore, it is of the utmost importance to identify the correct variables when delineating a region. In addition, it is important to note that the delineation of a region may vary depending on the purpose of the delineation and the criteria which were used. The following section will elaborate on the types of regions and distinguishing the characteristics of regions.

2.2.3 *Regional categories*

Glasson (1978) identified two ways to recognise regions, either through a subjective or an objective view. To view a region subjectively is to derive a region from a specific purpose and an objective region can be identified according to physical and geographic features. To understand the different regional classifications, the sub-regional groups will also be investigated to provide the reader with adequate knowledge of how regions are classified. The following features are used in order to identify or to classify regions.

Homogeneous regions are usually classified by applying homogeneity criteria, which generally includes physical features, in order to delineate the region. According to Haggett *et al.* (1977), homogeneous regions will contain a minimum of internal heterogeneity and a maximum of external heterogeneity. In its most elementary form, a simple homogeneous region can be

described as a single quality which is found in a region, such as a single soil type or similar vegetation types. In contrast, a region which encompasses various qualities, such as a climatic region can be classified as a complex homogeneous region. These types of regions are classified by taking several identical qualities into account. The above-mentioned qualities can be found in groups or combinations, such as mountains and valleys and are usually on a larger scale than simple homogeneous regions (Rodoman, 1972:450). It is also important to note that a homogeneous region is never absolute and that certain deviations will always manifest themselves.

In some cases, an area's characteristics are vague due to the transition between different physical characteristics, for example, vegetation differences in areas. This type of region is called a transitional region. Other physical characteristics, such as the precipitation or elevations can also assist in the delineation of a region and are called relief regions, due to the similar criteria (Meybeck *et al.*, 2001:34).

Physical features are the most dominant criteria when classifying a homogeneous region due to the stable and permanent structures; hence the region is considered to be more static than heterogeneous regions, which encompass both economic and social structures (which vary and change more rapidly). According to (Rodoman, 1972:450), heterogeneous regions are far more complex and can be divided into several categories depending on the criteria used. The following sub-groups are believed to have relevance later in the study and are described below:

- (i) Connective regions can be classified by their interaction and connection between other parts of different regions (Rodoman, 1972:450). Most of the interactive regions developed due to similar purposes. Regions are often connected by the flow of information by means of communication, energy and products.
- (ii) A functional region (nodal region) is considered as an area which displays certain functional coherence and is based on either single or multiple variables (Burrough, 1996). The interaction of the functions within the regions is considered to be independent and these functions usually attract other functions within the region (Preston, 1952:199). The notion of the interaction described above is that the interaction generally emanates from a node, from which movement migrates outwards (refer to Section 2.4.2 and 2.4.3). Therefore, interaction is fundamental to the growth and development of the region.

Lastly, planned regions are categorised as unique regions (neither homogeneous nor heterogeneous) due to the human factor where these regions are planned before the development of the region takes place. The creator of the region adopts a number of methods,

elements and calculations to form an idea of the region. Therefore, an individual has the ability to manage and control certain aspects of the region (Preston, 1952:203). Planned regions are thus created to guide the development process in a specific direction to prevent unwanted development. Planned regions mainly focus on the interaction within the region rather than interactions with other regions and can be described as a single entity (Glasson, 1985:78).

In short, regions can be categorised into three regions i.e. (i) formal regions is categorised according to the homogeneity of the area in terms of a selected criteria i.e. similar climate or topography (Glasson, 1978:37); (ii) functional regions which relate to the operational concern for instance, it can be delineated by using both quantitative (boundary of a region) and qualitative (the actual flow of goods, services and individuals) techniques (Glasson, 1978:41; Dawkins, 2003:163) and (iii) administrative regions (planned) which are generally focused on political aspects (Friedman, 1986:70; Dawkins, 2003:134).

Other theorists (Friedman & Alonso, 1964) used the planned region to address several planning problems located in regions. They established that the region node usually consists of a high growth rate and the growth rate (refer to underdeveloped and overdeveloped regions) also has the tendency to be more stable than other parts of the region. Friedman & Alonso (1964) also argued that nodes (refer to Section 2.3) can be classified into different orders which drive the economy in the area. The different nodes generally develop due to an increase of commercial activities that takes place along the corridors between different nodes (generally due to the discovery of new resources). Hence nodes are connected to different order nodes which form commuter patterns (refer to Section 2.4.3).

As described in Section 2.2.2, regions can be classified by identifying several characteristics, such as culture and languages which contribute to the development as well as the identity of an area. The development of regions can generally be described as uneven development (refer to Section 2.4.4) and geographers have argued that a capitalistic economy is genetically encoded within social relations and encompasses several forms of regional problems (Dawkins, 2003:139). The type of regional problem will depend on the circumstances of the region and can be described as an equally enduring feature of the economy all over the world (Hudson, 2004:3). Uneven development (refer to Section 2.4.4; i.e. balanced and unbalanced growth) is the basis of problematic regions and can, in its simplest form, be described as either “under” developed regions or “over” developed regions.

- (i) Underdeveloped regions: These regions are generally sparsely populated as they are dependent on primary activities, such as farming, fishing, mining etc. It is usually a challenge to access services due to poor infrastructure availability, which in return

causes industries to decline and strains the economic growth of a region (Myrdal, 1957:26). Several theorists support this argument by incorporating internal factors, such as literacy, the traditional agricultural structure, the low partition of labour, the traditional attitude of the population, communication etc. to underdevelopment in regions (Kuhlen, 1987:2; Dawkins, 2003:152). The above-mentioned phenomenon contributes to a high unemployment rate as well as the migration of the skilled and usually the young (Glasson & Marshall, 2007:25). Succinctly, underdeveloped regions are frequently accompanied by low economic growth due to low diversification.

- (ii) Over-developed regions: Different economic fields and forces function in geographical areas and can be categorised as either centripetal (attract) or centrifugal (diffuse) forces (Boudeville, 1966:192) which generally leads to unbalanced economic growth (refer to Section 2.4.2 and Section 2.4.4). Therefore, an overdeveloped region can be described as a region with a higher concentration of economic activities and this type of region enjoys impressive economic dynamism and interaction (due to the centripetal and centrifugal forces) and can be described as opposite to underdeveloped regions (Clout *et al.*, 2014:198). An over-developed region usually accompanies a low unemployment rate and high-income levels, which attracts several individuals. The attraction of several individuals leads to a pressurised transportation system, a large demand for housing and other types of infrastructure, a high demand for land and several environmental problems (Glasson & Marshall, 2007:25). In order to accommodate these high pressures, a large amount of investment is required and is usually achieved after a great economic sacrifice (Clout *et al.*, 2014:198). It is suggested that most of the world's population are residing in over-developed regions due to the advantages described above.

As previously discussed, problematic regions face several economic challenges and by using policy intervention some of the problems in a region could be overcome (Hudson, 2004:5). Policy intervention could assist in challenges, such as the underutilisation of scarce resources in underdeveloped regions and over utilisation of resources in over-developed regions (Clout *et al.*, 2014:198) as it could identify and manage resources in the identified regions (refer to Chapter 5 and Section 6.2.1.3, 6.2.4 and 7.2.3.3).

The identification (as described in Section 2.2.2) and understanding (refer to Section 2.4) of regions play a critical role in the planning and controlling of regions. Regional understanding is vital when attempting to create a systematic approach, especially when investigating resilience in different regions and nodes (Duckham *et al.*, 2003:173). For the purpose of this study, the most basic forms of problematic regions were investigated as mentioned above (Hudson, 2004:5).

2.3 Nodal development

This section will encompass a description of central and non-central places. It is important to understand the differences between central and non-central places, as it will have a significant impact on the study when investigating resilience in urban systems, which encompasses either central or non-central places or in some cases, both central and non-central places.

2.3.1 Context

Nodal development can be described as “points” which are established within regions and tends to interchange with regions (Hoover & Giarratani, 1984). There are normally several nodal places evident inside a region. A region can, therefore, be described as a more spatially extensive entity than a nodal place. Both regions and nodal places are typically interdependent spatial entities which function as integral parts of a continuously changing network. The scope of the interactions also varies, such as locally, regionally or even globally (Greenhut, 1956).

Mumford (1928) characterised a city as a collection of groups (families) and associations (economic activities) housed in a permanent structure within a limited area. A city could, therefore, be identified as an area which exists out of permanent structures and encompasses economic, social and cultural activities. In its simplest form, a city can be described as a geographic plexus, an economic organisation, a theatre of social interaction, an institutional process and an aesthetic symbol of collective unity (Mumford, 1937:94).

Christaller (1966) and Lösch (1954) defined a nodal development as settlements which can be defined as hierarchical systems (refer to Section 3.2). They described that each region will encompass several hierarchical nodal developments. Each region will, therefore, encompass a small number of large high-order cities and a large number of smaller, lower-order cities. However, more recent approaches defined nodal areas as spatially interdependent areas (Dawkins, 2003:133).

Numerous factors contributed to the development of central places in ancient times. Some settlements developed due to administrative or religious motives, even as defensive sites. Other settlements began as important locations for commerce and trade and they grew and flourished over the years (Richardson & Catlin, 1979). The growth of settlements can be ascribed to numerous and complex economic forces, where the most basic level of economic activities was agriculture and trade. As the settlement developed, politics, arts and cultural activities also developed, which contributed to a more diverse and complex economy (Hoover & Giarratani, 1984).

A simplified description of a settlement can thus be an important centre of human activity, where each has different characteristics and are obtainable in different sizes (Mumford, 1937). Furthermore, urban areas are classified by the type of activities found, such as industries. A small urban centre can be distinguished between rural communities by means of the essentiality of the centre for rural communities (King, 1984:9). However, recent research has indicated that the basis of the central place theory is useful in order to understand the spatial structure of retail and services and the content of the theory is widely applied due to the relevancy of different activities that are included in the theory (Dawkins, 2003). Several topics were treated, such as how the theory developed in order to identify recent contributors, the consequences of the theory that was enhanced by empirical studies and how the theory was reformulated. The theory may be formulated by using the threshold and it frees the theory from assumptions, such as shape and the homogeneous character of regions.

The following section will explain the concept of the central place theory while incorporating other academic interpretations and suggestions to refine the theory.

- **Central Place Theory**

The Central Place theory is one of the most influential theories in spatial economics and the theory was formulated by Christaller (1966). The central place theory played a fundamental role in the imagination of spatial analysis (Sonis, 2005:2). Geographers, economists and sociologists are using this spatial concept to study different settlement patterns and trading areas. The theory is not entirely accurate as it leaves a gap between theory and the empirical application, however, the describing concept of different hierarchies as well as the interaction between them is useful (Sonis, 2005:2). The above-mentioned gap exposes the theory for both improvements and criticism.

The central place theory is an economic approach and predicts the emerging of optimal settlement patterns, through the competition for space (Christaller, 1966). The above-mentioned tendency was responsible for the development of theories that explain different population sizes and varying zones of influence of a central place. The theory examines the interdependencies between towns and regions, whereafter the economic functions are considered. These factors contribute to the hierarchical classification of urban settlements which is aimed to assist in the interpretation and development of settlements i.e. analysing the structure of social communities, planning or identifying locations for new settlements as well as to predict or describe why and when small villages will decline (Christaller, 1966).

The central place theory is, therefore, initially based on specialised functions and develops a service function for the surrounding area over time (Christaller, 1966). The settlements that interact with their adjacent hinterlands by means of providing goods and services are classified as central places. Central places are, by definition, closely connected by location, which in turn is closely connected with the distribution of the population (Dawkins, 2003).

It is known that central places which are situated in a favourable location can accommodate a larger population and they also offer more specialised services (Dawkins, 2003). These central places also tend to grow progressively larger than other non-central places that are located in an area where the population is distributed more evenly (Christaller, 1966).

The central place theory is focused on serving the needs of the surrounding area. While the population are a measure of importance, it is not a measure of a settlement's centrality. Centrality can be described as the extent to which a place serves its hinterland by means of goods and services offered (Christaller, 1966). As previously mentioned, products and services consist of different orders and can be classified by means of cost and the frequency of the products or services bought (Mulligan *et al.*, 2012:406). An example of a low-order product is groceries, it is an everyday need and the supplier requires a small population to maintain its business. More expensive products, such as furniture, are classified as a high-order product and businesses require a larger population to maintain their profit (Pacione, 2009:126).

Two concepts emerged with the finding explained above:

1. A threshold population is a minimum population required to maintain a profitable business. It is the minimum demand that makes the goods and services viable.
2. The range of a good can be defined as the maximum distance that consumers will travel to purchase a good or service. The inconvenience of travel is measured in time, cost and effort will eventually outweigh the value or need of the good or service.

These concepts identified an upper and lower limit for each good or service. Lower limits are determined by thresholds and upper limits by the range (Mulligan *et al.*, 2012:406). The gap between these limits will generate a surplus for the business. In an ideal world, a central place would trade in a circular area. However, when three circles are placed in a certain area, overlapping of areas will occur (Christaller, 1966). Thus, hexagonal market areas were derived from the circular theory to ensure a more realistic approach, as projected in Figure 2-2.

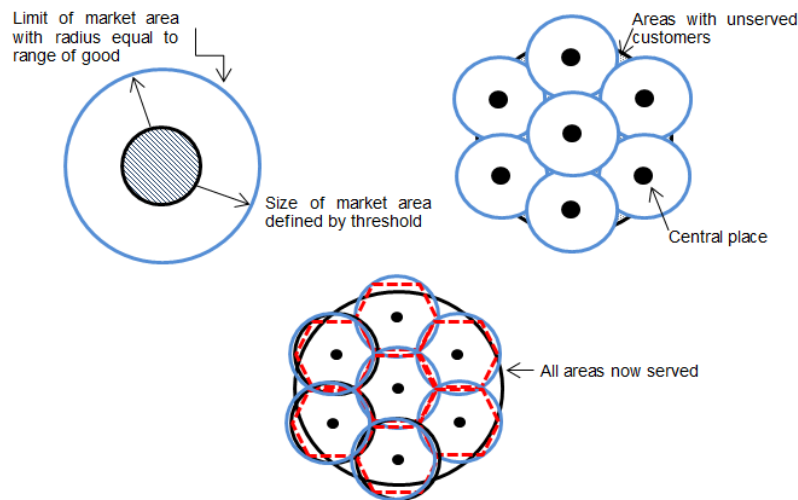


Figure 2-2: Deriving the hexagonal pattern of market areas for central places

Source: Adapted from Christaller (1966)

Christaller refined his theory by identifying settlements of different sizes. He used the average population, the distance apart and the hexagonal extent of the tributary areas in Southern Germany (Christaller, 1966). Christaller stated that a certain hierarchy of a central place follows a fixed ratio, from the largest to the smallest settlement (Mulligan *et al.*, 2012:408). The fixed ratio was defined as the K-value, where the largest hierarchy level can be identified as a regional capital and the smallest hierarchy level a hamlet (Pacione, 2009:126).

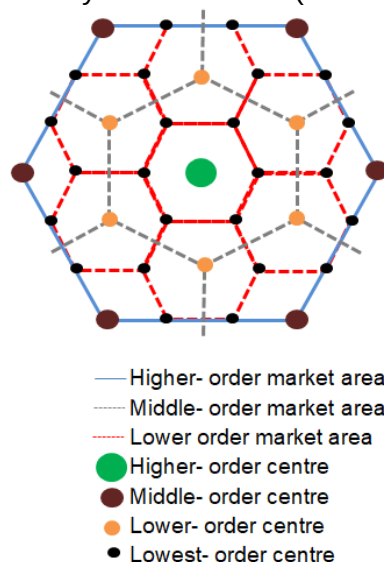


Figure 2-3: Hierarchical and spatial arrangement of central places

Source: Adapted from Christaller (1966)

Christaller's model proposed that settlements with a low level of specialisation would be equally spaced and surrounded by hexagonal hinterlands (Mulligan *et al.*, 2012:408). The theory in its simplest form proposes that for each of the six hamlets, there is a larger, more specialised central

place. This central place would be equidistantly located from other centres (refer to Figure 2-3). As previously mentioned, the larger central place is more specialised and would provide services that were not available in the hamlet. As the hierarchy progresses, the settlement is more specialised, and they would also have their own hinterlands with an equal distance from one another (Christaller, 1966).

In theory, lower-order centres are located within the tributary areas of a higher hierarchy because of the provision of more specialised goods or services (Christaller, 1966). The marketing principle can be explained as the need for central places to be as near as possible to the population that they serve. The spatial functional arrangement was believed to be efficient for serving a dispersed population (Mulligan *et al.*, 2012:408). Christaller thus derived the central place theory from the location, size and space of the settlements (Pacione, 2009:127). The central place theory's main strength is the geometric simplicity as well as the consumer travel behaviour insights.

The central place theory was tested by numerous individuals with the attempt to modify and refine Christaller's ideas. The best reformulation was proposed by August Lösch (1954), where he reformulated the central place theory by using fundamental economic principles to refine the Central Place theory. Lösch argued that the central place theory's rigid hierarchy was too restrictive and conceived a more bottom-up complex system by including determinants of location in economic regions (Mulligan *et al.*, 2012:408).

Lösch used the same hexagonal lattice that Christaller proposed in his model, however, he developed a more sophisticated economic model. He proposed hexagonal nets of market areas which focus on the most central location of the system by rearranging and overlaying several hexagonal systems (Mulligan *et al.*, 2012:408). Lösch (1954) emphasised that raw materials would be equally spread across a flat plain, but the possibility of specialisation would encourage concentration of sectors and individuals. Lösch also claimed that different goods in the functional range should have their own signature market area and that businesses will naturally arise at the centre of each different sized market area (Mulligan *et al.*, 2012).

Lösch considered ten of the smallest places where the goods and services were sold. He argued that they would each have different upper and lower limits, which could be plotted by a variety of points (Lösch, 1954). Six city-rich and six city-poor areas were identified by using nets that are centring and rotating on one point, thus areas with the maximum degree of coincidence were used. The sectors reflect various production points that are coincident on the underlying lattice (Mulligan *et al.*, 2012). Higher-order central places can be described as the city-rich areas, while the relatively poor services can be classified as the city-poor areas (Lösch, 1954).

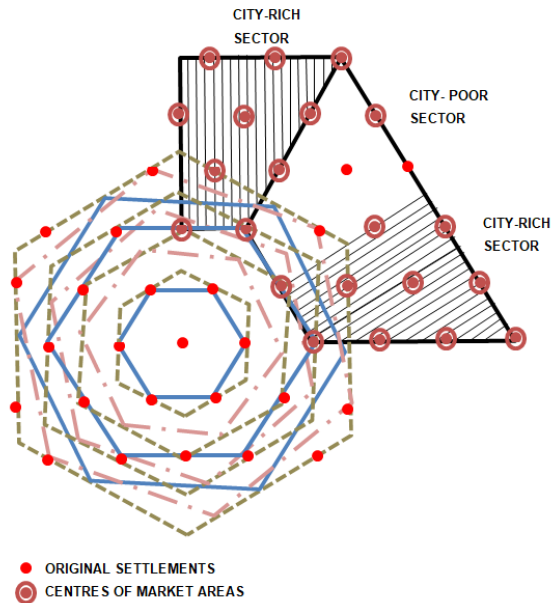


Figure 2-4: Lösch city-rich and city-poor areas

Source: Adapted from Lösch (1954)

The figure above illustrates the specialised functions are double circles (maroon circles), while the dependent places are the open circles (red circles) that lie within the field (hexagon) of the central place (Lösch, 1954). The closed circles are where the dependent places are situated in the parameter of each field. The hierarchy is ordered according to the size and functions of each place, thus higher-order places will contain functions of the smaller places, hence Lösch (1954) identified that settlements do not need the same functions to be classified as the same size. In short, larger settlements do not necessarily provide all the functions of the same, smaller central place.

This reformulation of the central place theory was aimed to create a system that would be most efficient for both customers and firms. The most distinctive feature could be that the sectors have the same number of central places, although the total activities vary across the economic landscape (Lösch, 1954). The theory also suggests that small places with a low functional complexity can serve large places that have a larger functional complexity. Lösch (1954) compiled a more realistic division of space for businesses and used the household demand over space to calculate the market area by means of calculus. In this way, microeconomics can be utilised to help specify a firm's maximising profit using the price and output for the specified market area (Mulligan *et al.*, 2012:409).

In short, businesses strive to occupy central locations to their markets to achieve maximum profit. Businesses eventually settle on price location that minimalises travelling costs while reaping mutual advantages from clustering (Lösch, 1954). Clustering leads to the formation of hierarchies

which have the ability to provide all possible services and goods in a sector (Mulligan *et al.*, 2012:410). Even though Lösch suggested that businesses will locate where travelling costs are minimal he was not the first theorist with this theory. Alfred Weber, a well-known locational theorist suggested that industries will position themselves where there is a minimum transportation cost in order to obtain maximum profit (Weber, 1929). This again verifies the importance of industries and their location in order to satisfy the demand of individuals residing in a demarcated area.

2.3.2 *Non-central places*

The Central Place theory was based on the assumption that all geographic areas are uniform (Christaller, 1966). This assumption led to the development of the non-central theory, which expanded on the concept of the central place theory (refer to Section 2.3.1). Richardson (1973) argued that each region's geography is unique and therefore each central and non-central place has its own benefits and challenges (Richardson, 1973:170).

Richardson (1997) extended on the central place theory by including polycentric regions which include several nodes and several peripheral areas and also includes a high degree of internal functional integration. As mentioned in Section □, location constants are, amongst others, important factors which are responsible for the development of central places. Location constants (such as the availability of minerals and natural resources) are fixed and may predetermine the spatial economic structure of non-central places (Richardson, 1973:172).

The economy of a non-central place does not necessarily play such an important role in the larger regional economy as in central places, however, the size and type of economy determine the existence of a non-central place. Various opportunities are offered by the location constants which contribute to the existence of a non-central place, such as a fixed natural resource present in the area (Weber, 1929). For example, the location of a natural resource, such as gold, iron etc. would have an impact on the location of a settlement due to the workforce; who mostly prefer to establish themselves in close proximity of where they are employed. This tendency results in established settlements which could be classified as a non-central location, encompassed with the essential basic services (Richardson, 1973). The demand for services and products amongst other factors, directly affect the location of non-central places, as well as the development structures between settlements (Richardson, 1973:47). Heterogeneity is common in non-central places as they contain different functions. As previously mentioned in Section 2.3.1, a central place is mainly dependent on the economic sector, thus for a non-central place to transform into a central place, its economy should be developed and functions are to be expanded. Non-central places tend to be small, thus economic development will result in an increase in town size and could lead to an

increase in the hierarchy in the spatial structure. The interaction between central and non-central places along the various linkages gave rise to the urban system (refer to Section 3.4).

The following section will discuss the concept of urban areas. This would be necessary to understand why they develop and what type of interaction is found in and around urban areas to improve economic activity and growth.

2.3.3 *Urban areas*

An urban area can either be defined as a central place or a non-central place as described in Section 2.3.1 (central places) and Section 2.3.2 (non-central places). It was also mentioned that both central and non-central places exist due to economic activities, either through the availability of natural resources or through the provision of goods and services. Economic opportunities and infrastructure in urban areas result in population redistribution towards urban areas of individuals who seek better economic opportunities (Firebaugh, 1979:199). Economic opportunities are, therefore, vital as they tend to attract the rural population towards urban areas. As subsequently discussed, numerous businesses and industries will be located in urban areas, as it provides economic opportunities which attract individuals (Firebaugh, 1979:200).

Weber (1929:127) proposed a general theory of location with generalised theoretical rules. He argued that an industry's location is selected to minimise transportation costs and that the location would result in the minimisation of distance, mass and effort. In addition, Weber suggested three assumptions in terms of the spatial system. Firstly, that the location of raw materials is set, secondly that the market is set in terms of size and location and lastly, that there are only a few fixed locations for manual labour (Weber, 1929:129). Weber also stressed the importance of agglomeration effects (refer to Section 2.4.4). In short, Weber suggested that in order for an industry to be viable, it would locate itself in close proximity to resources to minimise transportation costs (i.e., such as central places).

Another theorist, Marshall (1980), identified three reasons for the location of industries, namely (i) the concentration of firms in one location often results in centripetal forces (refer to Section 2.2.3 and 2.4) for other businesses, industries and workers; (ii) industries which are localised can support the production of non-tradeable inputs and (iii) clustered firms have a better production function by means of information spillovers (refer to Section 2.4.4). Marshall (1980) and Weber (1929) used the same economic principles and therefore, have similar industry location theories. However, there are more elements than economic factors which contribute to the location of industries in geographic areas.

In conclusion, an urban area consists of a spatial concentration of people who are mostly organised around non-agricultural activities (Weeks, 2010:34). An urban area can be determined by a range of elements, such as population size, population density, economic and social organisation and the conversion from natural environments into a built environment (Weeks, 2010:43).

2.4 Interaction

After the delineation of regions has been explored, it is important to understand how regions grow and develop as there are several forces and dynamics which impact how and why regions develop. Regions develop over a period of time and have numerous impacts on the social structure; for instance, population density (refer to Section 2.2). This section will emphasise the different stages regions should undergo which would lead to the improvement on technological transfer, as well as the diversification of economic sectors. The different growth stages a region undergoes are due to numerous forces and interactions, hence this section intends to equip the reader with a description of the main regional development forces.

2.4.1 Stages of economic growth

Economic growth can be defined as the rate of income and production over a period in an area (Haller, 2012:67). In short, economic growth increases production and services supply, which in turns stimulates the availability of job opportunities. The increase in created jobs positively impacts unemployment, hence an increase in the quality of living for individuals (Haller, 2012:67).

One well-known historical model of economic growth was developed by Rostow, an economist who identified five different growth stages of regional development (Rostow, 1960). Even though Rostow is not the only economic growth theorist, Rostow's model is more structured than most of the other economic growth models. Rostow mainly argued that economic take-off should initially consist of a small number of individual economic sectors (refer to Section 2.3.2). As mentioned in Section 2.3.3, it is important for the purpose of this study to understand how a region grows and develops in order to achieve its maximum growth potential. The following figure illustrates Rostow's (1960) theory, whereafter the theory will be explained in detail.

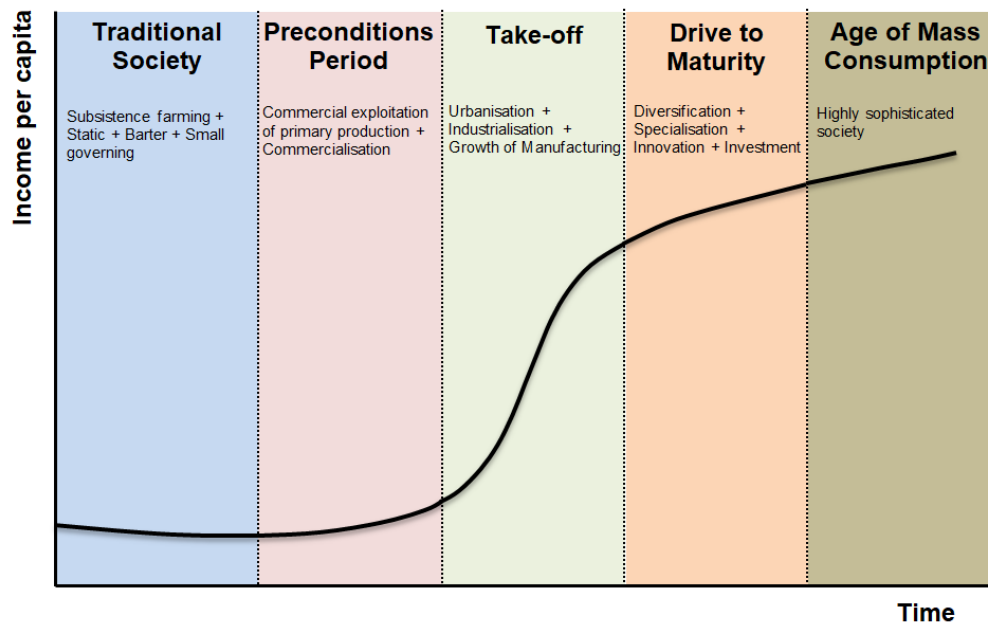


Figure 2-5: Rostow's theory of economic growth

Source: Adapted from Rostow (1960)

2.4.1.1.1 The traditional society

A traditional society can be described as a society that develops within limited production functions. Individuals are dependent on technical innovation to increase their productivity in industry or agriculture and that could be introduced in trade. Various sectors developed, such as agriculture and manufacturing, as their productivity was limited due to limited resources (such as technology and information) (Rostow, 1960:4-16). Traditional societies are dependent on agriculture and the flow of the agricultural system (hierarchical social mobility). Political power generally lie in the hands of those who controlled and owned the land which resulted in a highly fluctuating region as the interests of the landowner varied. The economic development of the region can thus be described as the man's capability to manipulate the environment to his own economic advantage. The growth of the traditional stage is dependent on various political and social structures which have the ability to promote or inhibit economic growth (refer to Figure 2-5).

2.4.1.1.2 The Preconditions for take-off

The preconditions for take-off is a period where the traditional society transforms in ways that are necessary for exploiting modern science. New production functions in the agricultural and manufacturing sector are developed in order to increase both productivity and to diversify world markets and international competition (De Vries, 2008). The more advanced societies set ideas in motion which were a modern alternative to the traditional technologies (Rostow, 1960:4-16). Hence, new enterprises arose where the general welfare and a better quality of life was the result of economic progress. New types of enterprises, such as banks and other institutions arose, which

leads to an increase in investment, communication, transportation and the extraction of raw materials (Rostow, 1960:4-16). In many cases, modern manufacturing appears where new methods are used and the scope of commerce widens both internally and externally (refer to Figure 2-5).

2.4.1.1.3 The take-off

During this stage, industries tend to expand quickly, and a large proportion of the profits are reinvested in new industries. This leads to rapidly expanding industries which in turn results in job creation and further expansion in urban areas. The whole expansion process and the increase in income results in higher investments of the private sector (Rostow, 1960:4-16). Numerous innovative techniques are used in agriculture to increase their production to achieve a commercial level of farming (Costa *et al.*, 2016:2). The economy transforms into a high-order political business (Costa *et al.*, 2016:4). Investments also tend to receive a higher interest than in the previous two stages, which leads to an increase in savings. Social capital investments generally form a high proportion of investments; such as transportation modes, for example, railways. The basic social and political structure of the society transforms in such a way after a while that the economic growth can be sustained at a steady rate (refer to Figure 2-5). Even though Rostow identified this stage as complex and difficult, Costa *et al.* (2016:3) suggest that as the international economic leaders become richer, it became easier for poorer countries to achieve the economic take-off stage.

2.4.1.1.4 The drive to maturity

The drive to maturity can be described as the stage of a regular growing economy where modern technology drives the economic activity. Old industries tend to level off while new industries accelerate as new techniques improve (Harris, 2007). The economy transforms where former imported products are produced locally instead, and new import requirements develop. The growth of industries is supported, rather than to constrain the growth by means of modern efficient production (Costa *et al.*, 2016:3). The stage to maturity can, therefore, be defined as the stage where the economy proves the capacity to diversify their original industries by improving the efficiency of resource utilisation by means of using the most advanced technologies possible. The period to achieve this stage will depend on a country's willingness to absorb modern technologies, thus it would be challenging to identify the exact amount of years it will take to achieve the drive to maturity stage (refer to Figure 2-5).

2.4.1.1.5 The age of high mass consumption

The age of high mass consumption can be described as the time where leading sectors shift towards consumer products and the distribution of services. This shift resulted in an increase of the urban population as well as the proportion of the skilled working force. Henceforth, the further expansion of modern technology is no longer emphasised. More resources are allocated to social welfare and security especially when focussing on western societies. The social welfare state is an indication of a society that is moving beyond technical maturity (Rostow, 1960:4-16). In this stage, the sewing machine, the bicycle and various household appliances were distributed. A large number of developing countries have still not entered this phase due to political and social problems (refer to Figure 2-5).

It is important to note that the five stages of growth identified by Rostow, are merely a classification for the different economic trends. Growing societies have the tendency to develop into the most optimal pattern possible over a period of time. Resources are the key catalyst in economic development and therefore, political and social decisions should be made responsibly to increase the welfare of society. As time progresses, the rate of growth and the essentiality of sectors vary, which contributes to the expansion of societies (Rostow, 1960). It is also clear that the development and dispersion of technology and innovation plays an important role in economic development.

Another theorist, Gerschenkron (1962) proposed that there are no equivalent stages of economic growth but rather that elements of modernity and backwardness survive side-by-side in a systematic fashion (especially where countries are more backwards). This theory could be of great significance to this study as policy intervention could influence the rate of economic growth in a developing country. A similar theory was also suggested by Costa *et al.* (2016:4) as they emphasised that countries which are behind the economic leaders can achieve higher levels of growth rates by reforming their institutions and policies, such as the catch-up - a case which Mexico experienced at the end of the nineteenth century.

Rostow's theory of the five economic stages of growth lays the foundation of how regions and countries develop over time to reach a higher level of productivity, to diversify the economy and to focus on secondary and tertiary sectors. These concepts will be used later in the study to identify and to correlate the main economic sectors of a country with the level of development for that country. Furthermore, the concepts as proposed by Gerschenkron (1962) will also be investigated to determine if policy intervention could lead to a higher and more stable economic growth. The following section will describe the different interactions in and around settlements which leads to economic activities.

2.4.2 Growth poles

One regional development theory which received great attention from several specialists is the growth pole theory. Growth poles can be used to explain the economic space and how it functions in a geographical area (Boudeville, 1966:192). Economic growth does not occur in nodes at the same time and extent and can rather be described as a form of polarisation where different sectors and fields of forces occur over a functional and geographical space (Glasson, 1985:140). Economic growth can also be measured by using the population growth and taking the production and income rate into account in order to calculate the growth per capita (Gantsho, 2008).

In addition, a growth pole can be described as a settlement with a higher concentration of activities in several economic sectors than other settlements (Perroux, 1950). Generally, a dominant economic sector exists and other economic activities which surround the dominant sector will benefit from the dominant activity (refer to Section 2.3). When other industries and activities benefit from a dominant economic sector or industry, it can be classified as agglomeration (Perroux, 1950:95, described it as “fields of economic forces”). Agglomeration has several benefits and has minimal risks compared to other independent industries which lead to a clustering of industries (Perroux, 1950).

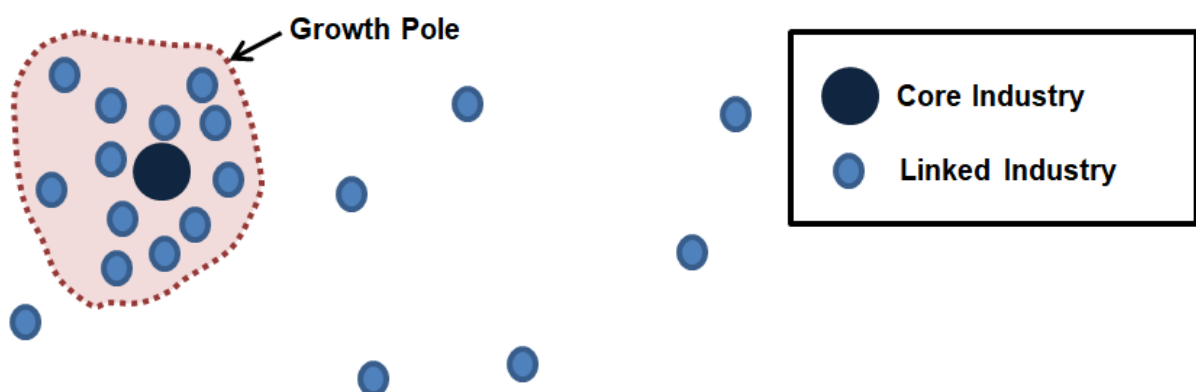


Figure 2-6: Growth pole theory

Source: Adapted from Perroux (1950)

Another theorist, Boudeville (1966) also used the growth pole model and placed Perroux's formulation into a geographical space. Boudeville (1966) suggested that growth poles are defined in terms of their presence of propulsive industries and firms which generate sustainable regional growth through linkages with other industries and firms within a region. Other theorists who also supported both Perroux's and Boudeville's theories suggested that nodal developments have two dominant characteristics (i) the nodal area is functionally integrated internally (the flow of labour,

capital and commodities are more common than in other areas); (ii) activities are orientated towards a point, where the node is dominant over the surrounding areas (Hoover & Giarratani, 1984:58).

The clustering of the economic activities as described above can then be described as polarisation and can either have a positive or negative effect on the area and is generally described as agglomeration (Glasson, 1985:146). Agglomeration leads to an increase in costs, such as property, salaries and public services and thus it determines the size that the concerned area may grow into. This attributes to the economic development of the area due to key sectors which lure other associated firms and industries and the more technology is available, the better the chance of old industries surviving (Glasson, 1985:150; Richardson, 1987).

The growth pole theory is relevant to the study as it supposes that economic growth can be seen on a regional scale, as a nucleus for industrial growth can be used to stimulate development in the area surrounding the pole. The following section will, therefore, describe how growth poles can be “linked” in order to create an interaction which can stimulate regional growth and counter the underdevelopment of regions (refer to Section 2.2.3).

2.4.3 Corridor development

As discussed in Section 2.3 and Section 2.4.2, nodal development and growth poles form and result in economic development. Nodes (refer to Section 2.3) could potentially connect with corridors over a period of time due to numerous factors (Taaffe *et al.*, 1963). The development of corridors can be described as axis development which links two nodal areas in a region and should be examined as a functional unit (Richardson, 1987:216-217).

Corridor development could be particularly advantageous when connected to two growth centres, as the corridor will result as a reinforced viability of the growth centres and they link the supply and demand side of markets. Even though no economic corridor is the same, it still has the same function as it will lead to the interdependence between the centres and will also result in numerous economic advantages (Taaffe *et al.*, 1963). The following figure illustrates a conceptual illustration of corridor interaction:

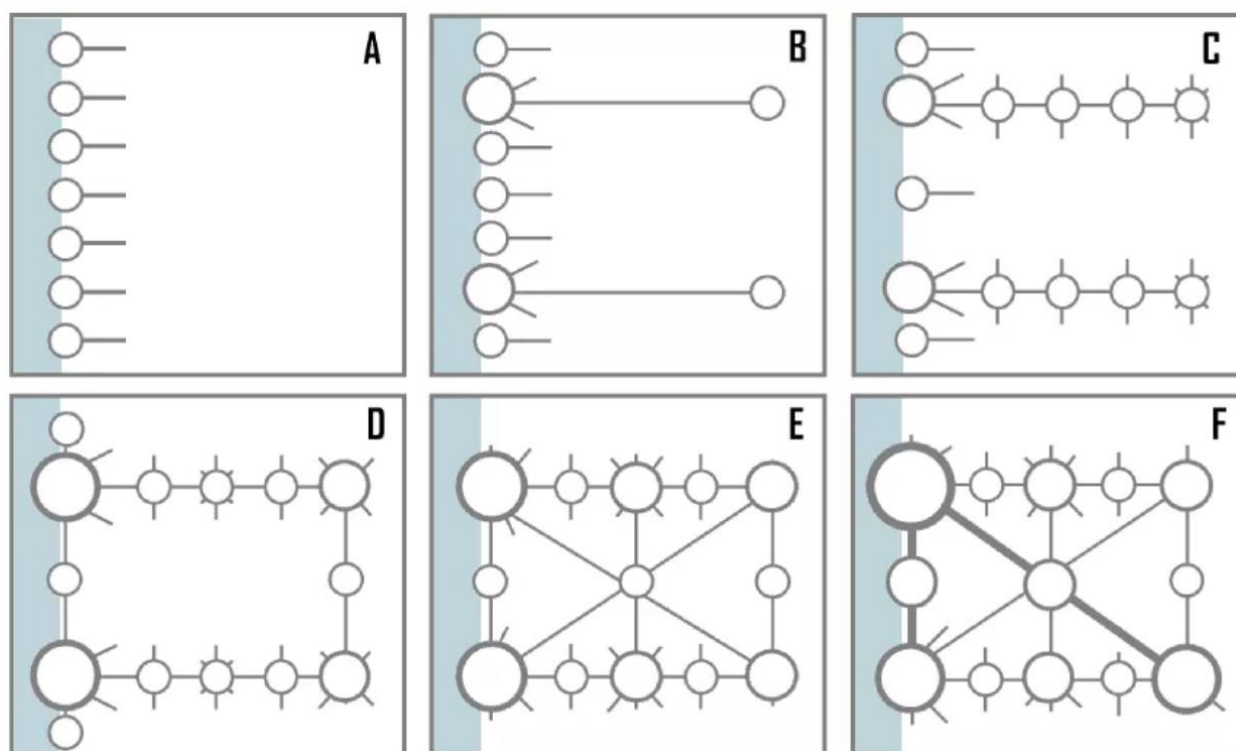


Figure 2-7: Conceptual corridor development

Source: Taaffe *et al.* (1963)

The figure above illustrates the development of transportation networks through the spatial concentration of flows along the corridors (Taaffe *et al.*, 1963). Phase A illustrates small settlements which are connected to other settlements for distribution purposes. Phase B elaborates on Phase A by accessing the hinterland which, in turn, provides opportunities to additional resources and new markets. Phase C is when the hinterland connections are further expanded, and Phase D is when these networks develop interdependently to become interconnected. When the connectivity increases, more dominant centres develop (Phase E) and will eventually result in the emergence of high priority links which are favoured by the concentration of economic activities (Taaffe *et al.*, 1963).

A corridor can, therefore, be described as follows: (i) both ends of the corridor should comprise out of a primary growth centre; (ii) the growth centres should be mutually dependent on one another; (iii) interaction of the axes may result in additional development and (iv) both economic and physical growth should be generated along the axes (Richardson, 1987:207-220). It is important to note that economic corridors should not be classified as mere transportation connections, but rather as integral to the economic fabric and other economic activities surrounding it (Brunner, 2013:4). Therefore, economic corridors do not function in isolation but as part of integrated economic networks, for instance, global and regional economic activities and

production networks (Brunner, 2013:1). The figure below illustrates the function of an economic corridor:

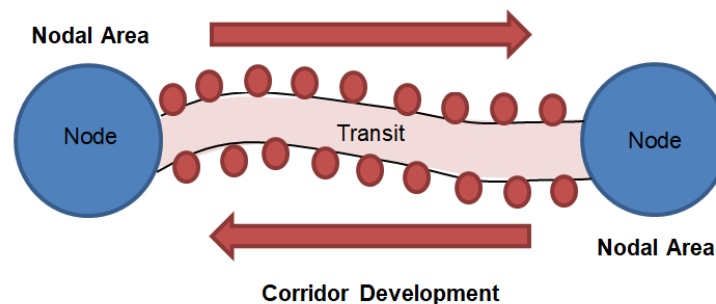


Figure 2-8: Corridor development

Source: Own compilation

The development of corridors is significant to the study due to its connective nature. This section described the importance of corridor development together with nodes in order to obtain more viable economic and physical growth. As indicated previously, the interaction between the growth poles results in greater economic opportunities and increases both centres sustainability. Even though the centres are now interdependent on one another, they have the potential to develop and thrive with minimal risk.

2.4.4 Balanced and unbalanced growth

Regions can be problematic by existing either as underdeveloped or overdeveloped regions (refer to Section 2.2.3). Economic growth is vital for the development of nodes and regions (refer to Section 2.4.1) and can be categorised according to two schools of thought i.e. (i) balanced growth and (ii) unbalanced growth. Balanced growth can be described as the simultaneous growth of all sectors in the economy and was initially conceptualised by academics and was believed to be the ideal type of regional growth (Hirschman, 1958). According to theorists, one of the disadvantages of balanced growth was that it required large capital investment from the start of the growth process (Hansen, 1965). Balanced growth theories generally assume a lack of a motivational problem and are seen as if there is perfect knowledge with regards to all the constraints that are within the growth process and therefore, it was described as unrealistic by several theorists (Bhatt, 1964:612). On the other hand, unbalanced growth questions the assumptions of balanced growth and rejected that perfect knowledge could be obtained from all the constraints within the growth process. Unbalanced growth can be explained as a growth strategy for development which is generally used in underdeveloped countries to achieve vast economic growth (Hansen, 1965). The theory suggests that investment is required in strategic sectors of the economy, rather than all of the sectors simultaneously.

Hirschman (1958) suggested that imbalances in underdeveloped countries are the best strategy for growth due to the lack of available resources. He suggested that the resources which are available should be used to their maximum potential and enjoy priority over other sectors where income is concerned. Hirschman (1958) suggested that the economy can grow by means of unbalanced growth as follows:

- i. Unbalancing the economy through Social Overhead Capital (SOC): SOC is important as it includes education, electricity, water and drainage, public health, irrigation etc. and is the foundation of primary, secondary and tertiary economic activities (refer to the stages of economic growth as described in Section 2.4.1). By investing in SOC's, it would encourage growth of small-scale industries due to the availability of transportation networks, inexpensive electricity or water supply. Investing in SOC's will also have a positive effect on private investment as well as directly productive activities (DPA). This type of investment is autonomous and will increase private profit (for instance, lower cost for electricity and water will reduce the operating costs of industries, irrigation infrastructure will generally result in a higher production etc.). It is also perceived that if an imbalance occurs by the investment in SOC's, it would alternatively lead to investment in the DPA (Hirschman, 1958).
- ii. Unbalancing the economy with Direct Productive Activities (DPA): By directly investing in DPA's, the flow of goods and services are accelerated and are usually the product of private investment. As described above, an imbalance could be achieved by investing in SOC's and can also be created by investing in DPA's. By investing in DPA's, it would directly influence the SOC investment as the demand for services will increase, again contributing to the overall development of an economic sector in an area (Hirschman, 1958).

In addition, it is important to note when unbalances are created to stimulate economic growth, that linkages are vital (Mcgilvray, 1977:49). According to Hirschman (1958), two linkages exist, i.e. backward linkages and forward linkages: (i) backward linkages can be explained as when the growth of industries stimulates the industries who supply them with raw materials and therefore, the production of the raw materials will increase to satisfy the demand of the industry it supplies to. (ii) Forward linkages can be described as the growth of a raw material industry (such as steel) which then stimulates the growth of a secondary industry, such as an industry which produces tools (Mcgilvray, 1977). The above-mentioned linkages are important since they could potentially facilitate the investment choice (industries with maximum linkages should be developed first).

Other theorists criticised the theory as they argued that unbalance is not necessary for underdeveloped countries as imbalance is already caused due to the uncertain behaviour of

demand and supply forces (Kuhlen, 1987). There is also the argument that the availability of facilities, such as transportation networks is more likely to be insufficient and the investment into specialised sectors will only pressurise the already pressurised supply of services (Hansen, 1965).

2.5 Conclusion

This chapter attempted to provide a platform for the development of regions, in accordance with Objective One (i.e. to include a region in an urban system and not only a node) of the study. The chapter was divided into three main Sections. The first section explored how regions could be delineated depending on the main characteristics of a region. It became clear that the characteristics of a region have a significant impact on the delineation of a region. Furthermore, the characteristics of a region could also have an impact on the growth rate, as some regions hold valuable resources which often lead to economic growth.

The second section of the chapter focussed on the different regional categories. Regional categories are only used to standardise some characteristics which a region may encompass. In some cases, regions have multiple characteristics which could complicate the regional categorisation. To understand the different characteristics and how regions are delineated is important, however, it will not ensure viability. For a region to be viable, several nodes are important in order to achieve economic activity in an area. Furthermore, nodes were described in two main categories, such as central and non-central places, where all the important aspects of growth were described to ensure a sustainable nodal area.

Even though nodal places were identified and described, research unveiled that a nodal place would not be sustainable if there is no interaction. The argument of Glasston strengthens the purpose of this study by motivating that urban systems should be recognised as a complex union of spaces rather than focussing on one entity.

Therefore, the last section examined the importance of interaction as well as the different interaction patterns which could lead to economic growth of an industry, area and even a region. As mentioned in Section 1.3, one of the objectives of this study is to identify the linkages between urban and rural areas and therefore, the interaction Section is of utmost importance. Due to the complexity of interaction and regional growth, five economic stages were introduced and described in order to understand the different stages which regions or countries could be positioned.

The second part of the interaction Section focussed on growth poles and research concluded that growth poles can be described as the catalyst for economic growth in regions. In addition to the growth poles, research also examined how growth poles can maximise their economic potential and link to other important economic centres where it was evident that corridors unlock several new economic opportunities. It was also noted that innovation and new technology is vital in order to promote growth in growth poles; when referring to this study, Rostow also stretched the importance of innovation in order to achieve a higher stage of economic growth (refer to Section 2.4.1). Lastly, balanced and unbalanced growth was examined as policy intervention could be guided through these theories. Due to the nature of the South African economy, the focus was on unbalanced growth as South Africa could benefit from some of the theories and investment guidelines (refer to Section 8.2.2 and 8.3).

In the following section, the focus of regions will be intensified by studying several hierarchical theories related to regions. The above-mentioned will assist in the identification of different hierarchical urban systems, as well as the interaction between them.

CHAPTER THREE: EXPLORING THE URBAN SYSTEM

3.1 Introduction

The previous chapter aimed to explain the characteristics of a region and how to achieve economic growth. This chapter can be described as a more detailed Section of the study, as this chapter will attempt to explain urban areas, their significance, distribution and how they interact with one another (as identified in objective three of this study). This is important as several nodes are present within a region, however, their significance and importance vary according to their services and specialisation as population growth. The following figure illustrates the composition of this chapter (Figure 3-1):

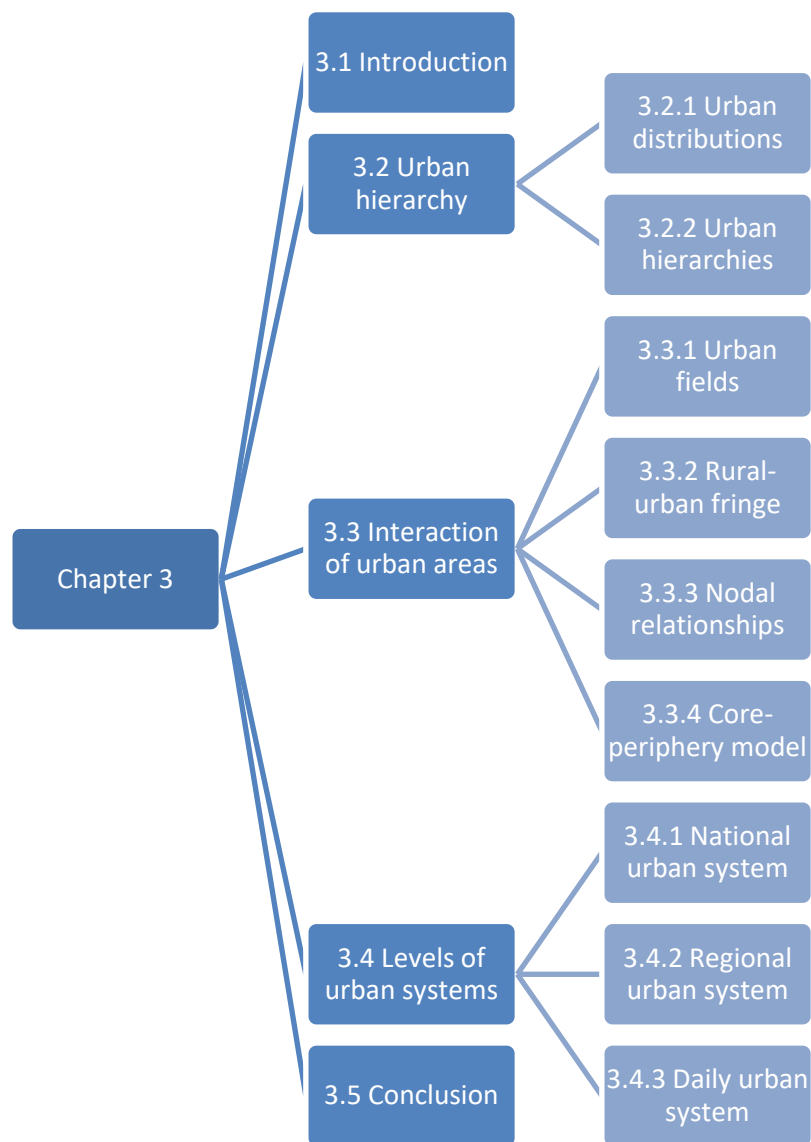


Figure 3-1: Structure of Chapter Three

Source: Own compilation

As illustrated in Figure 3-1, this chapter will encompass several theories which are especially focussed on urban areas (nodes) which are located within a region. The first section of this chapter aims to identify different types of urban distributions to empower the reader with the knowledge to distinguish between different types of distributions with the use of population sizes. Furthermore, different hierarchies of urban areas are also explained on an international level, which will be used later in the study to assist with different hierarchical distributions on a smaller scale.

The second part of this chapter aims to explain the interaction between urban and rural areas and also explores the importance and significance of rural areas. In addition, this section also attempts to identify several relationships of the urban and rural areas in order to strengthen the urban-rural relationships.

The last section of this chapter will attempt to assemble all the sections of this chapter by using urban areas and their interaction with the rural areas in order to create a system which explains all the different hierarchies and their interaction with one another by combining them on the largest scale possible. This chapter will, therefore, aim to inform the reader of the relevant urban development theories as well as the distribution and connection of urban areas in a demarcated area.

3.2 Urban hierarchy

According to Christaller (1966) and Lösch (1954), the order of a city is determined by the diversity of services and products offered in the city, which is also determined by the size of the market area for the services and products (refer to Chapter □). It is recognised that lower-order settlements will import products from higher-order settlements and generally do not interact with cities of the same order (Henderson, 1974:640). However, more recent theorists approached the nature of hierarchy different by suggesting that the homogeneity of regions decreases as the hierarchy increases (Dawkins, 2003:133).

This chapter aims to identify urban areas by means of their characteristics and spatial importance. After urban areas are identified and the different sizes of urban areas will be explained as well as their trends and spatial distributions.

3.2.1 Urban distributions

As mentioned in Section 2.3, central and non-central places have different functions and can therefore, be classified in different hierarchical levels and distributions according to the level of

development and spatial distribution. This concept resulted in a new theory where researchers attempted to explain this phenomenon and it led to the development of the rank-size rule.

Zipf (1949) suggested that city sizes follow a Pareto distribution and have a shape parameter equal to 1. The Pareto equation includes several factors, such as total population, labour available, GNP, land area etc. (Rosen & Resnick, 1980). To visualise Zipf's model, a country must be identified whereafter different order cities should be identified by means of the population size. The data are then to be plotted on a graph by means of the log-rank (y-axis) and the log of the population (x-axis). The outcome of the graph should illustrate a straight line with a slope of -1 (Gabaix, 1999) and would then illustrate a normal distribution.

Pareto distribution is illustrated as follows:

$$y = Ax^{-\alpha} \quad (1)$$

or

$$\log y = \log A - \alpha \log x \quad (2)$$

The formula above can be described as x (the particular population size) and y (the number of cities with populations greater than x where α are constants). Zipf argued that the city's distribution should not only include the Pareto distribution but rather that it took the form of a distribution with $\alpha=1$ and A would be the size of the largest city.

The notion to use a growth model in order to explain the size distribution of cities was suggested by Herbet (1955) and later refined by Gabaix (1999) by illustrating that the expected growth of a city and its variance is dependent on the size of the city. However, Krugman (1991:484) again stresses the importance of several geographic and economic factors, such as location, resources, agglomeration etc. when referring to the growth of a city (refer to Sections 2.4.1, 2.4.2 and 2.4.4).

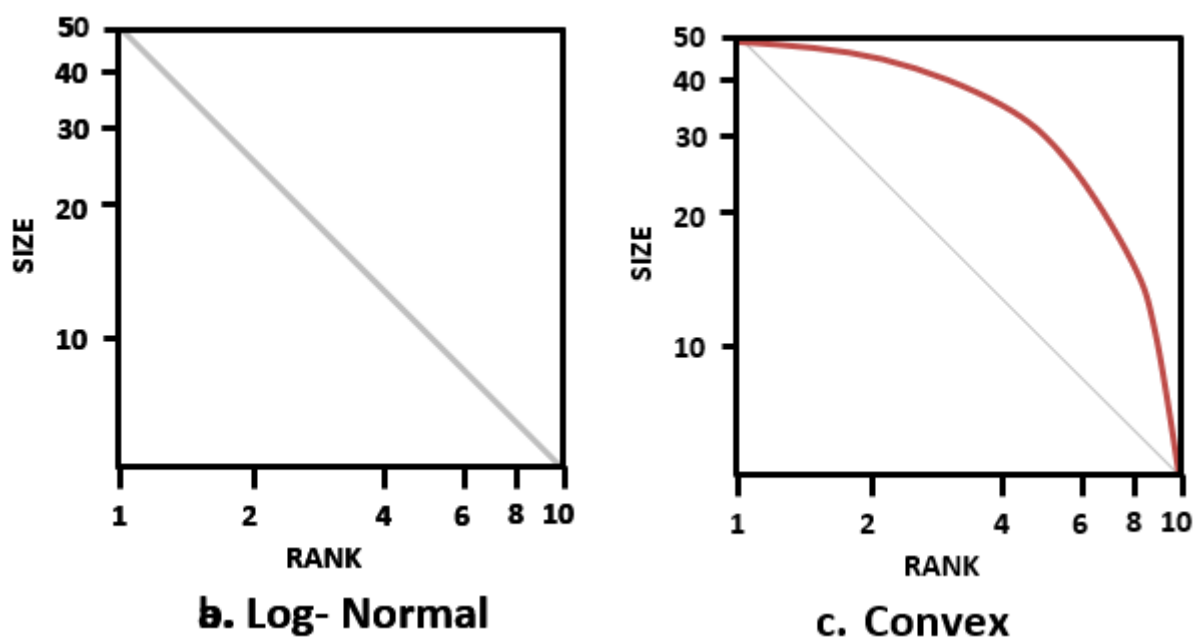
In a basic model, Zipf's law can be considered as if there are a fixed number of cities and that their sizes grow over a period of time. It is also assumed that for a certain range of size, the cities will have a common mean and variance. This homogeneity of growth is often referred to as Gibrat's law (Gabaix, 1999), which confirms that in a steady state the distribution of cities will follow Zipf's law. In short, in a normal distribution of cities (more evenly distributed cities), the city may double or halve in size at any point of time since the constraint should be satisfied (Zipf, 1949:23).

The rank-size rule was designed for both developed and developing countries, where the rank was revealed against the size of the city and on a normal scale in a cumulative frequency. Berry

(1972), analysed city size distributions and their relationship to economic development in both developed and developing countries. He then suggested that the distributions fall into two categories, namely (i) rank-size distributions and (ii) primate distributions.

As previously mentioned, the rank-size distribution is plotted against a log-normal state. The primate distribution (known as the primate rule), on the other hand, can be described as where small cities and towns are dominated by one large settlement. Berry (1972) suggested that the primate distribution is associated with high levels of urbanisation and colonial economies in developing countries and when illustrated on a graph, it would pose a steeper slope from the largest city to other cities (refer to Figure 3-2). He also argued that primate cities are described as paralytic as they negatively affect the development of smaller settlements.

When populations and the size of the city are illustrated according to the theoretical rank-size rule, the pattern would form a straight line, while when in urban primacy, the dominating city would be much larger in population size than the next largest city and this will form a binary pattern, where two or more cities are larger than expected according to the rank-size rule. The following figure illustrates the different size distributions as explained above:



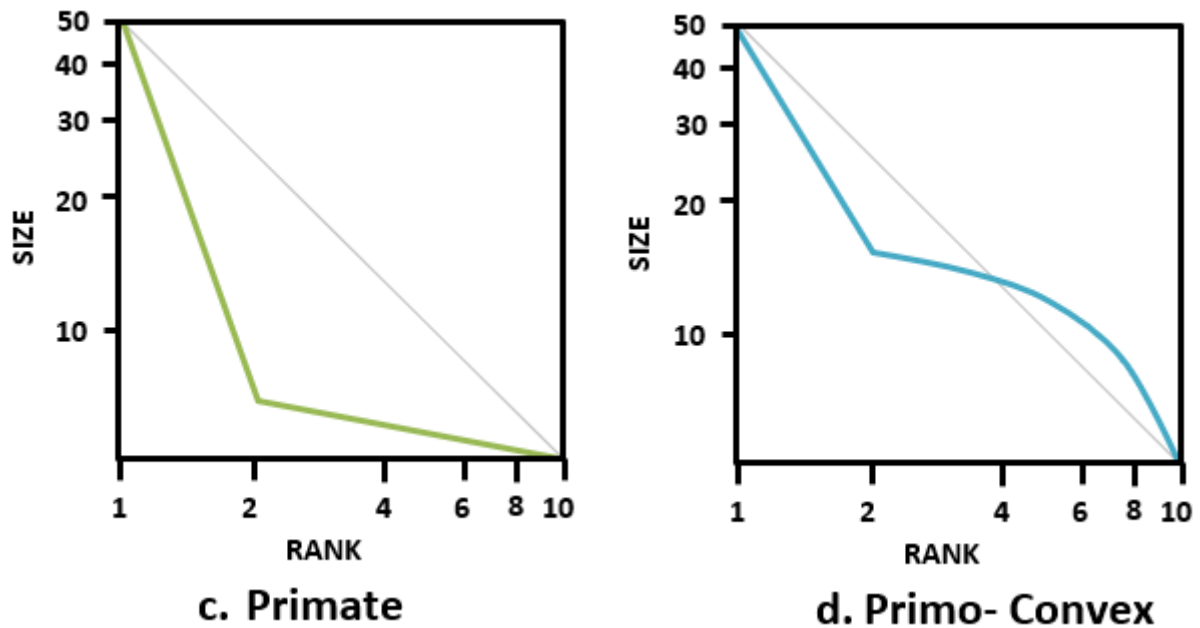


Figure 3-2: Different rank- size distributions

Source: Zipf (1949)

The figure above illustrates the different rank-size rule distributions as previously described. The Log-normal distribution can be described as the basic theory of Zipf's law where the distribution of cities and towns are suggested to form a linear line with a negative slope as the sizes of the city should decrease in a structured manner according to their hierarchy. The Convex distribution can be described as where the size of the second city is larger than expected. This illustrates that cities are more evenly distributed as what Zipf (1949) theorised. The Primate distribution with its steep slope can be described as where one large city dominates all the other cities in an area. Berry (1972) suggested that this type of distribution is usually associated with developing countries. Lastly, the Primo-Convex distribution can be described as a combination of the Primate and the Convex distribution and is also associated with developing countries where one centre dominates cities within a close proximity to one another.

Rosen and Resnick (1980:165) tested the Pareto exponent by identifying several cities within countries and testing the theory of rank-size distribution in relation to the Pareto distribution; they concluded that the Pareto exponent is sensitive to what is included in the city (population demarcation, the location of businesses and industries etc.) as well as the sample size of the city. Furthermore, Rosen and Resnick (1980:170) argued that large cities grow faster than smaller cities in developed countries which leads to a positive coefficient on the nonlinear Pareto equation (refer to Figure 3-2c). This indicates that developed countries would either encompass a Log-normal distribution or a Convex distribution.

This would be of relevance to this study as the population size could be plotted on a logarithm as described above to illustrate the type of rank-size distribution a country or region encompasses, and the concepts as identified above can be used to determine the status of the country and region (developed or developing). In conclusion, the rank-size rule is applicable to the study as the different size distribution models will be applied in order to determine the spatial distribution of cities in the South African context (refer to Section 6.2.1.2, 6.2.3, 7.2.2 and 7.2.3.2).

3.2.2 *Urban hierarchies*

The hierarchy can be described as exhibiting different levels of technology, industry composition, international penetration and workforce composition that have an effect on the size of the forward or backward linkages on lower levels in the hierarchical distribution (refer to Section 2.4.4). This could be explained by the following scenario: smaller and medium-sized cities generally have more standardised or advanced industries when referring to their industrial composition, which in turn produces fewer backward linkages that pull resources from rural areas (Fan *et al.*, 2005:1315). On the contrary, larger cities tend to a larger number of industries as businesses and industries have a tendency to agglomerate and this leads to rapid growth and pulls even more resources from places within the lower hierarchy (Henderson, 1974:640).

Even though different hierarchy settlements are present in the urban system (refer to Section 3.4), they are not necessarily functioning at their optimum size. Optimum city sizes can be defined as cities which maximise their economic potential from the participants of the economy (Henderson, 1974:640). On the other hand, equilibrium city sizes are determined by their location or investment decisions of labourers as well as capital owners which are interested in their own welfare (Henderson, 1974:640). Therefore, an equilibrium city size is determined by the provision of goods and services and the interaction between them (refer to Section 3.3).

The market potential of different hierarchies results into forward and backward linkages which have an effect on the rural as well as the urban growth (Hirschman, 1958). The location of industries and individuals do not only depend on market potential and travelling distance but also on other behavioural aspects, as explained in Section 2.3.3. It is therefore, important to note that there are several factors which determine the size and function of urban areas and these factors will have an effect on the hierarchical order of the area as the number of industries, types of industries/ businesses, market area and population size all have an effect on the growth and size of a city.

Settlements can generally be categorised into several hierarchies according to the spatial distribution and economic significance in the country (refer to Section 2.3.1). Urban systems do

not only exist on one scale (refer to Section 2.4) and interaction can take place either on national or international level or even both and therefore, Friedman (1986) developed the concept of world cities. The motive was to identify cities throughout the world which are used by global capital in the spatial organisation and the articulation of markets and production. Friedman, therefore, proposed that the world distribution of cities should be categorised into possible rank orders and thus Friedman developed two broad categories of world cities which can each be sub-categorised into a Primary and Secondary City. The world cities identified by Friedman are as follows (Friedman, 1986:72):

- (i) **Core world cities:** These cities are located within core countries (Friedman, 1986:71).
 - a. Primary cities: for example, Frankfurt, London, Los Angeles, New York, Paris, Tokyo.
 - b. Secondary cities: for example, Milan, Miami, San Francisco, Sydney.
- (ii) **Periphery world cities:** These cities are not located in core countries but play a vital role in the articulation of the country's economy (Friedman, 1986:71).
 - a. Primary cities: for example, Sao Paulo and Singapore.
 - b. Secondary cities: for example, Bangkok, Buenos Aires, Johannesburg, Rio De Janeiro.

The figure below illustrates the different world cities as identified by Friedman. The model was proposed to identify different networks which exist internationally.

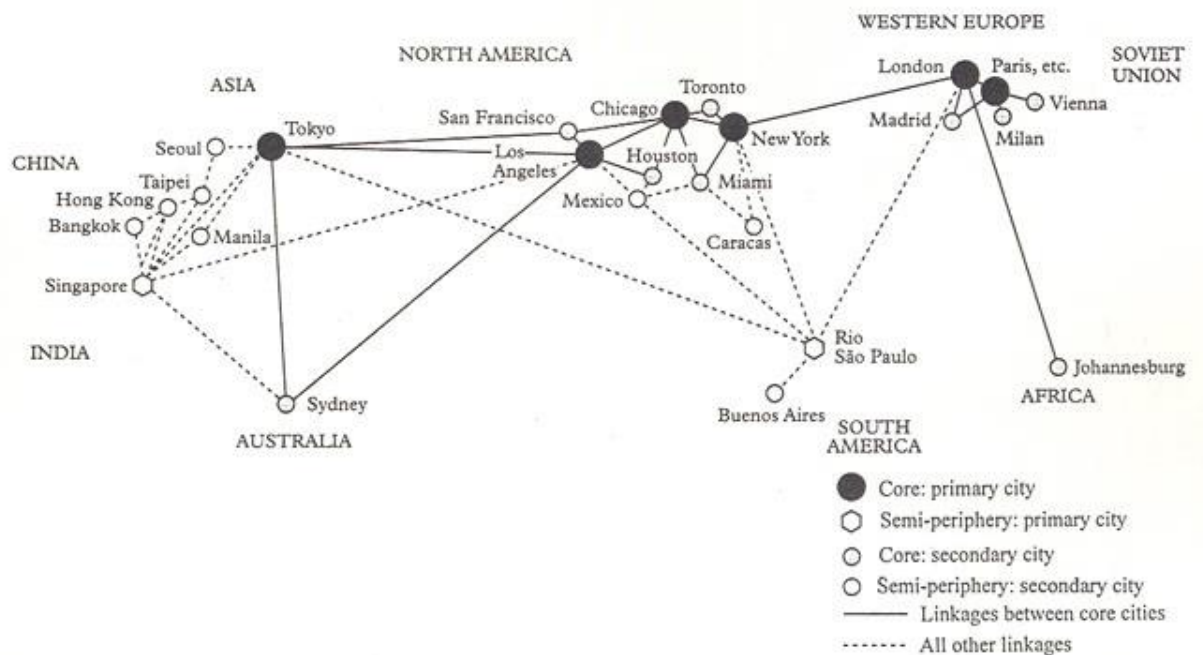


Figure 3-3: World cities network with three geographical subsystems

Source: Friedman (1986:74)

The figure above illustrates the different world cities identified by Friedman i.e. Core primary cities and Periphery world cities together with how they connect in an international urban system. This was only proposed to illustrate the theory of world city spatial distributions. Friedman took several factors into account to identify the world cities, such as population size, services available, the number and importance of institutions etc. (Friedman, 1986:73). Furthermore, cities can also be classified on a smaller scale (i.e. nationally) as they also conform within the urban system. The following table summarises the different hierarchical orders identified on a national and regional scale:

Table 3-1: Classification of hierarchical orders

Settlement Type	Description	Function
Hamlet	Small clusters/ smallest scale of rural settlements and are primarily residential.	Low economic activity.
Village	Varies in size (usually encompasses a population size of 1 000 people) and accommodates small-scale structures and activities.	Businesses and services, such as shops, a primary school, postal office and church exist.
Town	Population usually exists out of +-10 000 individuals and can be described as the primary centre of growth which takes place in rural and suburban areas.	Includes all the functionality of a village and encompasses chain stores. Some type of infrastructure, such as railway stations, hospitals, secondary schools and sports centres are present.
Regional or corridor centres	Are located along major transportation corridors and is highly accessible.	Multi-purpose settlements and encompass a diverse range of services, such as a daycare, library, medical clinics, hotels and all the functions of a town.

City	Population is usually < 1 00 000 individuals and are usually historic centres of the government, culture, residence and industries.	Includes all the functions of towns and has a large shopping centre, theatre and generally an airport.
Conurbation	Type of settlement is formed by growing outwards and capturing settlements which were once separate.	Includes all of the functions of all the settlement types.

Source: Adapted from Neuman (2000:122-123)

The rank of the settlements is important as it is not possible for settlements to provide all the services and facilities to their residents (Neuman, 2000:122). Settlements can also be subdivided according to their functions, however, for the purpose of this study, it was only important to examine the different hierarchical orders of settlements in urban systems.

This chapter identified the different hierarchical orders, from international to local level and described the spatial significance and the interaction required for different hierarchical distributions. It is, however, important to note that the significance of a town determines the forward and backward linkages to smaller hierarchy cities. The different hierarchical orders of South Africa will be categorised in Chapter Seven. The following section aims to explain the interaction of urban areas with their rural areas in order to promote growth.

3.3 Interaction of urban areas

It is important to note that urban centres are not isolated and are surrounded by semi-rural and rural areas. This section aims to explain the interaction of urban areas with their urban fields and the importance of these interactions.

3.3.1 Urban fields

As mentioned in Section 2.3.3, urban areas offer a range of services and materials which are supplied to a market area. The market area does not only include the node itself but also serves an area in close proximity depending on the level of specialisation (refer to Section 2.3.1 and 3.2). The market area can be derived from the maximum distance a consumer is willing to travel in order to obtain the service or product (Berry, 1967). Therefore, the market area can be described as the urban field (sphere) surrounding a node which is dependent on the node for services and

products. Among other theorists, Richardson (1973) studied the significance of spheres and acknowledged that in the spatial economy, agglomerations are found at particular locations and that these locations generally act as dominant centres in the national space. Thus, each centre has economic significance and could be classified as a node within a region. The following figure will illustrate the most basic concept of an urban field in relation to the urban centre:

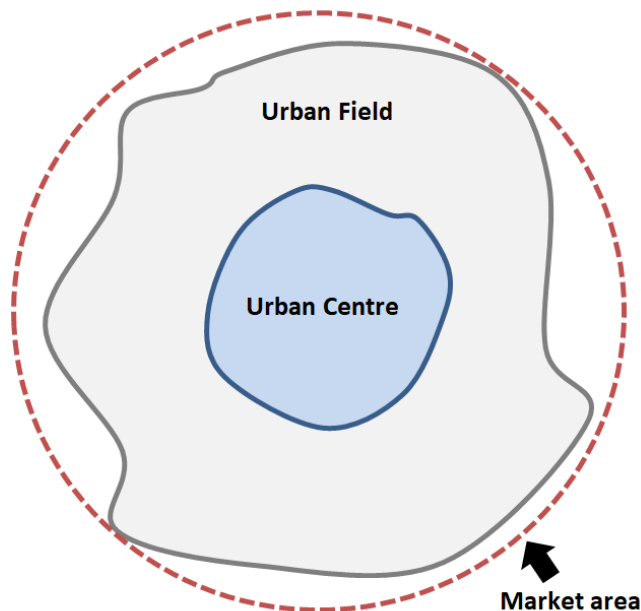


Figure 3-4: Basic illustration of an urban field

Source: Own compilation

From the figure, it is clear that the urban centre is surrounded by the urban field. The concept of nodes and their significance in terms of their regional importance, as well as their national importance, gave rise to a concept named polarised regions (refer to Section 2.4.2). Polarised regions are composed out of heterogeneous centres which are interrelated, and these interconnections stimulate flow from the centres. It is important to understand that the flows of these heterogeneous regions do not occur at even rates over space and that the strongest flow tends to polarise from and to a dominant node (Perroux, 1950). The following figure illustrates the concept of polarised regions:

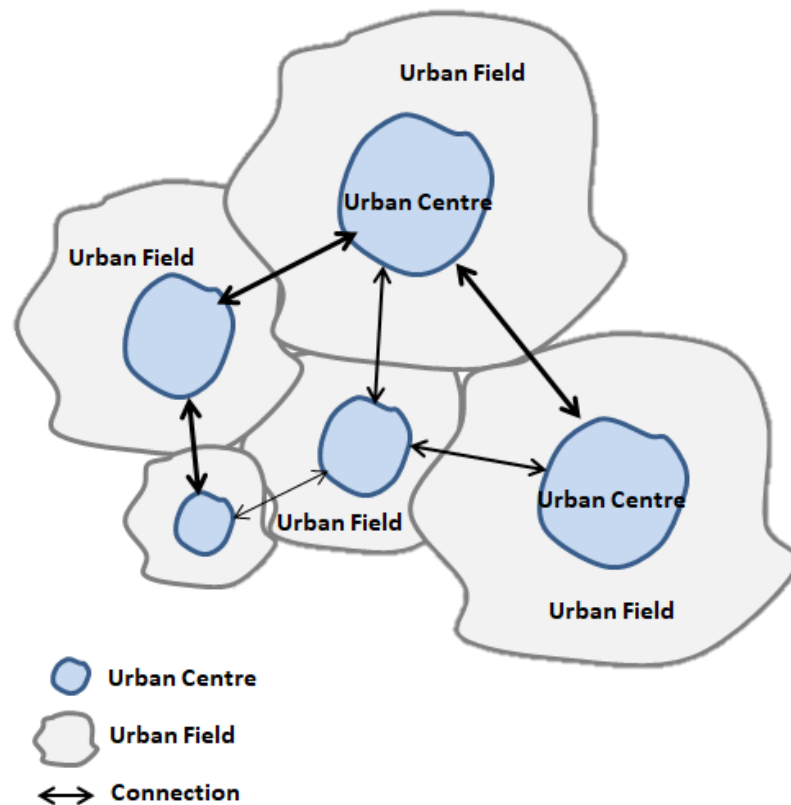


Figure 3-5: Polarised development

Source: Own compilation

As illustrated in Figure 3-5 it is clear that several urban centres exist even though they differ in size. Figure 3-5 also illustrated the interactions between the urban centres and further indicated that the interactions are stronger between the larger urban areas than with the smaller urban areas. Interaction will thus take place in the spatial field surrounding the node and as the distance increases from the node, the force of the urban field will weaken (Smailes, 1966:129).

In short, the strength of the flow will vary depending on the size of the node and then inversely with distance (Richardson, 1969:67-69). Consequently, as economic growth occurs at a node or growth pole, it will lead to job opportunities and other related opportunities, which would increase flows and increase the zone of influence surrounding the node or growth pole. This theory, therefore, corresponds to the growth pole theory described in Section 2.4.2 and also aligns with the central place theory (refer to Section 2.3.1) where the size of the central place influences the market area.

It is important to note that the boundary of a town's influence tends to change over time (Christaller, 1966; Hillhorst, 1971) due to several factors, such as if a settlement that strengthens its relationship with its periphery. This will result in an expanding periphery and other areas will most probably reduce in size. The boundary could also transform due to a new resource which is

discovered as well as technological changes, such as a new transportation route (Hillhorst, 1971). As mentioned previously, an urban area, as well as urban fields, has several influences, i.e. social, administrative or economic influences. All these influences have an effect on the size of the urban field and therefore, all the towns will not have the same size urban fields (Smailes, 1966:129). The following section will investigate the urban field in more detail in order to determine the characteristics and function of the urban field.

3.3.2 Rural-urban fringe

The rural-urban fringe can be described as the area outside the urban area where urban and rural land uses mix (refer to Section 2.2.2). The area is located within the urban sphere and the rural-urban fringe can be categorised by a large variety of land uses and the character is likely to change from largely rural to urban (Hillhorst, 1971). The outside boundary of the rural-urban fringe usually shows signs of suburbanisation (Verissimo, 2014). The following figure illustrates the concept of the urban and suburban as well as peri-urban areas:

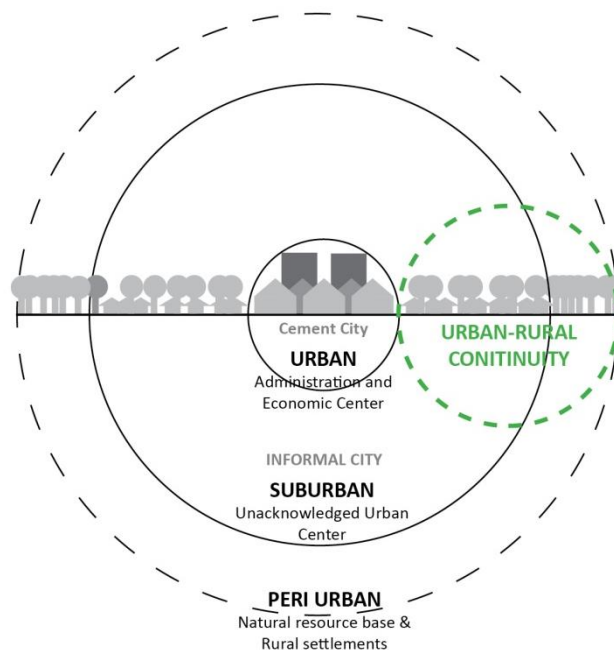


Figure 3-6: Illustration of the urban area in relation to the suburban and peri-urban area

Source: Verissimo (2014:12)

Figure 3-6 illustrates the concept of the urban area in relation to its suburban and peri-urban area. There are several categories of relationships that the urban centre has with its urban field (Dickinson, 1964). Firstly, trade relations which would include all trading activities, such as retail and wholesale. Large retailers which specialise in products, such as jewellery stores and furniture shops will have a larger market area than smaller retailers selling everyday items, such as newspapers and bread (refer to Section 2.3.3). The second relationship can be classified as social relations where entertainment and cultural activities will be present. The third relationship is a

commuting relationship which it includes the towns' individuals passing through on their way and from work (Dickinson, 1964:278-286). It could also include the area which people visit for recreational purposes, such as a resort. The fourth relationship is agricultural relations, where several agricultural activities take place which are supplied to a nearby city (such as dairy farms). The fifth relationship is the industrial relation and it includes factories which process raw materials produced in the urban field, such as dairies and meat-packing plants (Hudson, 1976:35).

Urban nodes and their relationship with their urban fields are important in order to obtain products from the urban field which are not present in the urban centre itself. An urban centre is dependent on these products as they improve the city's functionality and interconnection. As mentioned previously, a town does not only provide for itself, but it also provides products and services for the surrounding region.

3.3.3 *Nodal relationships*

Fox and Kumar (1965:58) suggested the "functional economic area" concept that is based on the dominance of a central place node over the surrounding peripheral area is dependent on the spatial dependence of employed individuals on nearby employment centres. The above-mentioned approach provides a conceptual economic area delineation base, for the following reasons: (i) the theory included labour as a unit of measurement, which is a clear correspondence between social welfare analysis and regional analysis; (ii) the concept of a functional economic area incorporates spatial integration among the economic units when defining a region (travelling of employed individuals); (iii) a clear economic rationale exists by including the concept that employed individuals attempt to minimise transportation costs and the employer who wishes to minimise his cost for compensating labour for higher commutes; (iv) the larger the labour market, the larger the consumer market and therefore, if a significant local labour market will serve as a consumer for the market (if the business wish to sell their products to their workers) as well as a labour force for businesses (Fox & Kumar, 1965).

The above-mentioned concept, therefore, includes one of the most critical elements when referring to the economic viability when determining economic boundaries which businesses and workers face in the spatial dimension while increasing an area's interdependency (refer to Section 2.3.3 and 3.3.1). One challenge of the above-mentioned approach is that communication and transportation technology has advanced in such a way that it weakened many of the elements which determined the spatial orientation of employed individuals to businesses. Telephonic conversations are now possible where no travelling will be required, as well as the convenience of air and road travel are much higher - which again proves that employees are not required to live within a close proximity of their employer (Dawkins, 2003:133).

These changes to a modernised society are the reason for urban and regional boundaries which become more difficult to define as there is no longer a clear spatial dependency between the workforce and their employment centres (Smailes, 1966). The amount of information available in recent years has bevelled several disciplines and thus no holistic idea could be developed as to date. This is due to the complex and indirectly wired natural and man-made systems (Hassan *et al.*, 2017). These systems can be illustrated as networks consisting out of nodes which are connected and interlinked with one another (refer to Section 2.4.3 and Section 3.3.1). Hassen *et al.* (2017:24) realised that real networks are not static and that the networks grow over time; connecting to nodes with respect to their degrees. The above-mentioned again confirms the importance of well-connected areas in order to obtain economic growth in a region. The following section will investigate the different scales of connection which are present in the urban system when referring to the nodes and connections present in a region.

3.3.4 *Core-periphery model*

The core-periphery model was developed to explain the process of economic growth when referring to spatial distribution. Friedman (1966) identified four stages of growth in order to reach industrial maturity and could also be linked to concepts identified in Section 2.4.1 i.e. stages of economic growth.

Stage one is the **pre-industrial** stage, where there is a strong presence in the agricultural sector. The economy is localised, and the spatial structure exists out of small settlements which are fairly isolated, and the mobility is low. Stage two can be described as the **transitional** stage where the focus of the economy is shifted to one core city as a result of capital accumulation as well as the growth of industries. The dominant city emerges within the urban system and acts as a growth pole which attracts numerous skilled labourers. Although the mobility and trade increases, the peripheral areas are still somewhat stagnant.

Stage three is proposed as the **industrial** stage and this stage encompasses extreme economic growth and diffusion which results in the emergence of other growth centres. The smaller centres which emerge are due to increasing input costs, such as land, in the dominant centre. The diffusion of centres initiates interaction in the peripheral area towards the dominant core. The final stage is the **post-industrial** stage, where the system becomes completely integrated and spatial inequalities are reduced.

The distribution of economic activities produces opportunities for other centres to specialise and increase the flow of materials along transportation corridors (refer to Section 2.4.3). This stage can be described as a functionally interdependent system of cities and is characterised by its

organised complexity and the centre's maximum growth capacity is reached (Friedman, 1966). The following figure illustrates the four stages:

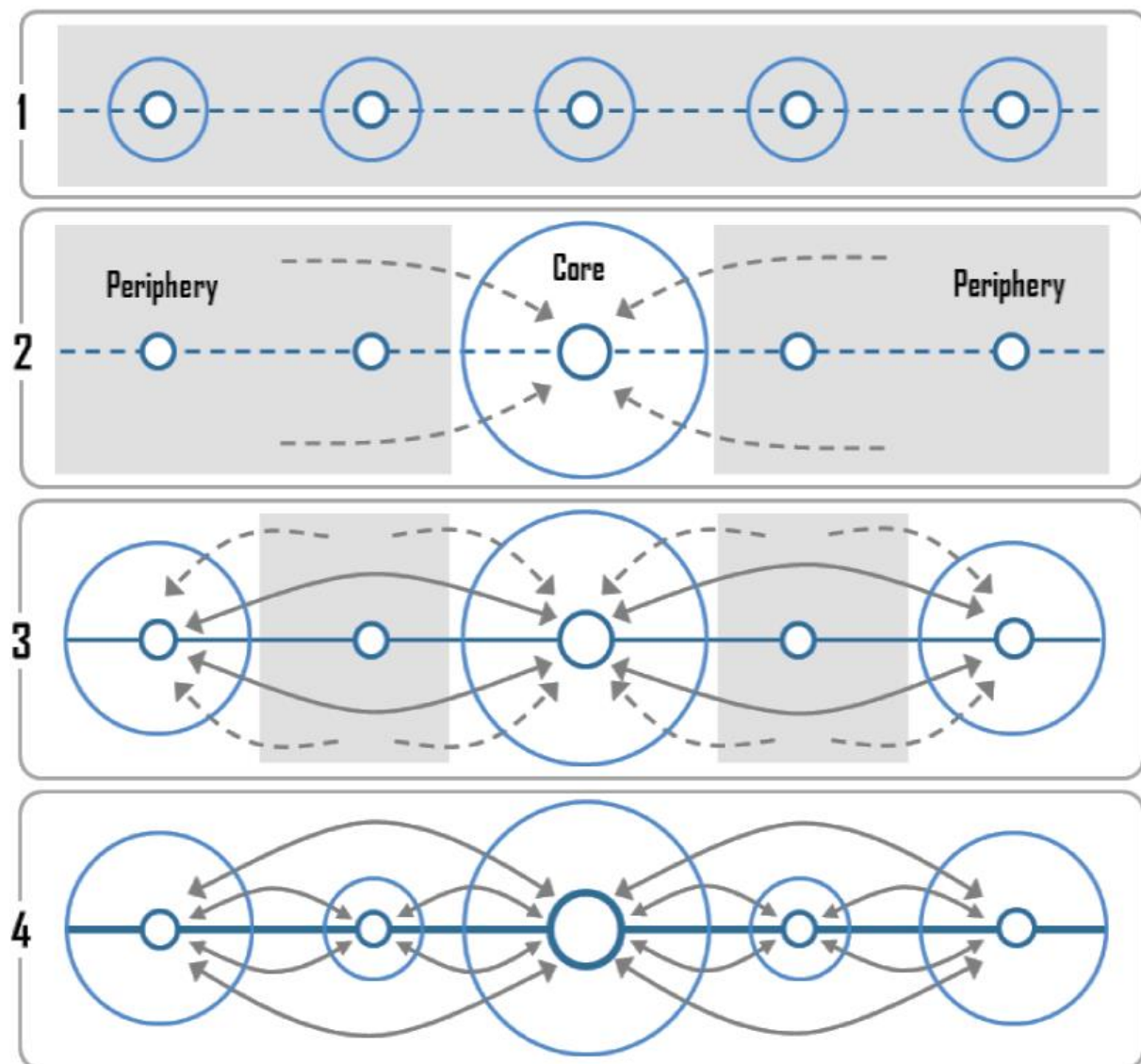


Figure 3-7: Core-periphery stages of development

Source: Derived from Friedman (1966)

When referring to the figure above, the reader should note that there is a strong dominance of an urban centre as soon as interaction occurs. This dominance again illustrates that hierarchies are present in urban systems as described in Section 2.3.3.

Richardson (1973) used the concept of the core-periphery model and suggested a new theory that was not that heavily based on international trade, macroeconomics and neoclassical theories. He indicated that a large number of core-peripheral theories did not include spatial differentiation within regions. Richardson's (1973) model included the growth rate of regional income by investigating agglomeration, location, the size and spatial distribution of materials, the rate of

natural increase and rates of the return of capital and labour, the region's capacity to absorb innovation as well as the strength of communication with other nodes.

3.4 Levels of urban systems

The following section aims to identify the interaction and linkages of urban areas with each other as well as the region they are located in. The general approach of the urban system can be described as a systematic interaction of several hierarchical orders within a region to create growth and development patterns (Bourne & Simmons, 1978:421). The evolution of the spatial system and the spatial pattern is important for social development processes on a spatial scale (Catalan *et al.*, 2008:176).

Urban systems originated through the growth of a single settlement which interacted with other settlements for industrial and investment growth (refer to Section 3.2.2). It can also be assumed that as settlements grow, their interaction increases, and cities start to group to interact with one another, especially when they are of the same scale within a region (Fan *et al.*, 2017:61). The spatial structure of the city refers to the networks constructed (refer to Section 2.4) in the urban area (refer to Section 2.3.3), such as transportation, information networks, the economic chain etc., and these networks are of utmost importance for they stimulate the interaction between rural and urban areas (Bourne, 1975:13).

The evolution of the spatial structure is closely related to both economic and population factors it also influences the growth of the urban area (refer to Section 2.3.3). The urban system, on the other hand, can be described as a system with the ability to organise itself and it becomes effective as the complexity of the system increases - which is also more favourable for sustainable development within the urban system (Park, 2011:398).

Urban systems can be classified into three levels; firstly, the national urban system, secondly the regional urban system and lastly the daily urban system. These systems are characterised by their spatial importance in relation to several activities, functions and spatial interaction (Bourne, 1975:12).

3.4.1 National urban system

The national urban system can be classified as a system which is dominated by one or more metropolitan centres which are characterised according to their hierarchy (refer to Section 3.2). As mentioned in Section 2.3.1 and 3.2, the higher the hierarchy of the urban centre, the less it would occur spatially whereas the smaller the hierarchy of the urban centre, the more frequent it would spatially occur (Bourne, 1975:13). In addition, Berry and Horton (1970:200) stressed the

importance of economic linkages and the exchange of information and innovation on a national level.

3.4.2 Regional urban system

The regional system, on the other hand, refers to cities with a similar hierarchical arrangement; however, it is less rigid than the national urban system. The regional urban system can be described as a subsystem within the national urban system which is largely concentrated around a single metropolitan centre with smaller cities surrounding the centre (Bourne, 1975:12). On this level, social service connections, regional hospitals, road traffic and telephone calls may dominate the system. These linkages (connections) can either be mutual or one-sided as well as direct or indirect (Berry & Horton, 1970).

3.4.3 Daily urban system

Lastly, the daily urban system represents the daily movement of urban residents within the regional urban system. The daily urban system develops due to the interaction and influence of each centre it reaches (Bourne, 1975:12). The following figure illustrates a generalised description of the three levels of urban systems as described above:

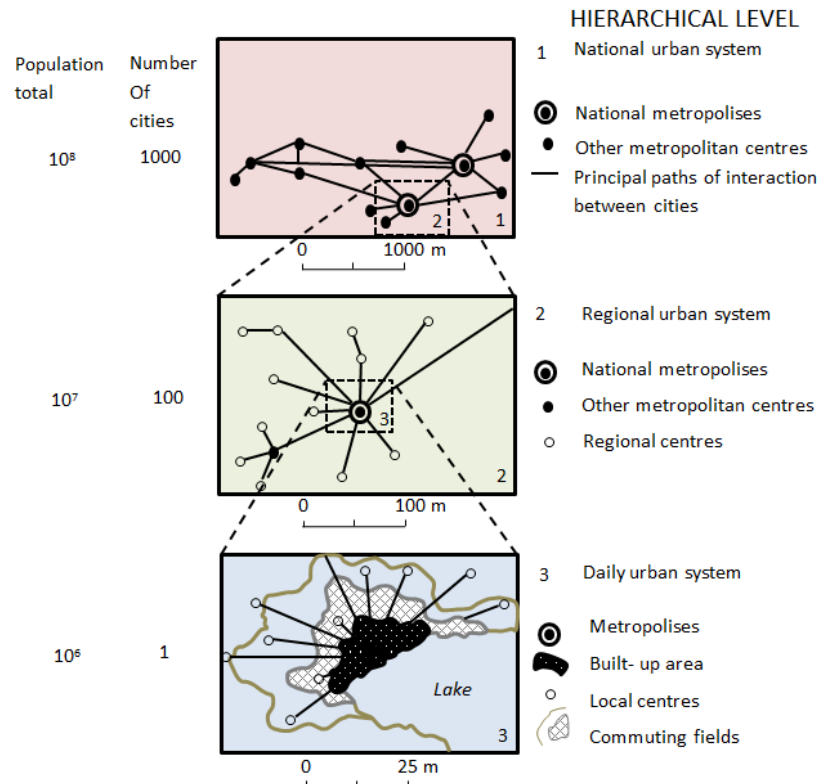


Figure 3-8: Levels of an urban system

Source: Adapted from Bourne (1975:35)

Figure 3-8 illustrates the different levels of an urban system according to Bourne (1975). Even though Bourne (1975) provided a foundation for the urban systems, several theorists refined his theory and added one additional level. The international level of urban systems (refer to Section 3.2.2) is the largest scale on which urban systems function (Walloth *et al.*, 2016:2). This study did not, however, focus on the international hierarchy as the study area does not connect on an international level.

The study of urban systems has created a recent interest, especially when referring to national development. According to Friedman (1973:12), research has united on two important questions (i) What variables are responsible for the growth in urban systems? (ii) How is the growth of urban systems related to those of the national system? The growth or the development of an urban system can be described as the structural growth of urban systems, which can be measured by the number of economic activities or population growth (Berry & Horton, 1970:200). The national system can, therefore, be described as the structural transformation, derived from a national economy to industrialism. Friedman (1973:12) believed that the linkages between national development and urban development are inadequately understood and more research should be focussed on the linkages of the urban systems (refer to Section 2.4).

The recent shift to modern industrialisation gave rise to a dramatic population and employment shift and this again led to the acceleration of urbanisation (refer to Section 2.3). Simultaneously, urbanisation generated its own dynamics, together with the development of modern industries. The above-mentioned shifts occurred vastly in the national territory and have significantly influenced the integration on a national level by challenging the political standings, transportation patterns and social integration (Friedman, 1973:12; Chen & Partridge, 2013:1321).

The concept of the urban system can then be divided into smaller, more specialised systems which are nestled within the national, regional and daily systems, such as economic systems, cultural systems, ecological systems, technological systems, political systems etc. (Walloth *et al.*, 2016:71). These systems then form a model of systems which change in different frequencies and lead to a specific method when dealing with them. In other words, some systems will change slowly as it could be due to its enclosed character where minimal external factors influence the system. The enclosed system usually has a dominant flow and is dependent on the interdependence within the urban system that it is nestled within (Murayama, 1982:382). On the other hand, an open urban system is dependent on external interdependencies, such as the national urban system which encompasses both regional and daily urban systems. The openness of a system should be kept in mind as several factors could influence the growth and development of the system.

Another factor which has an influence on the growth and development of an urban system is the stability of the system. Due to the nature of urban systems, it would be expected that the state would change as a system could be influenced by several factors. The stability, however, is the ability for a system to remain unchanged over a period of time while the organisation of the urban system changes (Murayama, 1982:382). This concept will be important as the purpose of the study is to examine regional resilience in different urban systems.

The urban system theory also gave rise to other theories related to the spatial significance and distributions of towns. One of these theories would be the “Urban Tree” theory. This theory categorised the different nodes according to their hierarchy and developed a model illustrating how the interaction could take place (Fan *et al.*, 2017:63). The largest nodes which connect are the “root” of the tree, the second largest nodes which connect are the “trunk” and the smaller nodes are conceptualised as the “branches”. Fan *et al.* (2005:24) suggested that an urban tree would be formed when using the nodes and how they connect within a region. The following figure illustrates the concept of the urban tree:

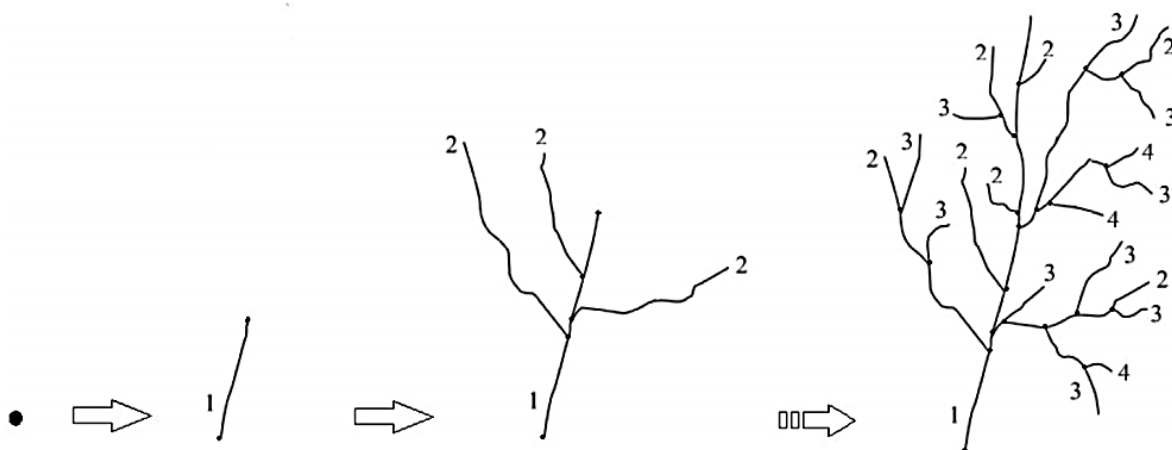


Figure 3-9: The urban tree model

Source: Fan *et al.* (2017:62)

Figure 3-9: The urban tree model illustrates the connection/interaction of different hierarchies located in the urban system (refer to Figure 3-9). The nodes labelled as ‘one’ can be categorised as the largest hierarchy available in the urban system whereas it decreases in the hierarchy. Hence the urban node labelled ‘four’ would be the smallest hierarchy present in the identified urban system.

Even though Fan *et al.* (2005:25) suggested the urban tree which encompasses several urban hierarchies; they also agree that the growth of the urban system exists out of three levels. The urban tree is, therefore, only an illustration of the spatial pattern of the urban system and attempts

to illustrate the origin and evolution of urban systems. Within a particular area, the earliest city (root) will develop due to its resource advantage (refer to Section 2.3.2), while the connections (branches) will be formed when resources and materials are exchanged (refer to Section 2.4). The connections will determine the direction of growth of the tree and the more the nodes grow, stronger connections will form. This will lead to the overall strengthening of the urban tree (urban system).

3.5 Conclusion

The aim of this chapter was to explore the urban centre and the type of interaction with its surrounding regions as described in Section 1.3 (objective three of the study). As mentioned in Chapter One, the purpose of this study is to explore regional resilience in urban systems. Hence, this chapter provided a basis of what the urban centre encompasses and how to stimulate growth in urban areas as well as the regions surrounding the urban centres.

The first section attempted to explore the nature of urban areas. Urban areas were then defined as areas which provide products and services to individuals who reside in the centre, whereas rural areas were defined as areas in which individuals who reside in the area are self-sufficient and grow their own staple food. After urban areas were defined, different distributions of urban centres were explored; taking both developed and developing countries into account. These distributions have their own advantages as well as disadvantages and were relevant to the study as South Africa is characterised as a developing country although we strive to become a developed country (refer to Section Seven). The different urban distributions are essential to the study as some of the distributions accompany strong economic growth. When the growth of urban areas is achieved, different hierarchies develop, and each hierarchy has its own function and provides different services and products to its consumers.

The second section then focussed on the urban area, as well as the region surrounding it. The section then explored the region surrounding the urban centre and the advantages and function of these areas. The research uncovered that the interaction of urban centres with its urban fields is essential to achieve growth and that interaction can be obtained through both nodal and parallel relationships.

The last section explored the different levels of urban systems as the study aims to provide a platform of an interconnected system rather than only focussing on an urban centre when focussing on economic growth and resilience within a demarcated area. The chapter concluded with the urban system network and it can be described as the relationships and paths of interconnection which form the foundation of the modern civilisation. It is important to note that

the levels of relationships differ in scale and composition depending on the urban hierarchical level.

From this chapter, it is evident that urban centres and their surrounding regions do not exist in isolation but connect with other urban centres and their surrounding regions. This interconnection is vital for the development and growth of the urban system network. Urban systems and towns will be measured as the study progresses in order to determine the spatial importance and regional importance to achieve maximum growth in the South African concept. The following chapter will focus on the resilience of urban systems to equip a region or area with concepts to minimise negative impacts which could occur and constrain the economic growth of an area.

CHAPTER FOUR: THE ROLE OF RESILIENCE IN A REGION

4.1 Introduction

The following chapter will explore regional resilience in urban systems. This chapter aims to describe the main concepts of resilience as well as explore how a higher level of resilience can be achieved. Furthermore, this chapter will focus on a regional scale as well as investigate the role of resilience in an urban system as a whole. The following figure illustrates the layout of this chapter (Figure 4-1).

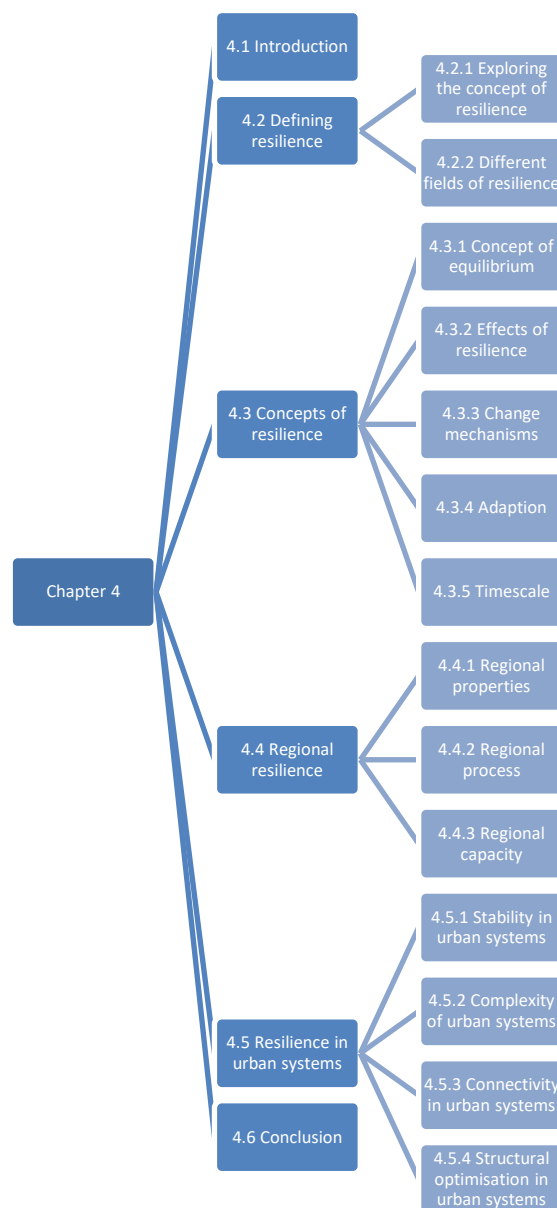


Figure 4-1: Structure of Chapter Four

Source: Own compilation

Resilience can be described as a fairly new concept in urban and regional planning and therefore, this section focussed on defining resilience in a comprehensive manner. Due to the widely used term, this section aims to define resilience, not as an isolated concept, but rather to include several definitions from different disciplines. Thereafter the concept of resilience will be explored to understand the concept and to examine how to achieve resilience on a regional level. One of the objectives of the study is to examine the urban system and not only individual cities, therefore, the last section of this chapter will also explore how resilience can be implemented on an urban system level.

This chapter is vital to the study as it aims to provide valuable concepts of resilience on different hierarchical levels to achieve better systematic integration in a country rather than to focus only on nodes. These concepts will be used and applied as the study progresses (refer to Chapter 8).

4.2 Defining resilience

The concept of resilience is widely used in several disciplines and therefore, several definitions exist (Meerow & Newell, 2015:39). As a result, resilience is interpreted in numerous ways and has several meanings of which this section will explore and identify. The resilience theory generally provides information on a complex social-ecological system and its sustainability (Folke, 2006:253). Thus, this section will incorporate a large number of theories and definitions of different disciplines which will be used to develop the most encompassing definition when referring to the study at hand. It is important to note that the definitions listed below were identified as the most relevant definitions and that there are numerous additional definitions which were not listed.

4.2.1 Exploring the concept of resilience

The term resilience is interpreted in many ways and therefore, a table was constructed to explore the most relevant theories and disciplines applicable to this study (refer to Table 4-1):

Table 4-1: Definitions of resilience

	Author	Discipline	Definition
1	Alberti <i>et al.</i> (2003); Pickett <i>et al.</i> (2004); Ernstson <i>et al.</i> (2010); Ahern (2011); Leichenko (2011);	Environmental Science	“the degree to which cities tolerate alteration before reorganising around a new set of structures and processes”

			“the ability of a system to adjust in the face of changing conditions” “To sustain a certain dynamic regime, urban governance also needs to build transformative capacity to face uncertainty and change” “the capacity of systems to reorganize and recover from change and disturbance without changing to other States systems that are ‘safe to fail’” “the ability to withstand a wide array of shocks and stresses”
2	Godschalk (2003)	Engineering	“a sustainable network of physical systems and human communities”
3	Campanella (2006)	Social Science	“the capacity of a city to rebound from destruction” “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”
4	Wardekker <i>et al.</i> (2010); Wamsler <i>et al.</i> (2013); Desouza and Flanery (2013)	Business Management and Accounting	“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”
		“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”
		“ability to absorb, adapt and respond to changes in urban systems”
5	Lhomme <i>et al.</i> (2013); Chelleri (2012)	Earth and Planetary Sciences
		“should be framed within the resilience (system persistence), transition (system incremental change) and transformation (system reconfiguration) views”

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

The table above confirms the variety of definitions for resilience when investigating different disciplines. These viewpoints, however, were only examined in order to provide a foundation and an understanding of the applicability of resilience. Meerow *et al.* (2016:39) combined the theories above into one flexible definition of urban resilience and it is defined as follows:

“Urban resilience refers to the ability of an 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”

(Meerow *et al.*, 2016:39).

This definition can be described as comprehensive as it includes the fundamental theories of resilience and it could still be adopted by several disciplines. Thus, it could be accepted that

resilience is applicable to several disciplines (fields). The following section will explore some relevant fields of resilience when referring to regional resilience by using the definitions in Table 4-1.

4.2.2 *Different fields in resilience*

The concept of resilience is used by several disciplines and each of these disciplines interprets resilience differently (refer to Table 4-1). Regional and urban planning is known as a multidisciplinary profession and therefore, it would be suitable to explore the professional fields which closely relate to urban and regional planning. The following disciplines discussed below were identified while the focus was on exploring resilience on a regional level.

- Engineering resilience

This type of resilience refers to physical properties and is also classified as a growth path to “bounce back” (Holling, 1996:31). In the perspective of disaster prevention, engineering resilience refers to the prevention and post-recovery of urban infrastructure, urban population (refer to Section 3.2, 6.2.1.2, 6.2.3, 7.2.2, 7.2.3.2 and 8.3.1) and adaptability of engineering construction as well as land utilisation (Allenby & Fink, 2005:1034-1036). Numerous countries realised the importance of engineering resilience by means of improving their infrastructure in order to withstand disturbances, such as earthquakes which in return improves not only a city’s resilience but regions’ resilience as well (Peng *et al.*, 2017:90). Other countries, such as China, proposed urban-rural integration by means of a green infrastructure network, which is implemented as land property is transformed. This illustrates that the field of engineering resilience is diverse and it can perform on multi-scale networks and should, therefore, be focussed to encompass a high adaptability in terms of the planning and design approach (refer to Section 8.2.2), in order to adapt to the different needs of development (Ahern, 2011:341).

- Economic resilience

The economic resilience of a region originated to address issues, such as regional economic recovery as well as sustainable development (Peng *et al.*, 2017:91). The economic system encompasses both self-organisation and artificial organisation processes which are closely connected to regional policies, planning, management etc. (Xiaohui, 2012:65). Some researchers even suggested that the degree of regional economic resilience depends on policies (refer to Chapter Five, Section 6.2.1.3, 6.2.4, 7.2.3.3 and 8.3.3), development strategies, economic diversity as well as social and economic characteristics (Dabson *et al.*, 2012:30-32). Economic diversity could be of utmost importance when referring to resilience as it shapes the regional

economic disparities and improves independence, especially when policy support is received (refer to Section 3.3). Economic diversity can be divided into the following categories:

- *Economic structural diversity*: This type of diversity is useful in preventing regional locking-in which is caused by a single industrial structure (refer to Section 3.3.4). This would reduce disruptive powers from regional disturbances and facilitate in a rapid economic recovery (Martin, 2012:1-32).
- *Economic typological diversity*: Typological diversity areas show more resilience than specialised areas as they can transfer and disperse the disturbances into different directions (refer to Section 3.2). This contributes to faster economic recovery as well as adaption (Xiaohui, 2012:65).
- *Economics of implementing diversity*: Economic growth does not result in the full optimisation of regional resilience (refer to Section 2.4.1). The transformation of economic implementation is also important, which includes strengthening technological innovation, adjusting the structure of the economy, environmental protection, development of ecological resources etc. (Peng *et al.*, 2017:91).

Furthermore, the economic process can be divided into two adaptive cycles which the regional economy will experience: (i) emergence phase: restructuring-development-maintaining and (ii) rigidifying phase: maintaining-declining-restructuring phase; which can be described as a transition process (Simmie & Martin, 2010:33). The information above proves that regional economic development is not only influenced by economic types and structures but also by policy management and allocations (refer to Section 8.2.2 and 8.3).

- Ecological resilience

The field of ecological resilience is important as it confronts resource depletion, environmental quality, global climate change etc. Ecological resilience can further be divided into single equilibrium which maintains the ecosystem completely and ensures that the system is stably resistant (refer to Section 8.2.2). The single equilibrium phase absorbs disturbances before it reaches a dynamic equilibrium phase without changing the original structure, function and characteristics (Folke, 2006:253-256). Secondly, a multi-domain exists which can be described as an ecosystem which updates, restructures and develops over a period (refer to Section 4.3.1). An ecosystem's vulnerability is affected by numerous factors and therefore, any disturbance will affect the ecosystem in such a way that the system will either result in a lower level of development due to the inability to restore itself to its original state or the system will reorganise itself into a better state of development beyond its original level (Simmie & Martin, 2010:28-30; Xiaohui, 2012:65-68).

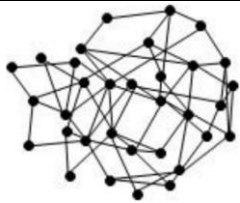
- Social resilience

This type of resilience places emphasis on government institutions and agencies' ability to respond to economic, political, social and ecological disruptions (Cho *et al.*, 2011:8-9). Social resilience is the ability to “bounce back” by recovering from the destruction caused by a disruption and to restore itself to its original state or to “bounce forward” by anticipating, preparing and preventing negative effects which would be accompanied by the next disturbance (Mazur, 2013). The social disturbances are generally invisible, such as policy changes in developing countries, economic changes (due to a financial crisis), demographic changes (unbalanced population, ageing population) as well as a technological transformation which results in a transition of the way of life (refer to Section 2.4.1 and 3.2.1).

Social resilience is an important field when referring to regional resilience as governmental institutions should maintain and develop policies to maintain and improve resilience (Cho *et al.*, 2011:5-6). The actions of government institutions are the main influential factors of social resilience and therefore, the government should strive to enhance social productivity and creativity to ensure sufficient resilience (refer to Section 5.2, 5.3, 6.2.1.3, 6.2.4, 7.2.3.3, 8.2.2 and 8.3). A resilience centre-periphery model (refer to Section 3.3.4) was suggested where government institutions play the role of the centre and the citizens and other organisations act as the periphery (Crespo *et al.*, 2013:3-5).

Due to the regional scale, the concept of network connection was used to construct a regional space structure for illustration purposes of the relationship between the nodes and peripheries. The core-periphery network should be recognised as it was explored on an urban level in Section 3.3.3 and the theory is largely used to explain numerous interactions on a nodal scale. Furthermore, the reader should keep the levels of urban systems in mind as discussed in Section 3.4, as it explains the different hierarchies as well as the distribution between different levels of urban systems. Three models were then conceptualised as illustrated in Table 4-2. Due to the large scale of development (regional development), the region with high resilience will have the ability to relieve the imbalance between centres and periphery areas which are located within the region (refer to Section 2.4.4). When constructing the regions, an efficient resilient regional network will typically consist of minimum nodes and effective connections (Crespo *et al.*, 2013).

Table 4-2: Resilient property model

Name of Model	Pattern of Model	Advantage	Disadvantage
Random network		• High resilience • Uncontrollable resilience process • Unpredictable resilience	• Causing instability in the regional space • Difficult to regulate the development tendency of space due to the absence of the core • Nodes and connections are altered randomly • Leads to an impossibility to forecast of the spatial development trend
Core/periphery network		• Aims to promote integration & cohesion • Network has a centre of strong clustering • Intensive resilience	• Centred framework weakens the expanding ability & resilience of the network • Rupture of network after-shock is irreparable • Poorly resilient
Centre-periphery network		• Strong resilience • Diverse • Stable resilient process • Network is an ideal resilient model	• Establishment of network is difficult • Hard to achieve an equilibrium between the degree and the level

Source: Adapted from Crespo *et al.* (2013)

Table 4-2 illustrates three conceptualised models which were suggested from a social resilience point of view. These models aim to increase the resilience of a region overall by forming the strongest and most strategic connections possible. These models can be used as a guideline when policies are developed to achieve maximum resilience in the most efficient manner.

This section confirmed that resilience is a multi-level understanding and consists of several professional disciplines. The following figure illustrates how the different disciplines (fields) interrelate in urban resilience research:

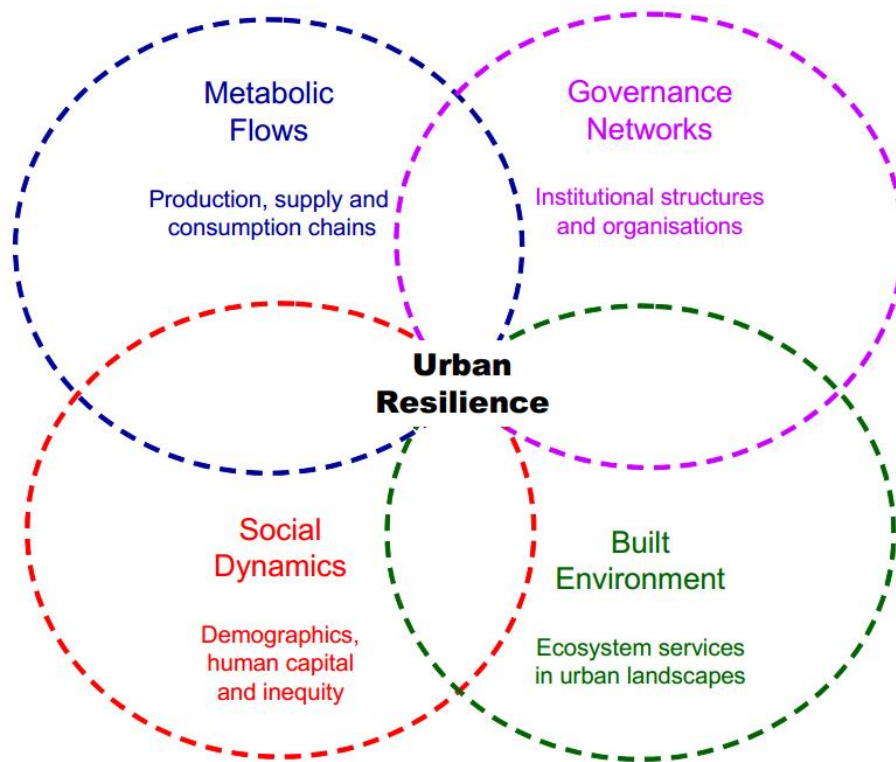


Figure 4-2: Four interconnected disciplines prioritising resilience

Source: Barnett & Bai (2007)

In short, four disciplines (fields) were identified when referring to regional resilience (refer to Figure 4-2). The disciplines are summarised as follows (i) engineering resilience; which refers to all physical structures on urban, regional and national level; (ii) economic resilience; which influences the sustainability of a node and region by means of businesses and industries; (iii) ecological resilience; which refers to the natural environment, resources etc., and lastly (iv) social resilience; which is vital as it includes government spheres who are responsible for development policies. As described above, these disciplines are vital in urban and regional planning and industry and it also gives the reader the ability to understand resilience in a more comprehensive manner. The following section will investigate the nature and concept of resilience while keeping the different disciplines (fields) in mind.

4.3 Concepts of resilience

Resilience has developed an attractive perspective when referring to cities, which could be theorised as highly complex, adaptive systems (Godschalk, 2003:136). The following section

aims to identify the different concepts of resilience and investigate the effects of these concepts when referring to resilience. According to Meerow *et al.* (2016:39), resilience can be categorised into five conceptual tensions which are illustrated below:

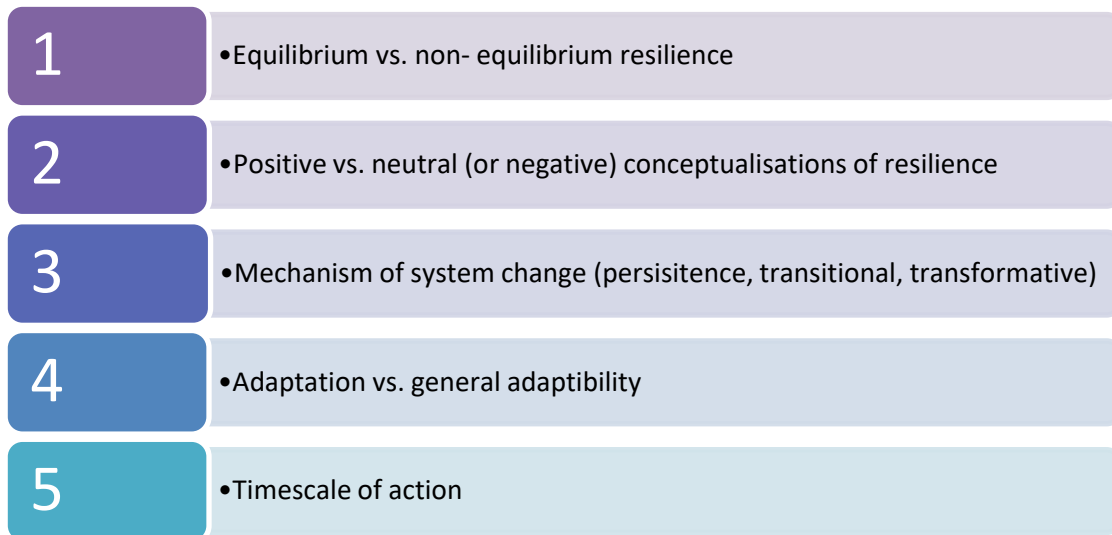


Figure 4-3: Five conceptual tensions of Resilience

Source: Adapted from Meerow *et al.* (2016:39)

The figure above illustrates five different conceptual tensions of resilience. The following section aims to investigate each tension individually by using the applicable discipline (field) of resilience to achieve an understanding of the effects of resilience on an area or region.

4.3.1 Concept of equilibrium

In terms of resilience, three types of equilibrium states exist, such as (i) single state equilibrium; (ii) multiple-state equilibrium and (iii) dynamic non-equilibrium (Holling, 1996; Davoudi, *et al.*, 2012). Single state equilibrium can be described as the ability of a system to return to a previous equilibrium state after a disturbance (Holling, 1996). The single equilibrium state is generally found in disciplines, such as engineering, economics, disaster management and psychology. The following figure illustrates the concept of the single equilibrium state:

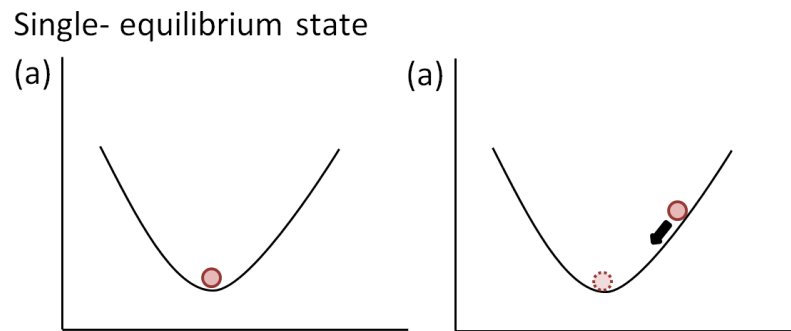


Figure 4-4: Single equilibrium state

Source: Adapted from Nyström *et al.* (2000:416)

The figure above illustrates a single equilibrium state where the resistance to a disturbance as well as the speed of return to a single equilibrium state are of primary interest.

The multiple equilibrium state, on the other hand, suggests that systems have different stable states and when disturbed, the states change to another stability domain (Holling, 1996). The multi-equilibrium state generally refers to ecological disciplines. The following figure illustrates the concept of the multi-equilibrium state:

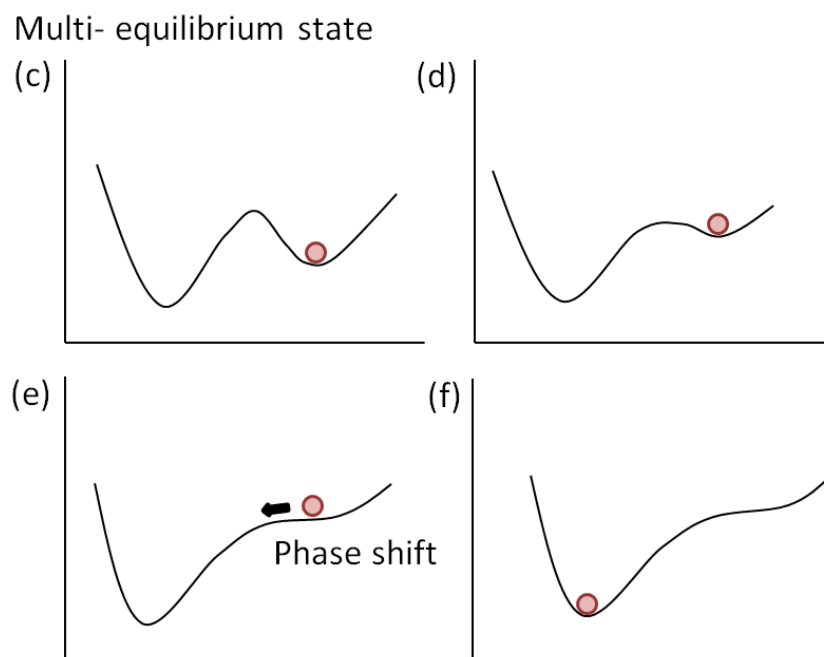


Figure 4-5: Multi-equilibrium state

Source: Adapted from Nyström *et al.* (2000:416)

As illustrated in Figure 4-5, several equilibrium states exist in a system and it is possible to move from one equilibrium state to another stable state. It should, however, be noted that the level of resistance decreases as phase shifts continue and therefore, the level of resilience decreases.

Consequently, the system will become more susceptible to disturbances which could be absorbed in the first phases (Nyström *et al.*, 2000:413-417).

Lastly, the non-equilibrium state concept recently received attention as several theorists challenged the equilibrium states discussed above. The non-equilibrium state suggests that systems undergo constant change and therefore, no stable state exists (Pickett *et al.*, 2004). This theory changed the perspective of resilience where it was suggested as “bouncing back” and transformed it to a “safe to fail” concept (Ahern, 2011:341).

4.3.2 *Effects of resilience*

According to Leichenko (2011:165), the effect of resilience is generally accepted as positive as it usually contributes to sustainability. Brown *et al.* (2012:531) defined urban resilience as the ability not only to maintain the basic functions but to improve and prosper. However, other theorists argue that when referring to an equilibrium focused definition of urban resilience, it should rather be referred to as the ability of a system to return to its steady or original state (Gunderson & Holling, 2002). The debate of positive and neutral effects of resilience resulted in a concept social theorists developed to determine the effect of resilience on stakeholders and the agenda of resilience-based actions. Several questions are asked, for instance, “Resilience for whom?” and “What to what?” (Davoudi, *et al.*, 2012). The above-mentioned questions were developed as resilience generally does not benefit all stakeholders equally and resilience is usually a prioritised agenda. In addition, resilience may be used to promote a neoliberal agenda or even to retain systematic inequality (Cote & Nightingale, 2011).

4.3.3 *Change mechanisms*

Several theorists suggested that resilience has three system changes towards a resilient state: (i) persistence; (ii) transition and (iii) transformation (Chelleri *et al.*, 2015; Chelleri & Olazabal, 2012; Matyas & Pelling, 2014). Firstly, persistence refers to the ability of a system to resist disturbances and try to maintain its original or stable state. The second change, transition, refers to the ability of a system to adapt or transform especially when the system is in an undesirable state, it should purposely transform (incrementally) into a more desirable state (refer to Section 4.3.2). The last change can be described as a transformation of the system and refers to the acknowledgement for the need to adapt to another stage (Wamsler *et al.*, 2013).

4.3.4 *Adaption*

According to Miller *et al.* (2010), this tension refers to the adaptiveness of a system and can be classified as specified resilience and general resilience. Wu & Wu (2013:215-217) argues that

when the focus of resilience is dominated by a specialised approach, the flexibility, diversity, as well as the ability to respond to unexpected threats, is undermined; while Cutter *et al.* (2008:599-603) argued that a generalised approach is more effective under normal conditions and that a specialised approach should be adopted during disasters.

4.3.5 Timescale

The timescale of action refers to the rapid recovery as a characteristic. The timescale may refer to rapid change or gradual change (Wardekker *et al.*, 2010:988). Rapid recovery is important when referring to resilience as faster recovery after a disturbance connotes to stronger resilience.

In short, the concepts of resilience provided important information regarding the effects and elements of resilience. This section indicated that resilience does not necessarily mean that a node should remain in the same state and that it has the ability to transfer into another state which could even be an improvement of the previous state. In addition, the concept of resilience determined that adaptability of a node or system is vital and the period in which the area adapts is also an indication of the level of resilience of an area or node.

Resilience, as described above, referred to the resilience of an urban area or a single entity whereas Objective One of this study is to evaluate resilience as a region and not as a node (refer to Sections 1.3, 2.2 and 3.4). Therefore, the following section will elaborate on the concept of resilience as described in this section but will place specific emphasis on a regional scale. Hence, the following paragraphs will investigate how regional resilience can be achieved and how to strengthen the resilience of a region by keeping the concepts of the section above in mind. This would provide the researcher with sufficient information to understand the concept of resilience and integrating it to understand resilience on a regional level which in turn will be used to develop recommendations on how to improve regional resilience in different urban systems (refer to Section 8.2.2 and 8.3).

4.4 Regional resilience

Regional resilience can be categorised into three essential characteristics: (i) the force of the system which can withstand external disturbances, namely the equilibrium state (refer to Section 4.3.1); (ii) the ability to self-organise and lastly (iii) the ability to adapt and promote learning, for instance innovation (Tongyue *et al.*, 2014). In short, regional resilience can be characterised by (i) stability; (ii) self-organisation and (iii) innovation (refer to Figure 4-6: Classification of regional resilience based on regional characteristics). Regional resilience should, therefore, be able to anticipate, prepare, respond and recover from external disturbances (Peng *et al.*, 2017:87).

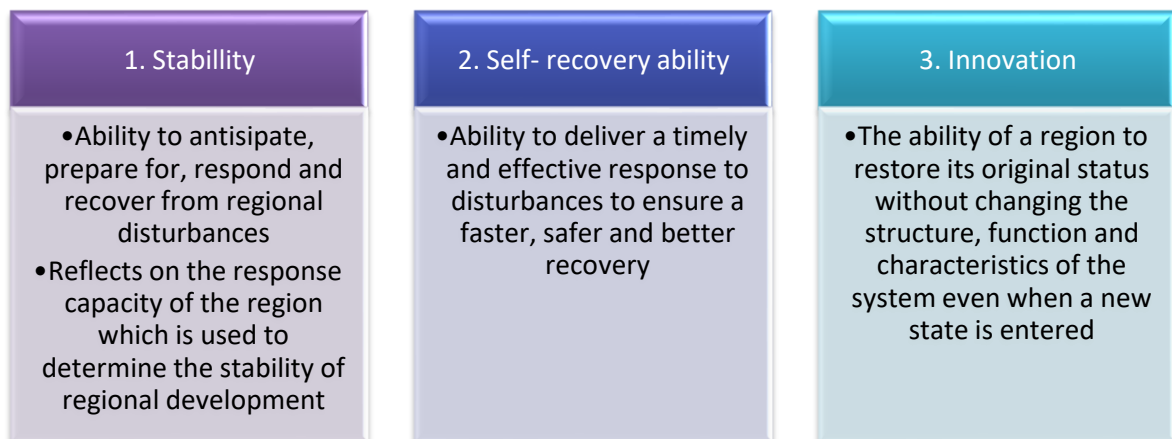


Figure 4-6: Classification of regional resilience based on regional characteristics

Source: Derived from Peng, *et al.*, (2017)

Figure 4-6 comprises of three characteristics which determine the level of regional resilience. These concepts will be used later in the study as supporting theories when referring to a region's regional resilience. When referring to regional resilience, several aspects should be considered before these three characteristics can be used to determine the resilience factor. The following section will investigate the regional resilience components.

4.4.1 Regional properties

This component can be described as the foundation of the capacity of the system which could be determined by resource availability and by the system vulnerability. The vulnerability of a system includes physical damages (damage to facilities and infrastructure), economic damage (medium- and long-term damaging economy impacts) and social damage (damage in social stability and the operation of the government) (Peng *et al.*, 2017). On the other hand, resource availability refers to the redundancy of resources as well as the availability of them when a region experiences a disturbance during the development process (Peng *et al.*, 2017:89).

4.4.2 Regional process

The process of resilience could be simplified as resistance-renewal-recovery-reorientation which could enhance the regional capacity (Martin, 2012). In addition, a more complex process was suggested by Dabson *et al.* (2012) which is iterative of nature. The following figure illustrates the process of resilience by means of a simplified diagram as suggested by Dabson *et al.* (2012:8):

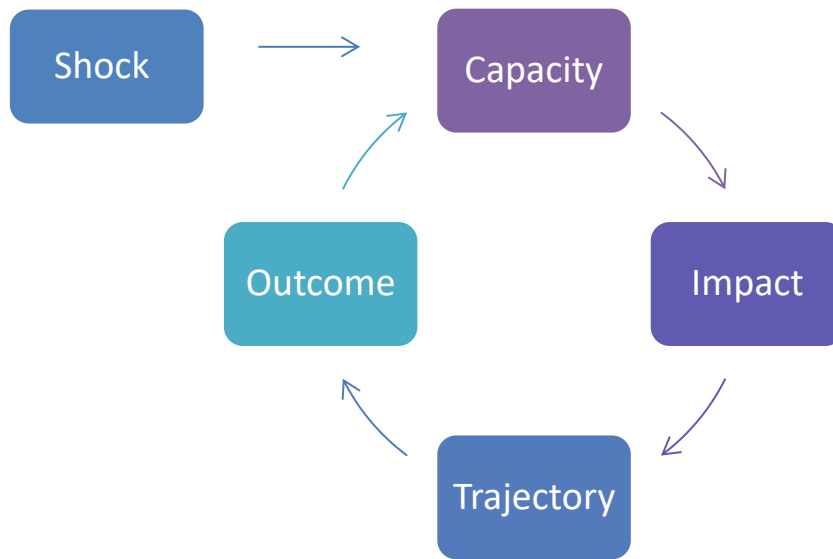


Figure 4-7: Iterative process of resilience

Source: Adapted from Dabson *et al.* (2012)

From Figure 4-7, it is clear that the process is of an iterative nature. The post-event status represents the capacity of the system to deal with the next shock (disturbance). This figure illustrates that the resources of a community are of the utmost importance when a disruptive event occurs to deal with and recover from the shock.

4.4.3 Regional capacity

The capacity of a system in terms of resilience can be described as the maximum pressure that the system can withstand. The high resilient systems usually include three resilient abilities: (i) resistance; (ii) recovery and (iii) creativity (refer to Figure 4-8). The capacity system illustrated below is similar to Figure 4-6, where three classifications of regional resilience based on regional characteristics were identified and discussed. As mentioned in Section 4.4, a system can become more resilient if the system is able to anticipate, prepare, respond and recover from external disturbances. Hence, Figure 4-8 is highly relevant to the study as it examines the three main classifications of regional resilience in terms of the capacity which a system can bear.

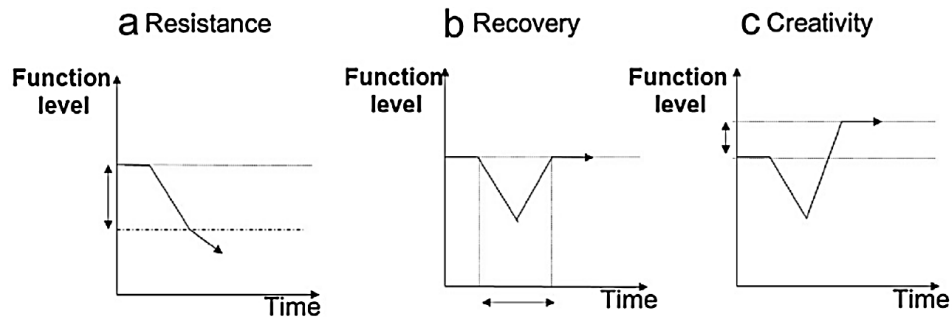


Figure 4-8: Three forms of resilience

Source: Maguire & Hagan (2007:17)

The three forms as illustrated in Figure 4-8 can be described as follows:

- a) Resistance - Refers to the ability of a system to deal with disturbances. It is regarded as the maximum damage a system can bear without changing the structure, function and character of the system (Frommer, 2011:85; Maguire & Hagan, 2007:17).
- b) Recovery - Can be described as how a system can “bounce back” to the state of the system before the disruption. The recovery component is important to measure the resilience of a region over a period. The faster the system can recover to its original state, the more resilient a region ought to be (Frommer, 2011:85).
- c) Creativity - Is the ability of a system to adapt to a new state, where the system does not only restore itself but improves to a higher functional level. This can also be described as the adaptiveness of the system (refer to Section 4.3).

The above-mentioned resilience forms could be used in order to improve regional resilience and its recovery to disruptions. Other theorists, such as Chelleri *et al.* (2015:187), used the basics of these forms of resilience but added additional information and they also stretched the importance of different timescales when referring to the different aspects of regional resilience. Chelleri *et al.* (2015) also suggested that these forms overlap; can be applied on different scales and that different term goals should be set in place to implement and facilitate resilience in an area in the most efficient manner. The following figure illustrates these concepts with their timescales (Figure 4-9).

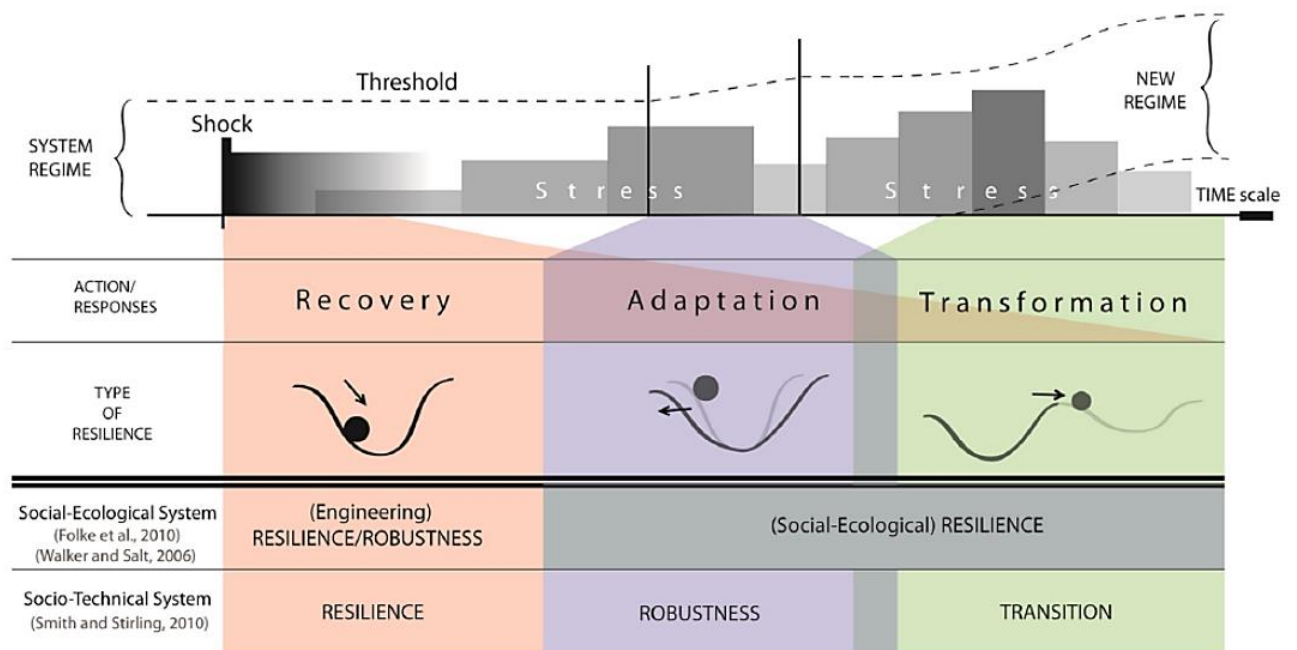


Figure 4-9: Three stages of resilience related to short-, medium- and long-term perspectives

Source: Chelleri et al. (2015:187)

Figure 4-9 illustrates the different stages or approaches of resilience when specifically focussing on the timescale (refer to Section 4.3.5). Building resilience in urban systems in short-, medium- or long-term scenarios will never fully remove the vulnerabilities in the systems, however, it could alter the configuration of the capacity of the system's resources. This will result in a shift in time and space and will open windows for development opportunities on different timescales.

The concept behind a resiliency approach is the broadening from how to deal with immediate disturbances, to plan and organise before a disturbance occurs as well as the rebuild after a disruptive event within a comprehensive framework (Dabson et al., 2012:7). However, numerous complex considerations should be pondered when determining the level of a community's resilience. It is suggested that one should start to propose a set of relationships for a community before a disturbance, the disturbance itself and the projected outcome; thereafter the trajectory of the community after the event. However, it should be noted that the outcome will be determined by the community's capacity to withstand the disturbance as well as the magnitude of the disturbance itself (Dabson et al., 2012:7-8).

The following figure is a conceptual model developed by Norris et al. (2008) and later refined by Dabson et al. (2012). The model exists out of five components: (i) the disturbance (shock); (ii) the community's capacity to withstand the disturbance; (iii) the impact; (iv) the community's trajectory and (v) the outcome and could also be linked to Section 4.4.2 (refer to Figure 4-10).

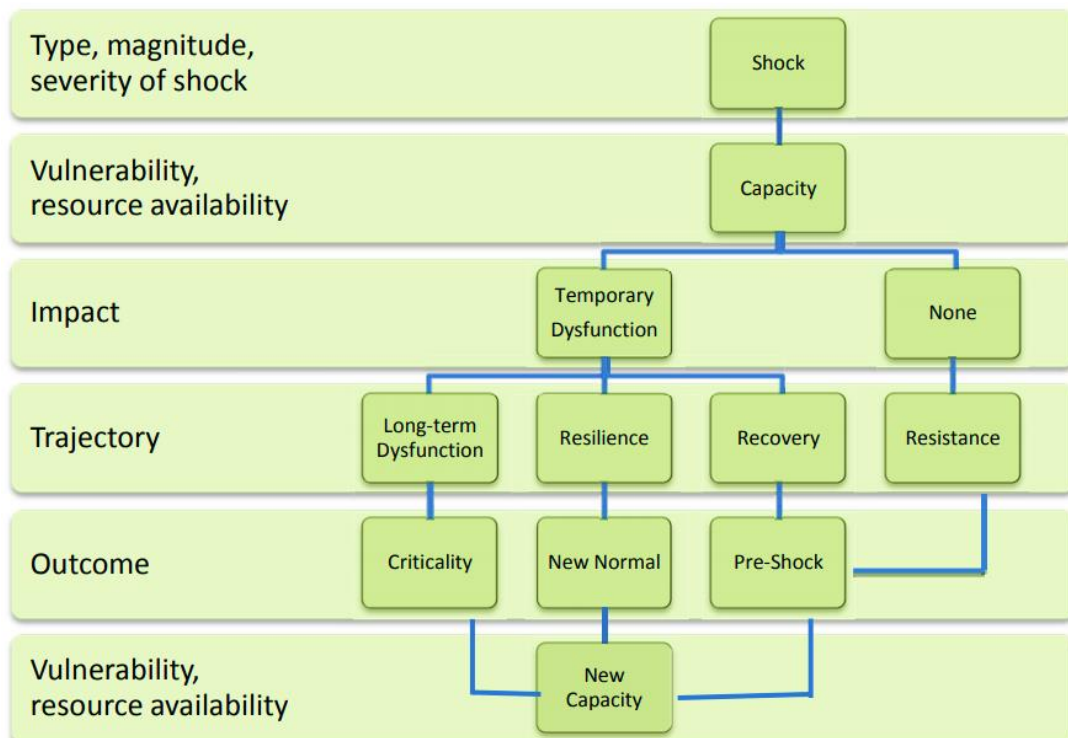


Figure 4-10: A framework for resilience

Source: Dabson *et al.* (2012:7)

The figure above illustrates five components which should be considered when determining the level of resilience of a community. The components, as illustrated above, are described as follows (Dabson *et al.*, 2012:8):

- (i) *Shock*: This includes two elements, namely the series of possible disruptions as well as the magnitude of these disruptions.
- (ii) *Capacity*: This component exists out of the vulnerability of the community to disruptions as well as the resources which could be adopted by the community (for instance if the resources of the community are able to withstand the disruptions without a loss of function, the community resisted the particular disruption).
- (iii) *Impact*: The capacity should match the magnitude of disruption, otherwise the disruption will result in the dysfunction of the community. What will happen afterwards depends on the strength of the community's resources.
- (iv) *Trajectory*: The community will resist, recover, be resilient or have a long-term dysfunction after the disruption occurred. The desirable trajectory would be if the community could overcome the dysfunction and return to a pre-event state without the need to change or adapt substantially (also known as static resilience). Another scenario of trajectory is where the community moves to a new normal which is not necessarily better or worse than the previous state before the disruption occurred.

Lastly, the worst case of trajectory is when a long-term dysfunction occurs after the disruption and the community is unable to return to an acceptable level of functioning (Moser, 2008).

- (v) *Outcome*: The outcome determines the capacity of the community to withstand the next disruption and can be classified into a pre-disruption (shock) level, a new normal level or a critical level which has detrimental impacts on the community.

The following figure illustrates the concept, components, research and assessment of regional resilience:

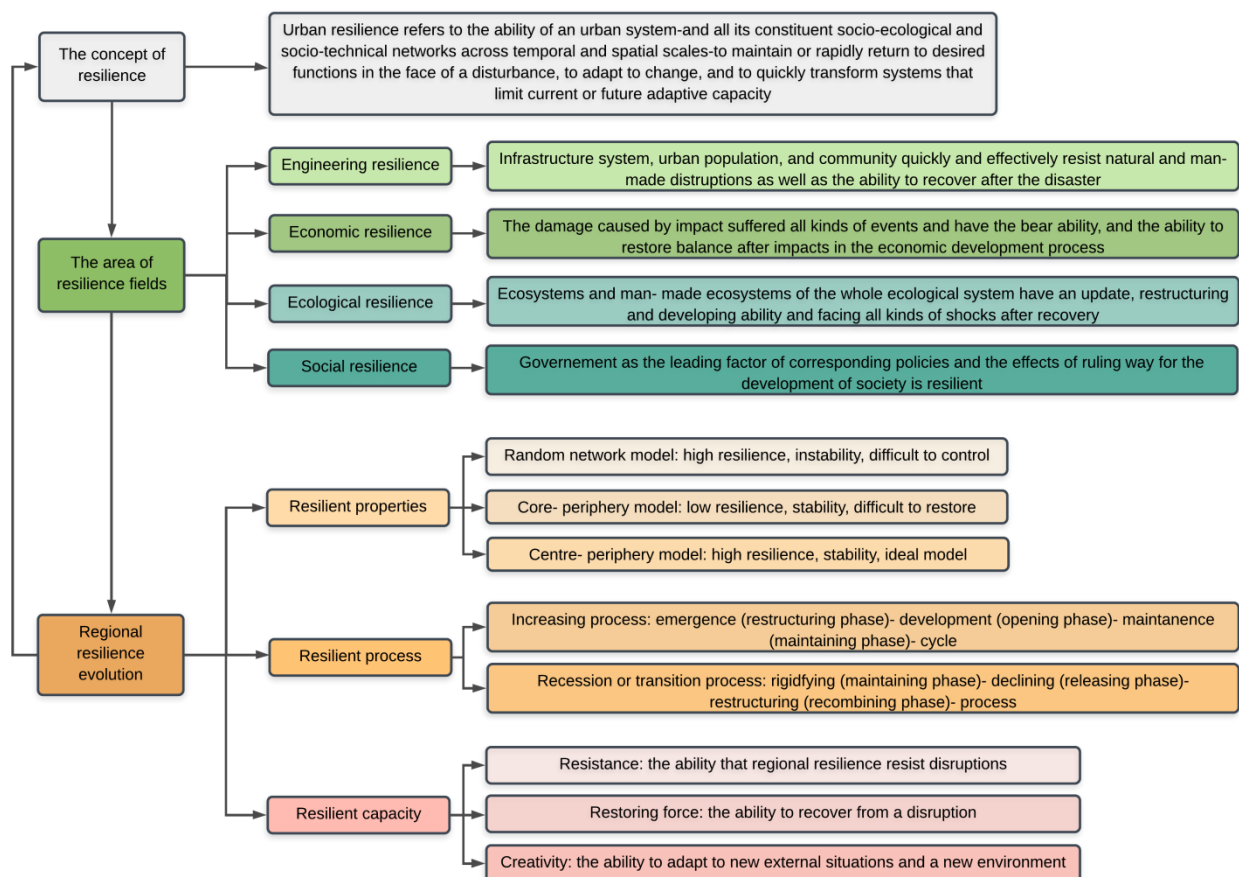


Figure 4-11: Concept, components and assessment of regional resilience

Source: Adapted from Peng et al. (2017) & Meerow et al. (2016)

The figure above (Figure 4-11) is a visual representation of what has been investigated in this chapter so far. The figure illustrates the thinking behind resilience and the evolution of regional resilience thus far. The following section will examine the importance of urban systems and the role of regional resilience in the different levels of urban systems. It should, however, be noted that the focus of this study is on a regional level and therefore, the regional component was explored in more detail without neglecting the other levels of urban systems (refer to Section 3.4).

4.5 Resilience in urban systems

The previous sections focussed on defining resilience, the concepts of the resilience and regional resilience. The focus of the study is on a regional level; however, the entire urban system should still be considered as the main objective is to prove that resilience should not be researched in isolation, such as nodes. It should be noted that urban systems also function on different hierarchies as explained in Section 3.4. The following section, therefore, aims to determine and explore the different aspects of resilience when referring to urban systems. This section will be important and used later in the study when resilience is examined and explored in the urban system.

4.5.1 Stability in urban systems

According to Salat & Bourdic (2012:57), the stability of physical systems depends on the reinforcement of perturbations. Therefore, dynamic stable urban systems will encompass several functional and geometric connections on different scales (refer to Section 3.3). As some connections are lost, new connections develop which transform cities when singular trajectories are followed. As cities evolve and expand, emerging properties which were not conceptualised initially are inserted in the system and to implement these properties on a large scale, it is recommended that small-scale properties should exist to support the larger property (refer to Section 2.3 and 3.2). Hence, each scale will support a larger scale in the hierarchy and over a period, the emerging properties will repair, stabilise and evolve in the system, which will strengthen and diversify the system even more (Edelman & Tononi, 2000). To develop sustainable emergent properties, it is recommended that the system should be of high connectivity as well as mechanisms which create connectivity and a low degree of control as fewer control results in more emergent properties and vice versa (Salat & Bourdic, 2012:66).

4.5.2 Complexity of urban systems

Numerous cities encompass a high degree of organised complexity. As mentioned in Section 2.3, 3.2 and 3.4, several hierarchical distributions exist on different scales and these hierarchies contribute to a coherent urban morphology instead of repetitive compositions or urban areas (Salat & Bourdic, 2012:66). The interaction of different hierarchies with different elements on various scales creates a systematic form which is neither fixed nor symmetrical. The structure of connections according to their hierarchies is important for evolving rather than the components itself. When focussing on single hierarchical entities, the modification of smaller components is easier as it is on a smaller scale and less modification will be required to achieve change (refer to Section 8.2.2 and 8.3).

4.5.3 Connectivity in urban systems

If a city encompasses multiple connections, the resilience is likely to increase, and it also has the potential to evolve, change and adapt. According to Salingaros, (1998) complex cities can be categorised as those which comprise out of networks that display a large degree of redundancy (refer to Section 2.4.3 and 4.2.2). For example, if one connection is lost between two nodes it will not have a significant impact on the nodes as another connection can be utilised, which increases the functionality of the nodes. Even though connection is vital between nodes, too many connections of the same type will result in an overload of the system's capacity, thus the focus should be to diversify connections as far as possible (Salat & Bourdic, 2012:63).

4.5.4 Structural optimisation in urban systems

For a system to be efficient and resilient, it should be structured in a complex manner where it is strongly connected and hierarchically distributed, according to the Pareto distribution (refer to Section 2.3.3 and Section 3.2.1). An efficient hierarchical structure optimises urban flows which increases the resilience of a city and the system it is nestled within (refer to Section 4.3 i.e. the urban tree model). Hence, the more structured the system, the better it can absorb disruptions without influencing its structure (Salat & Bourdic, 2012:63). In developing countries, the situation is somewhat different as they generally experience a rapid population growth and cities are designed instantaneously to satisfy the housing demand, rather than to determine the quality of interactions, the form of adaption to the flows as well as the systematic efficiency which determines resilience over time (refer to Section 3.2.1). The above-mentioned tendency results in lower resilience and connectedness, as well as an inefficient hierarchical system as the scale of hierarchical structures, is linked to their complexity, which in turn enables them to absorb fluctuations (Simon, 1962). The resilience of an urban system can be evaluated by removing a small node and studying the impact and how fragmented the system becomes (Buhl, 2004:123-124). Thus, to counter the vulnerability of cities requires a shift from mono-scale conceptualisation to a hierarchical-scale conceptualisation (refer to Section 8.3).

In short, spatial planning in terms of hierarchical distributions is vital for the level of resilience of a system. The scale relationships of different hierarchical levels state the frequency of their appearance for smaller elements will be encountered more often in the system and the larger element will be rarer (refer to Section 2.3). By focussing on the Pareto distribution, the connectivity and complexity and scale hierarchy will increase, which in turn will increase the level of resilience in the urban system (refer to Section 3.2).

Due to rapid population growth and other factors which were mentioned in this section, it is necessary to enhance resilience to counter these disruptions as well as related disruptions. As concluded in the literature, several definitions exist when referring to resilience and that resilience should also be applied (to a certain scale) to effectively counter disruptions (Meerow *et al.*, 2016). Resilience is a term used by several disciplines and therefore, it would be challenging to implement it as different stakeholders are involved which all have their own motivations and the trade-offs are on different spatial scales. Therefore, five questions were suggested to consider the nature of resilience implementation carefully (Brown *et al.*, 2012). Table 4-3 consists of five fundamental questions to be asked before resilience is discussed and development policies are developed (refer to Section 8.3.3). These questions should be contemplated in the process to understand resilience in the desired area or city.

Table 4-3: Fundamental questions related to resilience

Questions to Consider		
Who?	TRADE-OFFS?	Who determines what is desirable for an urban system? Whose resilience is prioritised? Who is included (and excluded) from the urban system?
What?		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?
When?		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?
Where?		Where are the spatial boundaries of the urban system? Is the resilience of some areas prioritised over others? Does building resilience in some areas affect resilience elsewhere?
Why?		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: Meerow *et al.* (2016)

The table above includes five fundamental questions when resilience is being explored in an area for the purpose of development or even to evaluate the level of resilience in an area. As previously mentioned, resilience is a desired feature of an area or town as it deals with disruptions. Resilience, however, should be carefully examined and explored to identify to whom it is being prioritised and who benefits (and loses) as a result.

4.6 Conclusion

This section focussed on the concept of resilience. As mentioned in this chapter, rapid population growth and urbanisation are problematic for urban areas and systems as the focus is on providing accommodation to the population instead of focussing on the function, integration and impact of these developments on the surrounding areas, as well as on urban systems (refer to Section 4.3). This tendency leads to numerous disruptions which could hinder the social, environmental, economic and physical potential and development of an area. Resilience is, therefore, highly applicable as resilience can be defined as the ability to deal with disruptions or negative influences, whereafter it recovers and rebuilds to the state before the disruption or even moves to another state which is better than the pre-disruption state.

In order to evaluate and implement resilience, it is important to define resilience and to understand the concept completely. This section provided a basic definition of resilience and indicated that resilience is a term used by several disciplines and therefore, it should be seen as a complex concept. Resilience is applicable in several disciplines and encompasses a wide variety of factors which could lead to a disruption (refer to Section 4.2.2). Therefore, resilience was categorised into different concepts which can be used as a guideline when evaluating the strength of resilience in an area as well as to identify in what category resilience can be improved. The concepts of resilience were then used as a foundation where the researcher applied these concepts and investigated the interaction and function of resilience on a larger scale, i.e. regional resilience.

Thus, regional resilience was explored and examined, and several vital components were identified, which could contribute to improving regional resilience in different urban systems. The process of resilience in terms of a region was also explored as well as the process and impact of disruptions on a region with potential outcomes.

Lastly, resilience in urban systems was explored and it was concluded that structural resilience is the highest when the correct spatial and population distribution within an urban system exists. The intensity of the connections also contributes to a higher resilience, especially when the connections follow a hierarchical order. Hence, smaller elements should be encountered more often in the system than larger elements, as defined in the Pareto distribution. The literature concluded that if elements and connections are spaced and connected according to a desired hierarchical distribution, all elements could be accessed, and the area would be optimised - which directly increases the resilience of an area. However, it is important to note that resilience does not benefit every stakeholder and area at once and therefore, it should be prioritised according to the development perspectives of an area. In addition, it was concluded that resilience occurs on

different scales and timeframes and should be implemented in terms of short-, medium- and long-term goals.

This section was vital for the study as it provided the basis of resilience and explored how resilience can be used to strengthen an area's development potential while maintaining the same functions of the area.

The following section will focus on different policies on regional development in South Africa. Policies and legislation in terms of resilience, nodal and regional development will be evaluated to determine if the existing policies enhance or hinder resilience in the regional context.

CHAPTER FIVE: POLICY AND REGIONAL RESILIENCE

5.1 Introduction

The following chapter will explore different policies which are implemented with the objective to improve regional resilience in urban systems. This chapter aims to identify several policies which could impact the implementation to improve regional resilience (as set out in objective two of this study). Several policies will be examined, starting at an international level and decreasing the spatial scale until national policies are examined. This approach will ensure that the reader is informed of both international and national policies and legislation and to understand why specific policies were selected. The reader should keep in mind that resilience is a relatively new concept and that several policies and legislation will focus on specific fields of resilience and related concepts, i.e. sustainability (refer to Section 4.2.2) and not necessarily on regional resilience itself. The following figure illustrates the outline of this chapter (

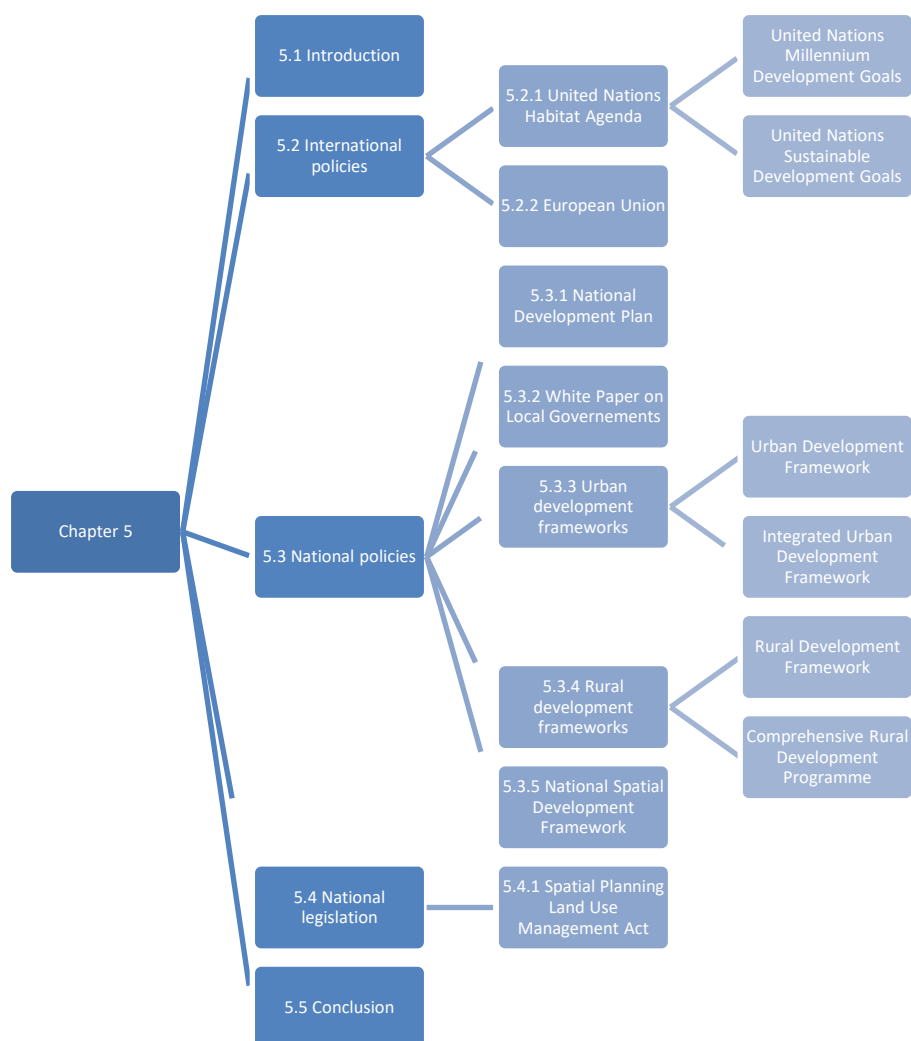


Figure 5-1).

Figure 5-1: Structure of Chapter Five

Source: Own compilation

This chapter is of great significance as it will examine policies and legislation which could have an impact on regional resilience. The concepts which will be identified in this chapter will be used later in the study to recommend and explain different concepts to several spheres of the government to potentially achieve greater resilience in urban systems.

5.2 International policies

This section examines several international policies and legislation regarding regional resilience. As mentioned in the section above, regional resilience is a relatively new concept and therefore, the policies studied below do not directly refer to regional resilience but rather implies several concepts that can be used to improve regional resilience (refer to Objective Two of the study i.e. the examination of different policies to improve regional resilience). This section aims to emphasise concepts that will improve regional resilience through different urban systems. The international policies referred to in this section include the United Nations' (UN) Habitat Agenda, the Millennium Development Goals (2000), the Sustainable Development Goals (2015) and the European Union's Strategic Approach to Resilience (2017). The UN and EU's policy guidance are highlighted for this study based on the important role these organisations play on an international level with reference to sustainable development policy and guidance.

5.2.1 *The United Nations Habitat Agenda*

The United Nations originated with the objective that nations of the world can/should cooperate to peacefully resolve conflicts and to increase the quality of life of individuals. Although the Habitat Agenda has been replaced by the New Urban Agenda (subsequently discussed) a few concepts will be highlighted in order to chronologically explain the policies. The purpose of the United Nations as set forth in the Charter is as follows:



Figure 5-2: Purposes of the United Nations

Source: Adapted from the United Nations (2011:4)

The UN faces new challenges as the years go by, such as population growth, decolonisation and globalisation which all had an impact on the modern landscape of areas (Anon., 2015). With technology constantly changing and improving, challenges of food and financial security arose and health and energy crises became prominent, the UN highlighted that sustainable development depends on three equal pillars: (i) Social Development; (ii) Economic Growth and (iii) Environmental Protection (United Nations, 2011:188) which also links to resilience concepts identified in Section 4.2.2 and 4.4. The UN emphasised that multilateral collaboration is crucial to achieving sustainable development with reference to the above-mentioned pillars and in 2000, the Millennium Development Goals (MDG's) provided a clear guideline for achieving the most acute needs of people.

Countries who commit themselves to be part of the United Nations have a responsibility to incorporate the objectives and goals of the United Nations into their own Development Frameworks within their National Development Plans and Frameworks (United Nations, 2011). The structure of these National Development Plans and Frameworks will be discussed later in this section with specific reference to South African legislation and policies (refer to Section 5.3)

- **United Nations Millennium Development Goals**

In 2000, members of the United Nations committed to a national and global plan to reduce poverty and to ensure development (United Nations, 2011). This strategy was titled the Millennium Development Goals and was categorised into eight plans of action as illustrated below:

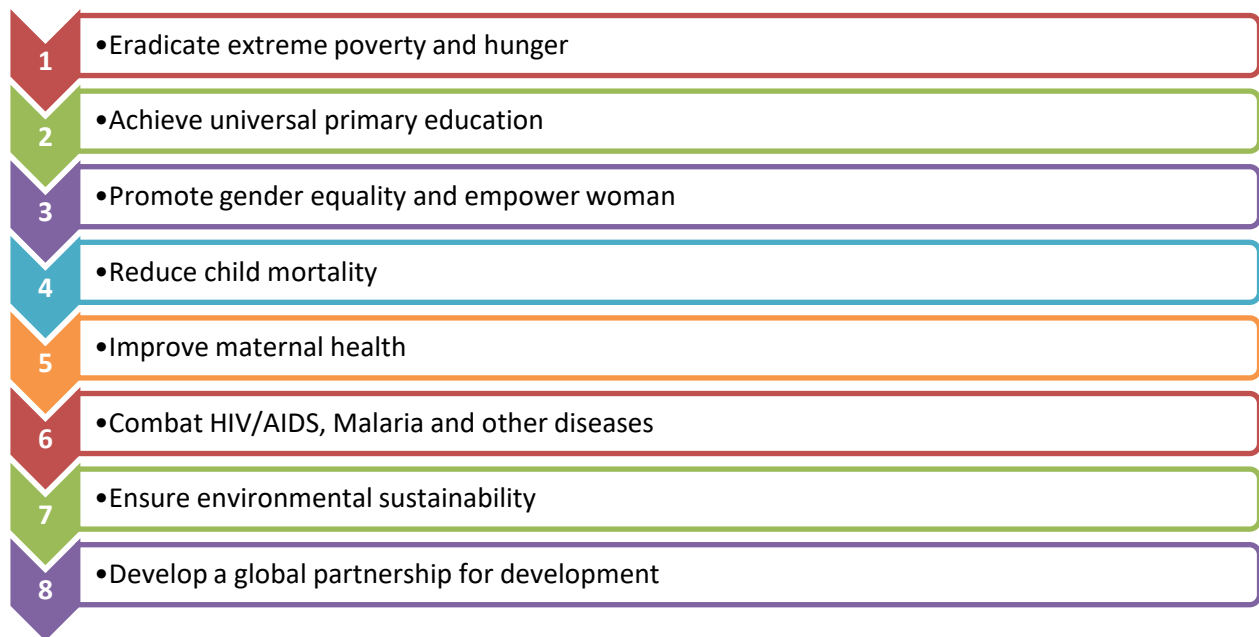


Figure 5-3: Millennium Development Goals

Source: Adapted from the United Nations (2015:4-7)

The Millennium Development Goals as set out in the figure above was suggested with the vision to fight poverty on all its forms. These eight Millennium Development Goals has remained the primary development framework for the United Nations for the last fifteen years (United Nations, 2015). Even though numerous countries achieved a better quality of life for their people, the work is not yet completed, as counties continue to improve their living standards and quality of life. Therefore, it can be concluded that these Millennium Development Goals will continue to circulate and be implemented in countries, and therefore it is applicable to this study even though these Development Goals do not directly link to regional resilience in urban systems.

- **United Nations Sustainable Development Goals**

In response to the comments received that the Millennium Development Goals were too narrow in focus, the United Nations identified seventeen goals which focus on the sustainability of both communities and the planet (Thomson, 2015).

In 2015, several countries adopted the 2030 Agenda for Sustainable Development Goals to end poverty, protect the planet and to ensure prosperity. It is proposed that several sectors (government, private, public, civil society etc.) take part to achieve the set goals within the next fifteen years (Anon., 2015). There are seventeen Sustainable Development Goals which are illustrated below:



Figure 5-4:17 Sustainable Development Goals

Source: United Nations (2015)

Figure 5-4 illustrates the Seventeen Development Goals of the United Nations as adopted in 2015. Even though these development goals do not describe regional resilience in urban systems itself, it can be used as a guideline as to what concepts important institutions include to achieve sustainability and increase the resilience of areas. When referring to Sustainable Goal 8 (Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all), 9 (Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation) and 11 (Make cities and human settlements inclusive, safe, resilient and sustainable) it is clear that the concepts relate to resilience concepts as described in Section 4.2 (United Nations, 2018). It is, therefore, important to note that although the term resilience is not necessarily used in the Sustainable Development Goals as set out by the United Nations, it still encompasses important concepts that will assist in improving the resilience in urban systems (on different geographic scales).

In the Sustainable Development Goals Report (United Nations, 2018:14), it was emphasised that the Sustainable Development Goals are interlinked and suggested that policymakers should reflect on how societies can achieve higher resilience when confronting challenges, such as rapid urbanisation, conflict, the changing climate, environmental degradation etc. (which could directly be linked to Section 4.4.3 i.e. the resistance component of resilience). The document also suggested that the transition to more resilient and sustainable societies requires an integrated approach between the challenges a society face and the solutions to these challenges (this in turn could be associated with the recovery and creativity forms of resilience as described in Section 4.4.3).

The above-mentioned illustrates that even though the Sustainable Development Goals do not focus on improving regional resilience in urban systems directly, they encompass several concepts that could improve the resilience of a society in a specific level of an urban system i.e. Goals 8, 9 and 11 (refer to Section 3.4). This, in turn, can be seen as a starting point on improving resilience in urban systems in the long run. The New Urban Agenda replaced the SDGs in 2017, as subsequently discussed.

5.2.2 New Urban Agenda

The New Urban Agenda was developed in the context of the 2030 Agenda for Sustainable Development as the world is facing an unprecedented era of rapid urbanisation. The New Urban Agenda aims to provide a guideline for both developed and developing countries to manage urbanisation and development to an optimal level of different government spheres. It represents a vision of a more sustainable future, where individuals can benefit from several opportunities which a city may offer. The New Urban Agenda also reconsiders urban spaces and how they interact and function within urban systems (United Nations, 2017:6). The New Urban Agenda acknowledges the critical role cities play with reference to the source and solutions of several challenges the world is currently facing and therefore it could be derived that the New Urban Agenda focusses on the daily urban system, which is already an improvement of the previously implemented Sustainable Development Goals (which mainly focussed on nodal areas).

One of the New Urban Agenda's visions, amongst others, is to create resilient, sustainable cities and human settlements which would foster prosperity and increase the quality of life for individuals who reside in the cities (United Nations, 2017:12). In addition, the New Urban Agenda also aims to encounter several challenges and opportunities for present and future sustainable economic growth, leverage urbanisation for structural transformation, increase resource efficiency, focus on value-added activities and high productivity, harness local economies and to take the role of informal economies into account while supporting sustainable economic transformation of the formal economy (United Nations, 2017:14). The New Urban Agenda also recognises the territorial functions of which cities play across administrative boundaries, as they generally act as growth centres for integrated and sustainable urban development across different scales (refer to Sections 2.4.2, 3.2 and 3.3).

The New Urban Agenda also made specific reference to resilience by focussing on reducing the vulnerability and building resilience and responsiveness to both man-made and natural disasters (United Nations, 2017:14). This proves that the New Urban Agenda's approach includes resilience for cities and urban systems and it is not only classified as resilience in terms of natural

disasters. The following figure illustrates the different integrated and indivisible dimensions identified for sustainable development in the New Urban Agenda:

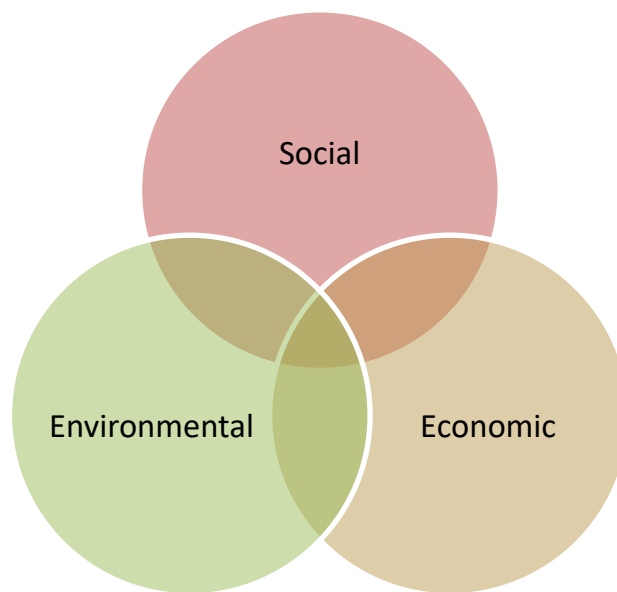


Figure 5-5: Sustainable urban development

Source: Adapted from the United Nations (2017:18)

The figure above illustrates three interlinked components to be recognised when attempting to achieve sustainable development. These dimensions also correspond with the dimensions identified in Section 4.2.2 to increase resilience in urban areas (refer to Figure 4-2) and it only excludes governance networks (which were already identified as an objective for the New Urban Agenda as described above). This again proves that the New Urban Agenda follows a more direct approach to improve resilience than its predecessor, the Sustainable Development Goals (refer to Section 5.2.1).

Furthermore, the New Urban Agenda also recognises the fact that urban areas face several challenges in terms of unsustainable production and consumption patterns, financial planning, mitigation and adoption efforts, the built environment as well as the management and government of urban boundaries and beyond (United Nations, 2017:25). These factors have a direct influence on the sustainability and the resilience of urban areas. It also includes the promotion and maintenance of well connected and well-distributed networks which in turn will improve resilience, as it would strengthen urban-rural linkages (refer to Section 3.3) by supporting the implementation of medium- to long-term adaption planning processes and policies (refer to Section 4.5) on different government spheres (United Nations, 2017:29). The New Urban Agenda identified five main pillars of implementation to achieve the goals and aims identified which are illustrated below:

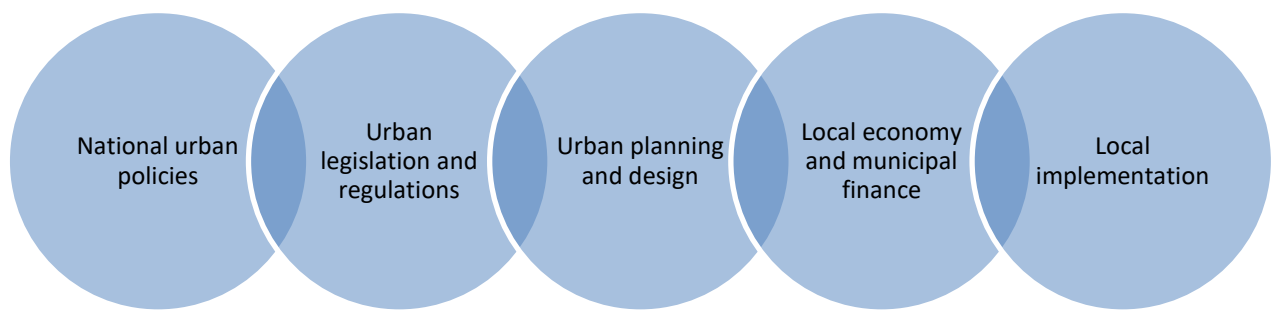


Figure 5-6: Five pillars of implementation

Source: United Nations (2017:6)

The figure above illustrates the five main implementation pillars identified by the New Urban Agenda to achieve successful implementation of the aims and goals identified for sustainable development and to increase resilience in urban areas as well as on a larger scale (i.e. regional scale).

In short, the New Urban Agenda can be described as universal as it includes priorities and actions which can be implemented on global, national, regional, sub-regional and local levels of government and other stakeholders based on their specific requirements (United Nations, 2017:44). The New Urban Agenda can be described as a holistic approach which promotes sustainable urban development by realising that cities play a key role in sustainable development, as it generally acts as a key economic driver in regions while taking the functions and importance of rural-urban linkages into account (United Nations, 2017:44-47).

5.2.3 European Union

The European Union (EU) and its Member States have implemented a policy framework to guide the EU's actions while linking the commitments they have undertaken on both a global and regional level (European Commission, 2017:2). The 2012 Commission Communication on the approach of the EU in terms of resilience defined resilience as "the ability of an individual, a household, a community, a country or a region to withstand, adapt and quickly recover from stresses and shocks" (European Commission, 2017:3). This directly links to this study and the type of resilience this study focusses on. Furthermore, the EU's strategic approach to resilience aims to achieve and sustain the objectives of the EU external actions as described above by strengthening the following:

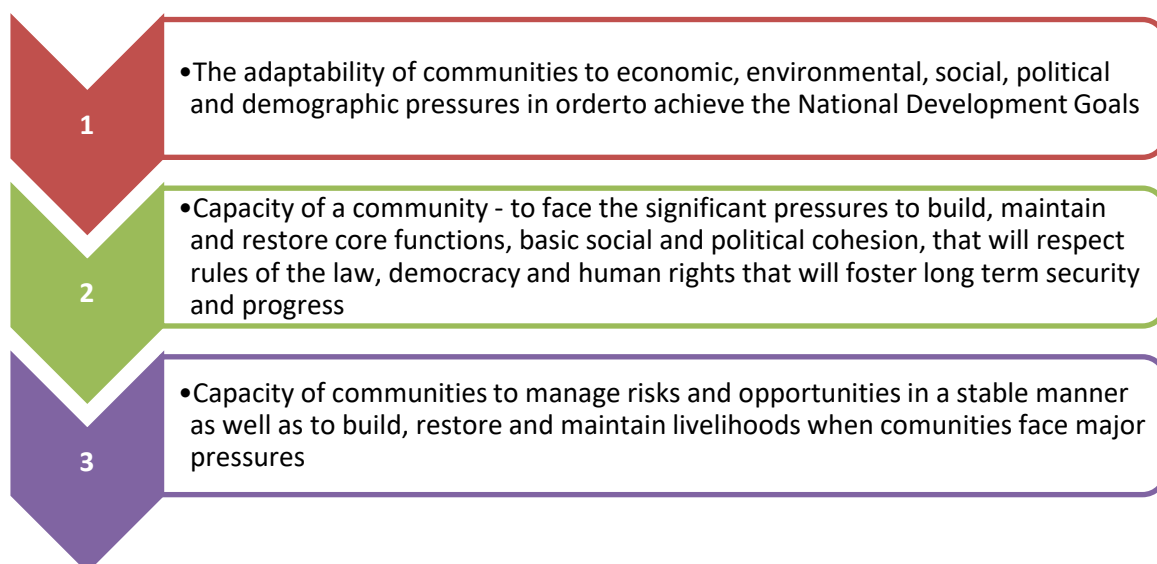


Figure 5-7: EU strategic approach towards resilience

Source: Adapted from the European Commission (2017:3)

The figure above illustrates that the EU focusses on some of the main concepts of resilience as described in Section 4.3. In addition to the strategies set in place to improve resilience in the EU and in the Member States, the EU also implemented the 2013-2020 Resilience Action Plan. Even though the 2013-2020 Resilience Action Plan is not all-encompassing, it still provides clear guidelines on the principles and priorities of the EU. It can be described as the foundation for collaborative action on building resilience, long-term development and cooperation and political engagement (European Commission, 2013:1). The EU Action Plan 2013-2020 has the following priority interventions:

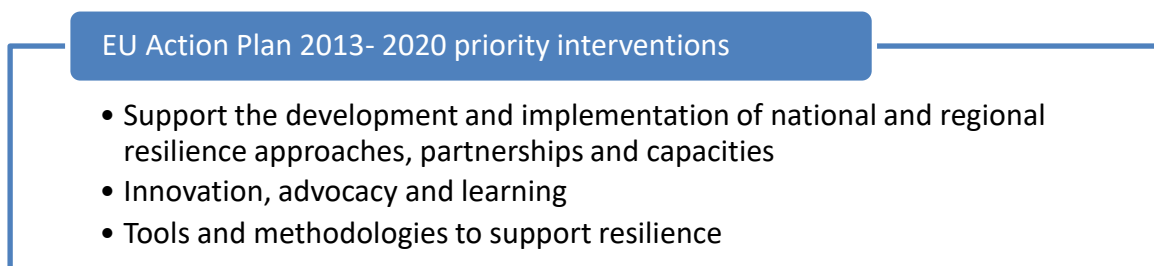


Figure 5-8: Priority interventions of the EU Action Plan 2013-2020

Source: Adapted from the European Commission (2013:7-22)

The EU Action Plan of 2013-2020 prioritises and supports development and implementation of national resilience approaches integrated into the National Development Plans. This policy outlined that resilience should benefit from both national and local policies (European Commission, 2013:4). The statement above is of the utmost importance when referring to this study as it clearly outlines the purpose of this chapter, to evaluate if the policies include resilience

and evaluate how these policies will influence regional resilience in different urban systems (objective two of this study).

The second policy intervention of innovation, advocacy and learning are important as an understanding of resilience objectives is required by governments. Effective, new approaches to resilience need to be developed systematically and included in key international documents. The Action Plan acknowledges that innovative resilience approaches will be tested in numerous regions, in different environments and on different scales (European Commission, 2017:5). This will result in a better understanding of resilience with specific reference to the impact and solution to numerous cases and could have a significant impact when referring to regional resilience in different urban systems.

Lastly, the tools and methodologies which can be used to support resilience can be seen as an immediate priority as the relevant tools will guide the EU with implementing its resilience-related strategies and frameworks. Emphasis will be placed on how joint risk assessments can be conducted as well as strategic planning (European Commission, 2013:6). Experience gained from previous studies and entities will be used to determine the flexibility of resilience that can be calculated into development policies and programmes to allow more time for responses to different shocks and crises (refer to Section 4.3.3, 4.3.4 and 4.3.5).

This concept can have a significant impact on the way policies and frameworks are formulated as it leaves room for innovation where new tools and methodologies can be tested and implemented if a desirable outcome has been obtained (refer to Section 4.4). This could have a remarkable impact if incorporated into local policies and frameworks. With reference to the other priority interventions of the EU, they can be described as significant ideas, although they could be difficult to implement on a local scale. The following section will focus on South African policies (as a study area, refer to Chapter Seven) with a specific focus on improving resilience on a regional scale.

5.3 National policies

This section examines numerous national policies and legislation with specific reference to regional resilience or the implementation/ guidelines on different urban systems (scale of implementation). This section focusses on the following policies, as they can be described as the most relevant when referring to the different scales of implementation of policies together with improving the resilience of areas and regions:

- National Development Plan 2030

- White Paper on local governments
- Urban Development Framework and the Integrated Development Framework
- Rural Development Framework and the Comprehensive Rural Development Programme
- National Spatial Development Framework

5.3.1 National Development Plan, 2030

The National Development Plan (NDP) is a comprehensive plan for South Africa which aims to reduce inequality and to eliminate poverty by 2030, which in turn will grow an inclusive economy, increase sustainability and build capacity to solve numerous problems which South Africa faces (National Planning Commission, 2011:1). The NDP acknowledges the effect apartheid had on South Africa on a spatial, social, educational and economic level and aims to reduce historical inequalities.

National development should not be categorised as a linear process and therefore, policies and plans that are implemented should also not be linear in nature but rather as a multi-dimensional framework that will increase sustainability. The process can be illustrated as a virtuous cycle of development where development in one area will support advances in other areas. This can be illustrated by means of the figure below, where close links exist between opportunities, capabilities and living conditions while also emphasising the role of leadership and the role of the government to assist and drive development in a cohesive environment, which in turn could improve resilience on different scales.

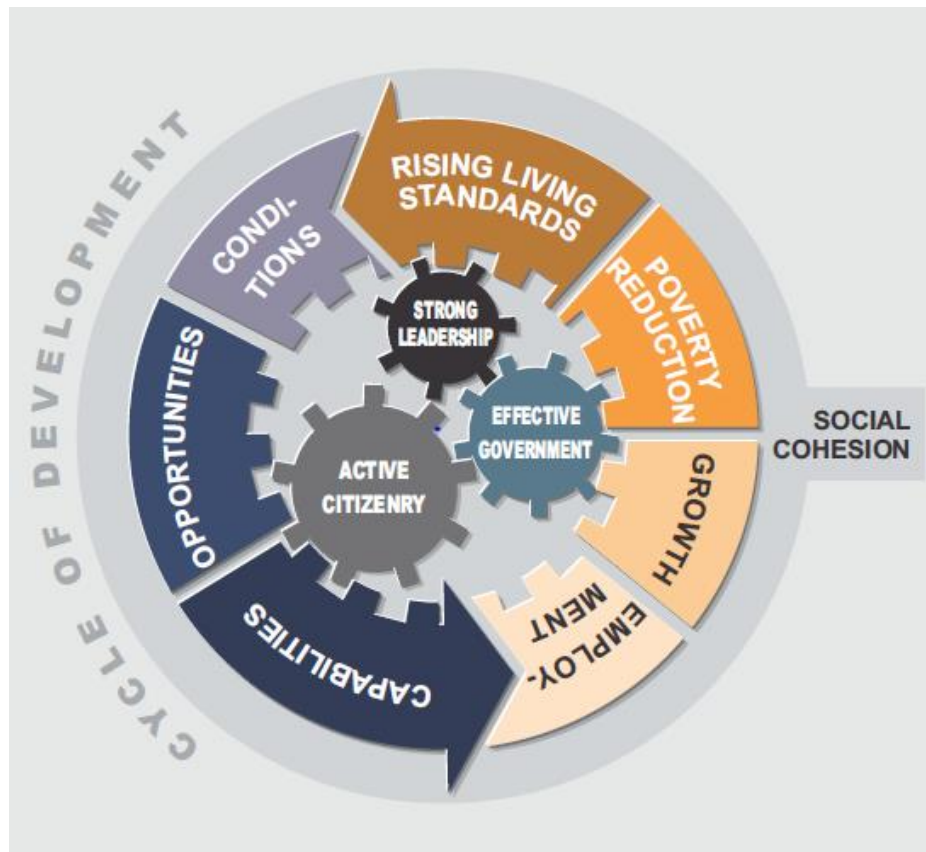


Figure 5-9: An approach to change

Source: National Planning Commission (2011:26)

The figure above illustrates the cycle of growth (which can also be linked directly to sustainable economic growth) as set out in the NDP. The cycle consists out of employment, growth, poverty reduction, rising living standards, conditions, opportunities and capabilities with governmental interference depicted as a gear (driver) for growth (sustainable economic development) and poverty reduction. This cycle as depicted above consists out of seven main links which the government of South Africa believes is the cycle of development. Furthermore, the NDP set out six interlinked priorities to increase National Development, which are illustrated below:



Figure 5-10: Six interlinked priorities of the NDP

Source: Adapted from the National Planning Commission (2011:26)

The figure above illustrates six interlinked priorities as set out in the NDP and it is clear that these priorities are mainly focussed on different social components. This, in turn, will not be enough to increase the regional resilience in different urban systems. Therefore, the NDP was examined further with specific reference to the remaining thirteen chapters which addresses major thematic areas and would indicate if the NDP addresses or acknowledges the importance of regional resilience in different urban systems. The following figure illustrates a summary of the objections and actions set out in the NDP:

NDP Objectives and Actions	Economy and Employment
	Economic Infrastructure
	Environmental sustainability and resilience
	Inclusive rural economy
	South Africa in the region and the world
	Transforming Human Settlements
	Improving education, training and innovation
	Health care for all
	Social protection
	Building Safer Communities
	Building a capable and developmental state
	Fighting corruption
	Nation building and social cohesion

Figure 5-11: Summary of objections and actions of the NDP

Source: Adapted from the National Planning Commission (2011:62)

The figure above and the objectives highlighted in red clearly indicate a few objectives relevant to resilience and the study at hand and actions which can be implemented and used to improve regional resilience in different urban systems. The following actions and objectives are relevant when referring to the purpose of this study i.e. to improve regional resilience:

- **Economy and Employment**

As mentioned in Section 4.2.2, there are several fields in resilience and one of the fields identified was economic resilience (refer to Figure 4-2). A resilient economy is vital for the development and sustainability of regions by means of industries and businesses (refer to Figure 4-11). Unfortunately, this section in the NDP places their focus on job creation and income levels of the South African workforce (National Planning Commission, 2011:64), which neglects the importance of diversification of industries and businesses which in turn could improve regional resilience (refer to Section 4.2.2). Even though this objective mentioned that South Africa should increase exports and the mining of minerals and natural resources, little emphasis is placed on guidelines on how to improve the economic sustainability of the regions themselves. This confirms that the NDP does not encompass clear guidelines on how to improve resilience through a sustainable economy and by means of targeted economic sectors or sector diversification and rather focusses on job creation. This poses a great concern in terms of resilience with a specific focus on economic development as several policies use the NDP as a guideline for development frameworks on a more local scale.

- **Economic Infrastructure**

Economic Infrastructure (or Engineering Infrastructure as described in Section 4.2.2) is of utmost importance when referring to the growth of an economy as it directly contributes to resilience when an area would experience either a man-made or natural disaster (refer to Section 4.4.1). The NDP places a large amount of emphasis on the provision of electricity to the population and provides room for renewable energy (this also links with some of the objectives set out in the New Urban Agenda and the European Union - refer to Sections 4.2.1, 5.2.2 and 5.2.3). The provision of electricity will have an influence on the environmental sustainability and resilience of South Africa as the development and operation of electricity plants can increase pollution and, on the other hand, if renewable energy solutions are imposed, it may have a positive effect on the environment. By promoting sustainable electricity solutions and promoting energy efficient solutions, environmental resilience will increase in South Africa. Other infrastructure-related objectives include the expansion of public transportation and increasing the capacity of important ports, such as the Durban port (National Planning Commission, 2011:65). By increasing the accessibility to public transport and ports, the productivity would be directly increased which could contribute to sustainable economic development. These infrastructure objectives to increase productivity also conform to the objectives as set out in the New Urban Agenda discussed in Section 5.2.2.

In short, the economic infrastructure objectives as mentioned above are somewhat guiding when referring to regional resilience in urban systems, as infrastructure is the key to development, investment and economic growth (refer to Sections 4.2 and 4.4). It is, however, not sufficient when referring to specific economic infrastructure concepts on how to improve regional resilience and neglects the role of urban systems as a whole. It would, therefore, be challenging for policies which adhere to the principles as set out in the NDP to use it as a guideline as the NDP is unclear on how resilience can be improved by means of economic infrastructure.

- **Environmental Sustainability and resilience**

This chapter in the NDP focusses on the environmental sustainability of South Africa while acknowledging protective environmental areas which serve as great tourist attractions; which in turn strengthen the local economy (National Planning Commission, 2011:67). The NDP also set guidelines for pollution with regards to greenhouse gas emissions, carbon, waste disposal (refer to concepts of resilience in Section 4.2.2), which will have a positive effect when referring to environmental resilience (these concepts also coincide with both the New Urban Agenda and European Union's objectives). It should, however, be stated that no indication or emphasis was placed on how to improve the environmental sustainability and the resilience of a region overall

which is the aim of this study. Thus, the objectives and actions as described above are also insufficient when referring to the improvement of regional resilience in different urban systems. Different government spheres could find it challenging to incorporate these concepts on a smaller scale, especially when integrating the above-mentioned concepts to increase regional resilience.

- **Inclusive rural economy**

As described in Section 2.3 and Section 3.2, a region and node does not exist out of one component and is rather dependent on several influences which surrounds the node (see Objective Three of this study, i.e. linkages between urban and rural areas will be evaluated to determine the connection between rural and urban areas) and including the rural economy would be of great significance to this study. When referring to Chapter Six of the NDP, the emphasis is placed on the development and potential of rural areas in the form of agriculture and the processing of agricultural products (National Planning Commission, 2011:67-68). The NDP stipulates that rural communities in South Africa should have access to more economic, social and political opportunity which should also be supported by quality education, transport, healthcare and other basic services (National Planning Commission, 2011:44). Economic growth and sustainability could be achieved by increasing agricultural production, through higher productivity levels (refer to the stages of economic growth in Section 2.4.1) which will result in an increase of economic resilience. Furthermore, by focussing on agri-processing, the economy of South Africa would be diversified in the rural community which in turn could contribute to more specialised services (an increase in secondary and tertiary economic sectors) which could act as an attraction mechanism and could also counter rural-urban migration (refer to Sections 3.2.1 and 3.3). This, in turn, could also have an effect on the distribution of the population (refer to Sections 3.2.1, 3.2.2, 7.2.2 and 7.2.3) and the resilience of different urban systems in South Africa overall.

- **Transforming Human Settlements**

This objective and action are described in Chapter Eight of the NDP and form part of the new Integrated Urban Development Framework implemented in 2016 (refer to Section 5.3.3). The aim of this chapter is to establish strong and efficient spatial planning systems which are well integrated across all government spheres (refer to Figure 4-2). Furthermore, this action also includes the upgrading of public transportation systems as well as residential densification near job opportunities which in turn will increase the livelihoods of residential areas and the quality of life for individuals residing in these areas. The NDP also places great emphasis on several financial options and grants to be used to contribute to a better and more sustainable social cohesion. The above-mentioned objective and actions are of utmost importance when focussing

on increasing regional resilience as it could be linked to the social resilience component identified in Section 4.3 to increase resilience.

Even though little emphasis is placed on regional resilience in different urban systems when referring to the NDP, it still encompasses guidance and concepts that can be used to increase the regional resilience as it includes the four main concepts, i.e. (i) metabolic flows; (ii) governance networks; (iii) built environment and (iv) social dynamics to increase resilience as identified in Section 4.2.2. Furthermore, all of the objectives in the NDP conform to the New Urban Agenda which are aimed to increase the sustainability and resilience in urban areas and urban systems. Thus, the NDP can be seen as a supportive plan as several South African sectoral departments use the NDP as a guideline within their documents and frameworks. The NDP does, however, encompass several shortcomings when referring to implementation guidelines, especially when referring to increasing regional resilience in different urban systems. The following section will evaluate several documents and frameworks which may be of better relevance when referring to regional resilience in different urban systems.

5.3.2 White Paper on Local Governments

The White Paper aims to establish a foundation for newly structured local governmental institutions who are committed to creating sustainable human settlements which in turn will increase the quality of life for all in a holistic manner (South Africa, 1998:8). Due to the fact that South Africa's spatial distribution was affected by apartheid (refer to Section 5.3.1), South Africa has a unique characteristic when referring to economic, geographic and social separation. For the purpose of this study, the geographical separation will be investigated as it will give a direct indication of what to expect when focussing on the spatial distribution of South African towns and cities, which in turn could be associated with sustainable development and resilience (refer to Sections 3.2 and 3.4).

As mentioned above, South Africa has a unique spatial distribution when referring to towns and cities and it is critical to understand these spatial distributions to develop and implement effective policies and to create the appropriate municipal institutions (South Africa, 1998:19). For instance, the type of settlement, population density and economic base will have a direct influence on the resource demands of the local government to provide the settlement with access to basic services and to install sufficient infrastructure (refer to different concepts of urban resilience in Section 4.2.2 and the New Urban Agenda in Section 5.2.2). The spatial distribution of the settlement should also be kept in mind as it could affect the demarcation of functional boundaries as described in Sections 2.2.2 and 2.2.3 (South Africa, 1998:19).

The White Paper identified the following settlement types to assist individuals and government institutions in understanding the complex spatial distribution of South Africa which would be taken into account in the following chapters, especially when focussing on South African case studies (South Africa, 1998:19-20):

- Urban core

This can be described as a formal town or city which includes the former white and township areas. This type of settlement usually consists of high population densities (generally more than 10du/ha), an active economy and high land values.

- Urban fringe

This type of settlement is usually established outside the urban core but inside the boundaries of the municipalities. It generally consists of low-income housing which encompasses middle order densities and service backlogs. In some cases (especially on the periphery of metropolitan areas) high-income housing with low densities exists and is also classified as part of the urban fringe (refer to Section 3.3.2).

- Small towns

This settlement type encompasses the characteristic apartheid urban form with the former white area with high service levels and the former black area with limited service levels. Most of these towns are linked to their surrounding hinterlands on an economic and social level.

- Dense rural settlements

There are two predominant kinds of densely populated rural settlements (i) betterment settlements and (ii) informal settlements, which have their own unique characteristics. For instance, the betterment settlements are commonly found in formal homeland areas and are densely planned with a population larger than 5 000. On the other hand, informal settlements are generally found in close proximity to urban areas and are usually unplanned with limited to no level of services. In some cases, informal settlements are found in rural areas with low economic activity as intensive commercial farming settlements are also classified as informal settlements.

- Villages

Usually consists of a population of more than 500 but less than 5 000 individuals. Usually, small settlements which developed as unplanned traditional settlements or resettlement areas.

- Agri-villages

Can be described as settlements which service surrounding farms and are usually dense, planned settlements.

- Dispersed or scattered settlements

Lastly, this type of settlement is usually an unplanned settlement and has a small population size of less than 500. Widely spread settlements in commercial areas and even on privately owned land falls within this type of settlement.

As described above, each settlement type has unique characteristics and contains diverse individuals, households and even communities (these concepts could also be associated with the different universal hierarchies described in Table 3-1). It is, therefore, important to understand the different settlement types as they have different requirements and would entail different levels of resilience and sustainability. As mentioned above, apartheid had a significant influence on the distribution of settlements and this contributes to large cost implications from the government's side to provide communities with sufficient infrastructure to access economic and social opportunities (South Africa, 1998:21) from rural to urban areas (refer to Section 2.3 and 3.3). By increasing the accessibility of products and services, the overall sustainability of both rural and urban areas would be increased and it could also contribute to a higher resilience in rural areas, especially if new economic opportunities arise and infrastructure are provided or upgraded (refer to Section 4.5).

It also provides an outline of the current local government model as well as emphasises the role of metropolitan municipalities to accommodate all the settlement types as identified for South Africa (South Africa, 1998:8). The settlement types, as mentioned above, pose several challenges for the local government models as they play a key role in transforming these settlements and to address some of the general shortcomings of the settlements which would result in a lower rural-urban migration and a higher level of sustainability (refer to Sections 3.2.2 and 3.3). With this in mind, it is important for local municipalities to focus on their identified development outcomes and the following approaches were identified as they will assist municipalities to reach their development outcomes:

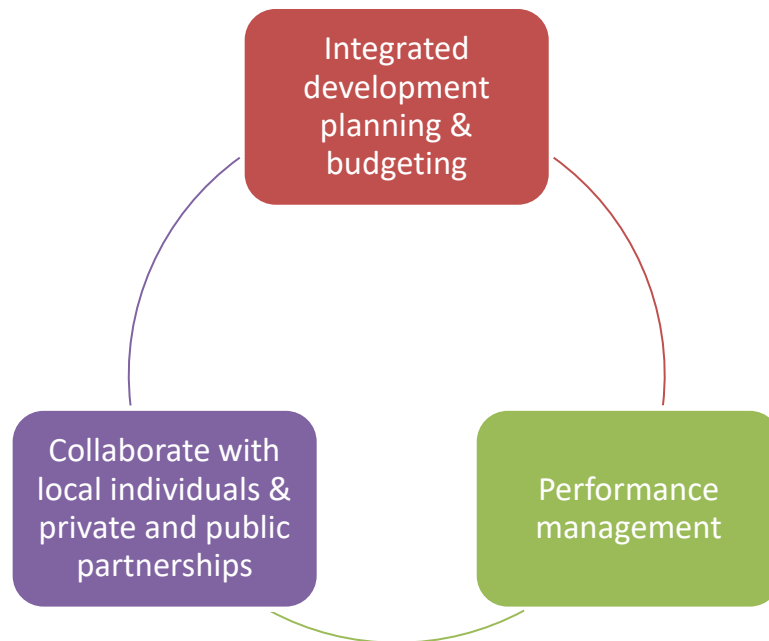


Figure 5-12: Three approaches municipalities can use to reach their development outcomes

Source: Adapted from South Africa (1998:9)

Municipalities are currently facing several challenges in terms of managing environmentally sustainable and viable rural and urban systems due to backlogs in service infrastructure, inefficient existing settlement patterns, spatial separations etc. (South Africa, 1998:21). If these three approaches as identified in the figure above were to be followed by municipalities in terms of management, it could lead to the improvement of regional resilience in different urban systems by utilising these concepts to achieve their identified development outcomes.

The White Paper provides a foundation for other policies and legislation to be formulated while acknowledging the current status of the South African population distribution (refer to Section 7.2.2). The main objective in terms of the settlement trends and municipalities is to encourage local municipalities to recognise their development outcomes, such as the delivering of services and installation and maintenance of infrastructure (water, electricity, sanitation etc.), economic development, empowerment of the community and to create integrated cities and livable towns and rural areas (refer to Section 4.4). It is important to note that this policy was developed in 1998 and neglects numerous new concepts in terms of resilience, however, the policy does provide a clear indication of the different settlement distributions and the challenges and shortcomings of these distributions. The concepts identified in the White Paper would be considered when recommendations are made on how to improve regional resilience in different urban systems. This policy will also be of relevance when identifying the different settlement types and categorising them within the urban system (refer to Section 8.3.1).

5.3.3 *Urban development frameworks*

South Africa developed urban development frameworks that focus on nodal developments, which are generally seen as a key driver of economic growth and sustainability within regions (refer to Sections 2.3 and 2.4). Cities and towns are generally interconnected with one another and encompass a high level of economic activities (refer to Sections 3.2 and 3.4). Cities and towns can be connected on different scales i.e. (i) daily urban system; (ii) regional urban system and (iii) national urban system where each scale encompasses different levels of interactions and networks. The following Urban Development Frameworks were identified to determine the different objectives identified to improve the resilience and sustainability of both cities and towns nestled within regions:

- **The Urban Development Framework, 1997**

The Urban Development Framework (UDF) of 1997 focused on the importance of cities and towns in South Africa to achieve sustainable development and was released by the Department of Housing as one of the first spatially focused policies after democracy. The framework aims to provide a guideline for programmes to be implemented for urban development to be integrated and environmentally sustainable in nature, which in turn will improve the quality of life for people residing in urban areas (Department of Housing, 1997:1). Although no longer in effect, it is regarded as an important link between previous policies and current policies to highlight the emphasis shift (refer to the concept of resilience in Section 4.3.4 i.e. adaption)

As mentioned above, the UDF focusses on urban areas thus, the UDF emphasises the importance of planning areas in a particular manner which includes sufficient infrastructure and the provision of housing (National Planning Commission, 2011:43). The UDF also aims to establish close relationships between the local government and civil society to reduce the gap between spatial and economic planning. If the stakeholders work coherently, urban areas would be more efficient. The UDF therefore, implemented several programmes to achieve the goals as mentioned above and for the purpose of this study, only the four key programmes will be listed (Department of Housing, 1997:44), namely:

- City integration
- Improving Infrastructure and the provision of housing
- Promoting economic development in urban areas
- Creating institutions for better service delivery

The key programmes as mentioned above can be described as urban development goals which will assist to achieve the urban vision of 2020 (Department of Housing, 1997:8). As mentioned

above, the UDF was developed in 1997 and since then, the urban tendencies and urban form changed significantly. This led to a compilation of a new framework which is more relevant to the current urban tendencies and to assist in managing urbanisation, namely the Integrated Urban Development Framework.

- **Integrated Urban Development Framework**

The Integrated Urban Development Framework (IUDF) was implemented in 2016 to respond to the rapid urbanisation South Africa faces and to minimise the negative impacts of urbanisation (Cooperative Governance, 2016:7). The IUDF acts on Goal 11 from the post-2015 Sustainable Development Goals (refer to Section 5.2.1) and the New Urban Agenda (refer to Section 5.2.2) to make cities and human settlements resilient, safe and sustainable. It also incorporates Chapter Eight of the NDP (refer to Section 5.3.1) with specific reference to transform human settlements as well as the national space economy. The IUDF's overall aim is to steer urban growth towards a sustainable urban model (the urban model should be compact, connected and coordinated) for both cities and towns (refer to Table 4-2). The reason why this framework was included is due to the fact that the framework makes a direct reference to resilient, inclusive and liveable urban systems (Cooperative Governance, 2016:8) while still addressing the current challenges South Africa faces, such as the unique settlement types as mentioned in Section 5.3.2. The IUDF identified the following strategic goals to achieve the transformation vision (Cooperative Governance, 2016:8):

Spatial integration	Inclusion and access	Growth	Governance
• Encourage new spatial forms in settlements, economic and social areas as well in transportation	• To improve access to economic opportunities as well as social choices	• Inclusive and sustainable economic growth and development	• Cohesion between the state and its citizens to achieve social and spatial integration

Figure 5-13: IUDF strategic goals

Source: Adapted from the Cooperative Governance (2016:8)

To achieve the four strategic goals as mentioned above, eight policy levers were identified, namely (i) Integrated urban planning and management; (ii) Integrated transport and mobility; (iii) Integrated sustainable human settlements; (iv) Integrated urban structure; (v) Efficient land governance and management; (vi) Inclusive economic development; (vii) Empowered active

communities and (viii) Effective urban governance. Even though the new IUDF has a more integrated approach towards resilience, there is still no connection between regional resilience in different urban systems. This is, however, a step in the right direction as it is clear that resilience is becoming a more familiar concept in newly formulated South African policies and frameworks.

When referring to the objectives of this study, city integration, improving infrastructure and economic development in urban areas will all contribute to the improvement of regional resilience as nodal developments (urban areas) are a critical element of a region (refer to Section 2.3). The study does, however, refer to the fact that most studies only investigate the importance of nodes and not a region as a whole and therefore, the following policies which focus on regional development will be evaluated.

5.3.4 Rural development frameworks

Rural development takes place when urban areas are connected with rural areas via corridors development (refer to Section 2.4.3) or urban fields (refer to Section 3.3) or both. Rural areas encompass unique characteristics and often provide ancillary products and services to urban areas. Rural areas are of great significance when referring to regional development in urban systems as the potential of rural development is often overlooked (refer to Section 3.3.1 and 3.4.3). Therefore, rural development frameworks were identified in the South African context and are described below:

- **Rural Development Framework, 1997**

The above-mentioned framework was developed to ensure that rural areas encompassed their own framework as they generally have different challenges and development objectives than urban areas. Rural areas can be defined as sparsely populated areas (refer to Section 2.2.2.) and rural areas in South Africa are generally less developed than nodal areas, thus the Rural Development Framework (RDF) was compiled and implemented to stimulate development and improve the availability of infrastructure in rural areas (Department of Land Affairs, 1997:49). The Rural Development Framework initiated the following key programme to ensure successful implementation in rural areas:

- **Development Framework: The Comprehensive Rural Development Programme (CRDP)**

This programme can be categorised within the government's Medium-Term Strategic Framework (2014-2019) as a strategic priority (Department of Rural Development and Land Reform, 2009:3) and was implemented with the aim to create vibrant, sustainable and equitable rural communities.

The CRDP is based on a proactive planning approach by encouraging the involvement of the community rather than an interventionist approach (refer to Section 4.4.3). The main objective of the CRDP is to facilitate integrated development and to improve social cohesion through community involvement and to partner with all sectors of society (Department of Rural Development and Land Reform, 2009:3). The CRDP identified several strategic aims to achieve their main objective with specific reference to rural development, namely integrated development which is illustrated in the figure below:



Figure 5-14: Vision of the CRDP

Source: Adapted from the Department of Rural Development and Land Reform (2013:10-11)

The eight aims as mentioned above have been categorised into three measurable phases to determine the progress of these strategic aims and to ensure that effective and efficient implementation takes place. These measurable phases will be used to determine the progress and the success of the implementation of the eight aims as mentioned above and can be described as follows:

- Phase 1: Meeting basic human needs (refer to Aim 4,5,6 and 8)

The first phase intends to focus on uplifting the individual, households and community. This phase aims to provide basic services for individuals who reside in a rural area. This will directly impact the availability of infrastructure, such as water, electricity, educational facilities etc. (Department of Rural Development and Land Reform, 2013:12) which, as mentioned in Section 4.2.2 and

Section 5.3.1, are crucial when referring to regional resilience in different urban systems. The improvement of infrastructure in rural areas will also have a direct impact on the productivity of food production which in turn will contribute to a more sustainable economy, better food security and a better quality of life, which are all forms part of resilience.

- Phase 2: Rural Enterprise Development (refer to Aim 2,4, 5 and 6)

This phase can be classified as an entrepreneurial development stage as it deals with enterprise establishments which include businesses of all sizes (Department of Rural Development and Land Reform, 2013:13). This phase will include the revitalisation of infrastructure, which could, in turn, generate vibrant local markets and more credit facilities (this will stimulate economic activities and ultimately improve economic resilience). Furthermore, this phase also aims to involve the livestock and crop farmer to take part in the value chain development. This will result in a rural area which will interact on a regular basis with a node to provide the node/urban area with the products they require (Department of Rural Development and Land Reform, 2013:22) and will ultimately result in the diversification of economic sectors, especially when focus is placed on the development of a value chain in rural areas (refer to Section 3.3).

- Phase 3: Rural Industries, markets and credit facilities (refer to Aim 4, 5 and 8)

By the time this phase is implemented, economic growth in rural areas will already be stimulated. Therefore, this phase will focus on the development of different size and forms of rural industries, which will contribute to rural areas with better access to credit facilities, infrastructure and other social facilities (Department of Rural Development and Land Reform, 2013:13) and will ultimately improve the quality of life for individuals who reside in rural areas (by developing different industries, economic diversification will be strengthened which is directly linked to resilience). The phases as mentioned above could contribute to regional resilience in different urban systems if implemented and managed correctly as they aim to improve infrastructure and the economic development of rural areas.

In addition, the RDF outlined the importance of rural-urban interdependency and the need for a balanced, mutually supportive approach between the two areas (Department of Rural Development and Land Reform, 2013:21). According to the RDF (Department of Rural Development and Land Reform, 2013:21), rural-urban dependency refers to the flow of private and public capital, the commuting and migration of people and trade between rural and urban areas which will lead to an increase in social and economic sustainability (refer to Section 3.3.2, 3.3.3 and 4.2.2).

In conclusion, the RDF (Department of Rural Development and Land Reform, 2013:25) stipulated that rural areas are not homogeneous (refer to Section 2.2.2 and 2.2.3) and that development strategies should take the demographic variations, social and economic context of the rural area as well as the institutional facilities available into account when developing policies. The RDF (Department of Rural Development and Land Reform, 2013:25) also acknowledges the role of the community when planning and implementing rural policies (refer to Section 4.4). By diversifying rural areas with non-farm activities and by increasing the economic infrastructure, rural areas will be able to achieve better economic growth and will also contribute to a more resilient region as the rural area is not dependent on one type of industry. This, in turn, will also ensure a more spatially balanced South Africa (refer to Chapter Eight).

5.3.5 National Spatial Development Framework

With the implementation of SPLUMA (refer to Section 5.4.1), all levels of spatial planning were given the responsibility to develop and implement spatial strategies on the appropriate scale which includes national, provincial, regional and district spatial development frameworks (Department of Rural Development and Land Reform, 2014:7) and these different scales will be elaborated on in Section 7.2). SPLUMA contributed to a new spatial regime in South Africa as it replaced several pieces of apartheid legislation with the aim to spatially transform South Africa in its democratic era (refer to Section 5.3.2). Hence it was of utmost importance to guide national planning to develop and implement a National Spatial Development Framework (Department of Rural Development and Land Reform, 2014:7).

The National Spatial Development Framework (NSDF) therefore, take its point of departure from SPLUMA's regulations, which is still in the drafting phase. The guidelines for the compilation of SDF's as stipulated in SPLUMA serve to clarify the different roles and responsibilities of different spheres of the government and to serve as an instrument for spatial transformation (Department of Rural Development and Land Reform, 2014:8).

Several guidelines were also proposed when compiling an SDF to ensure optimal usability for all intended users. The following figures (refer to Figure 5-15 and Figure 5-16) illustrates the relationships between institutions when referring to the spatial context of South Africa:

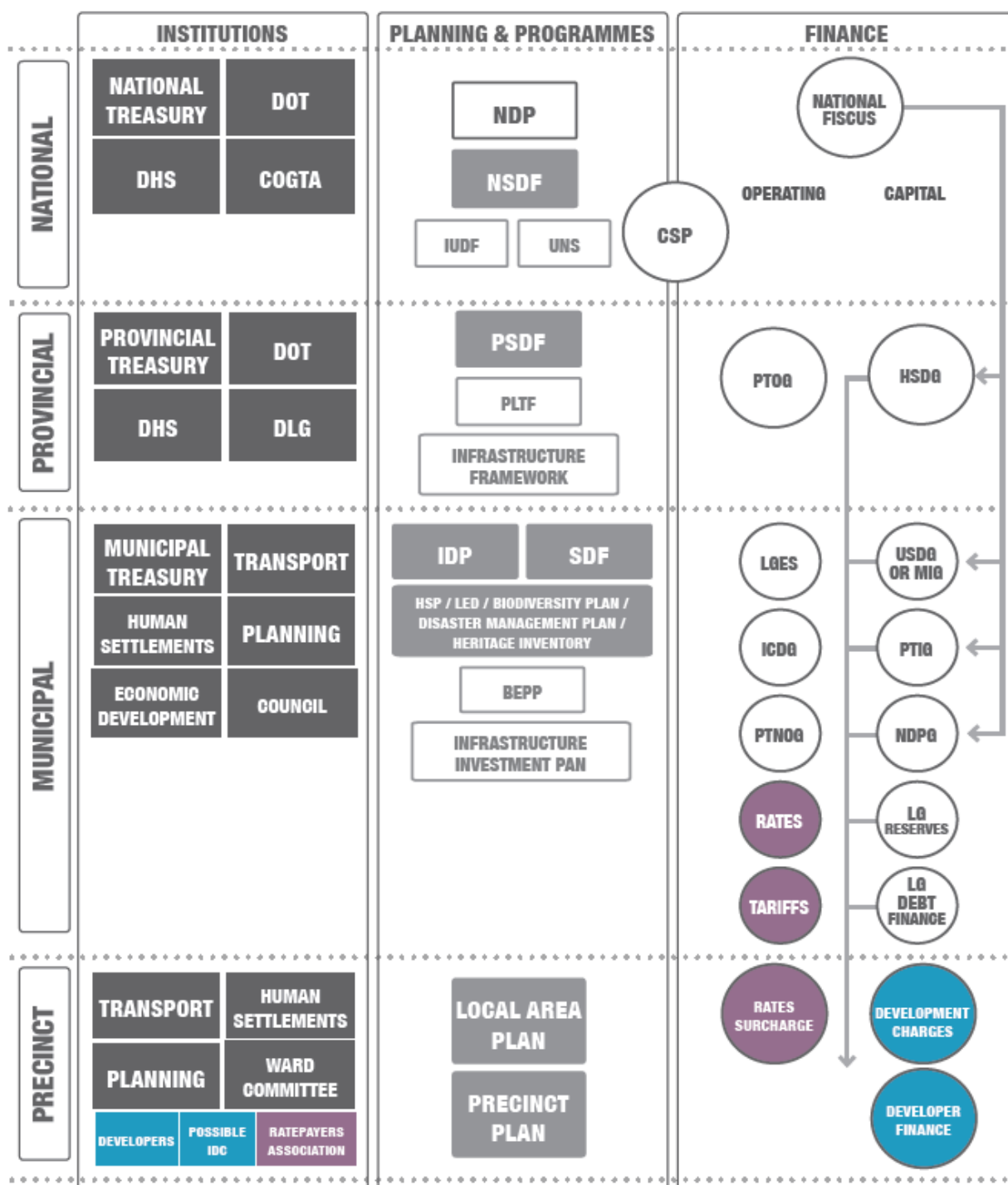


Figure 5-15: Relationships between institutions, planning programmes and financial mechanisms within the spatial context of South Africa

Source: Adapted from the Department of Rural Development and Land Reform (2014:9)

The figure above illustrates the different spheres of government and different legislation and planning programmes applicable to each of the scales.

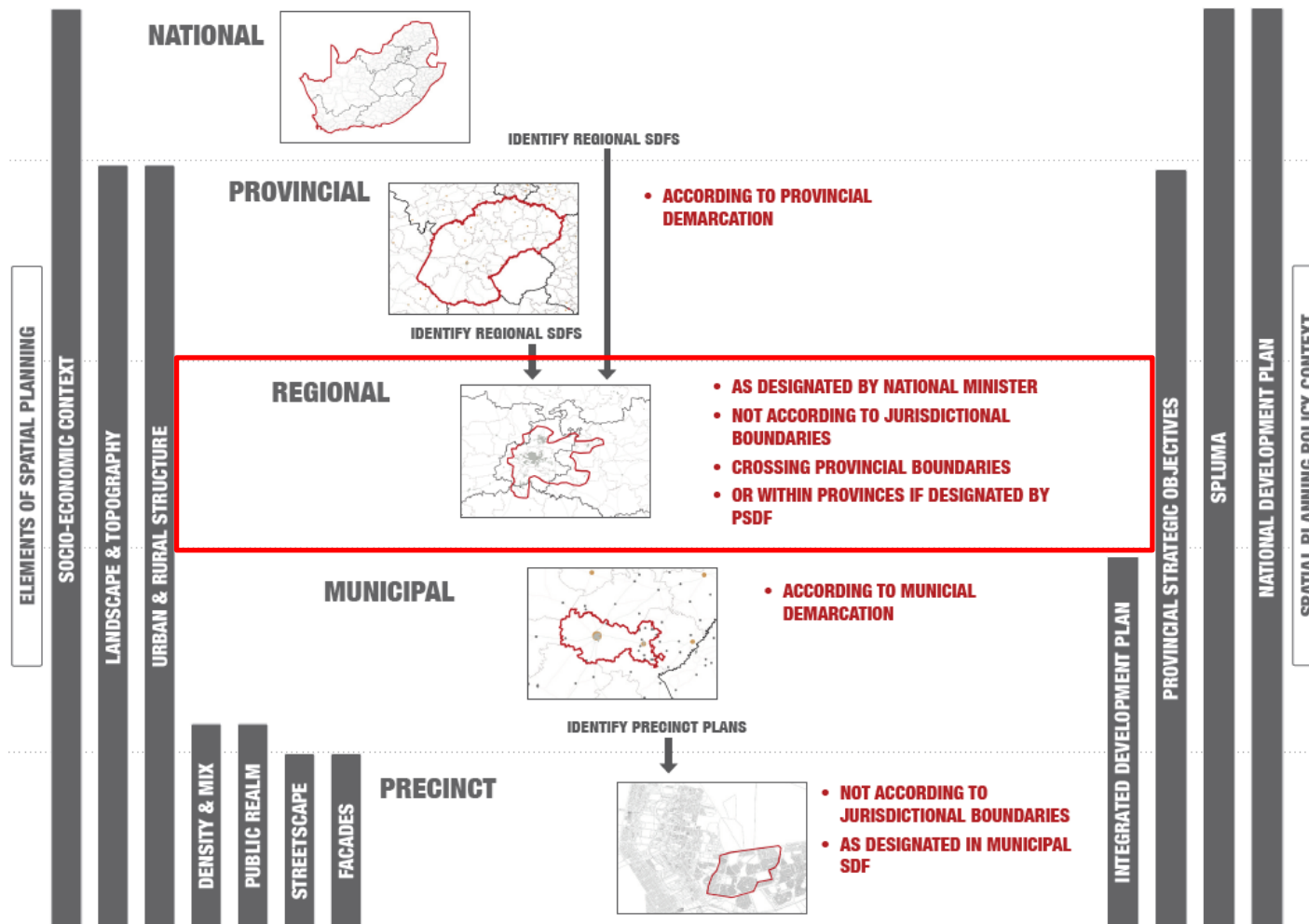


Figure 5-16: Differentiating the different scales of planning according to the relevant elements, policy contexts and legislative demarcations

Source: Department of Rural Development and Land Reform (2014:15)

Figure 5-16 illustrates the different scales of planning together with the different elements of spatial planning and the spatial planning policy context. From the figure above, the regional context was indicated in red and will be elaborated on in the case study Section, which focusses on the South African context (refer to Section 7.2.3).

For the purpose of this study, the NSDF will be relevant as it should encompass different levels of urban systems which could ultimately be used to improve regional resilience by means of government interference (refer to Sections 2.4.4 and 3.4). The NSDF will be derived from the NDP (refer to Section 5.3.1) and will also include several concepts from the IUDF (refer to Section 5.3.3) and its rural component. The Department of Rural Development and Land Reform will be responsible to prepare the NSDF to give spatial expression to the NDP. As mentioned previously, the document is still in the drafting phase and it could have a positive effect when referring to regional resilience in different urban systems

In addition, the NSDF will comprise out of the following five founding principles of SPLUMA (Spatial Planning and Land Use Management Act, 2013:15-16):

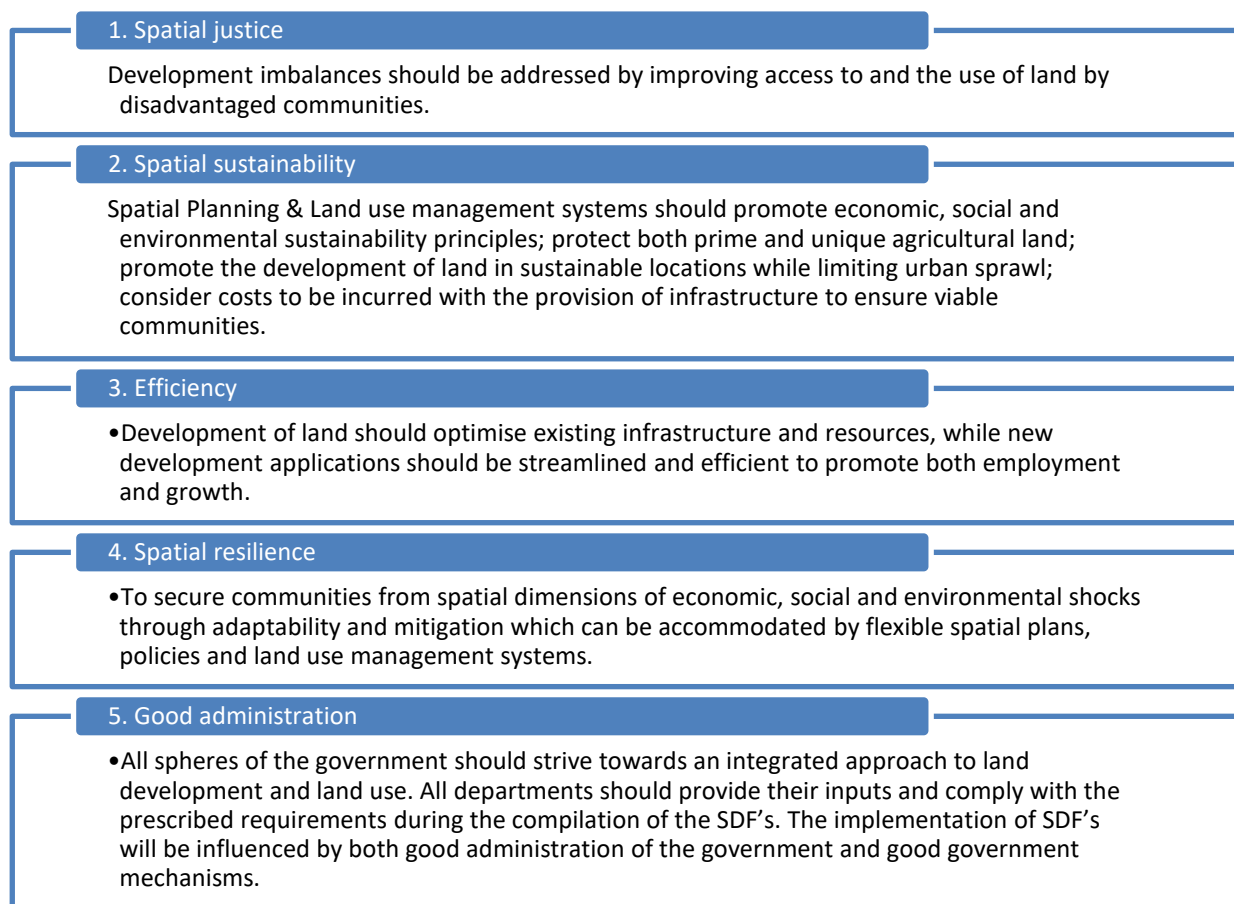


Figure 5-17: Five founding principles of SPLUMA to be applied in SDF's

Source Adapted from the Spatial Planning and Land Use Management Act (2013:15-16)

The figure above illustrates five principles which will be applied in the compilation and alterations of SDF's in South Africa. These principles can have a positive effect on regional resilience in different urban systems, especially when referring to the fourth principle as it refers to economic, social and environmental shocks and flexibility (refer to Section 4.3). The Department of Rural Development and Land Reform (DRDLR) is currently busy compiling a detailed guideline on how to interpret these principles and can be described as the Spatial Planning Outcomes Framework (SPO's). Furthermore, the Department of Rural Development and Land Reform (2018:24) also published a draft NDP where they included a proposed national schema for spatial targeting which sets out a series of initiatives to facilitate investment and to assist with transformation on a national scale, as well as to ensure that people and places benefit all over South Africa. This provides a platform of spatial investment on a national scale with a specific focus on the national urban system (refer to Section 3.4.1). The figure below illustrates the proposed spatial targeting as set out in the draft NDP (Department of Rural Development and Land Reform, 2018:24):



Figure 5-18: NDP's proposed national schema for spatial targeting

Source: Department of Rural Development and Land Reform (2018:24)

The figure above illustrates the proposed national spatial development initiatives for South Africa. This was in accordance with Chapter Eight in the NDP to transform human settlements and the national spatial economy (National Planning Commission, 2011). Even though spatial targeting is visible on a national urban system scale, there is, however, still a clear shortcoming when referring to the integration of different urban systems when improving the regional resilience.

5.4 National legislation

This section explores the Spatial Planning and Land Use Management Act 16 of 2013 (SPLUMA) which is widely used in numerous town planning.

5.4.1 Spatial Planning Land Use Management Act

SPLUMA was passed in 2013 and is a National Law that gives the Department of Rural Development and Land Reform (DRDLR) the authority to pass regulations and provide detail on how SPLUMA should be implemented. SPLUMA can be described as a framework law which provides broad principles for provincial laws that regulate planning.

SPLUMA was developed for the following purposes:

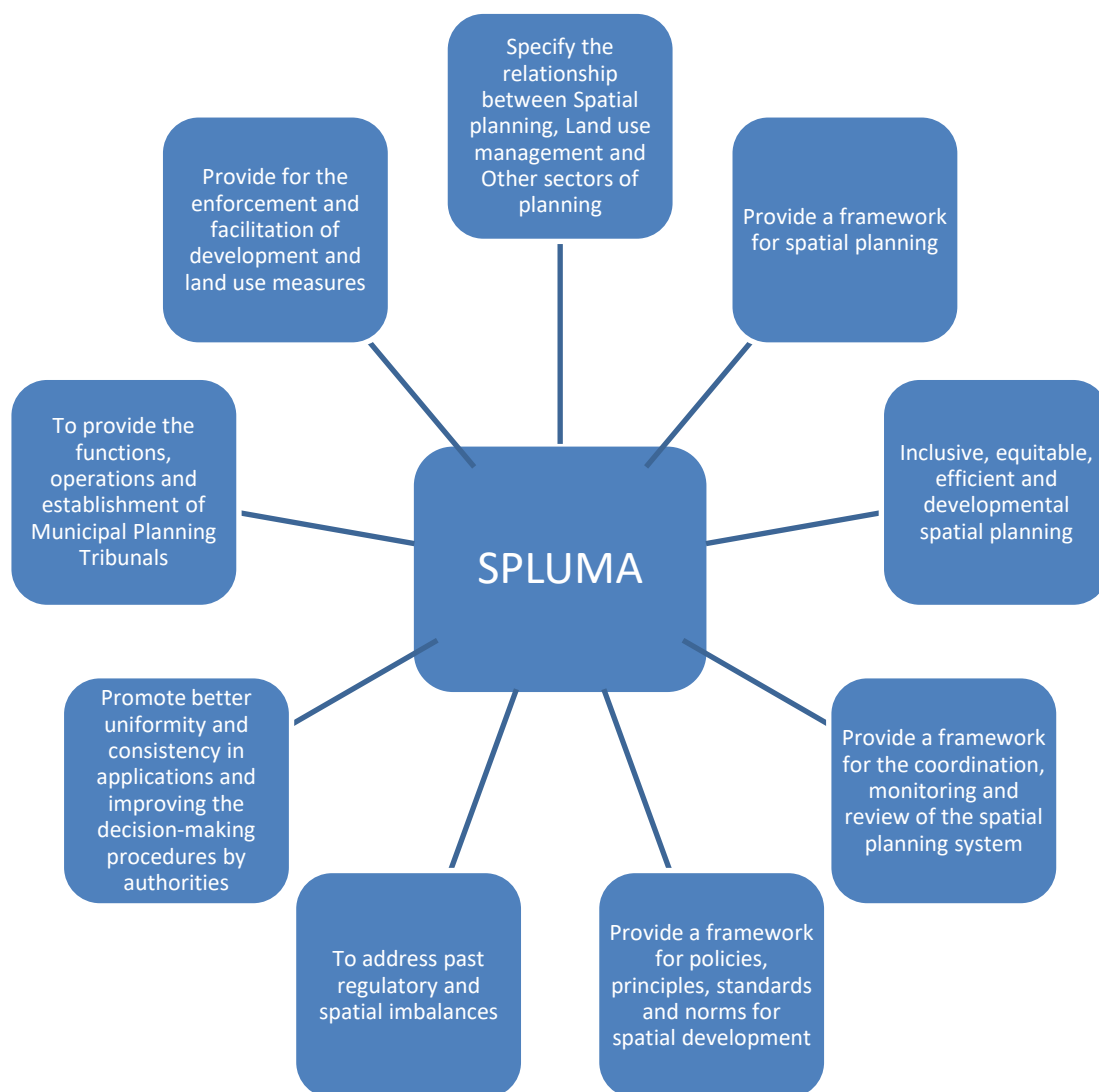


Figure 5-19: Aims of SPLUMA

Source: Adapted from the Spatial Planning and Land Use Management Act (2013:1)

In short, SPLUMA aims to develop a framework which governs planning approvals and permissions, sets boundaries for new developments and makes way for several lawful land uses in South Africa. SPLUMA grants traditional councils the power in numerous decision-making processes and applications which gives the traditional authority power to take over some land-use planning and functions which are located in the municipality.

SPLUMA stipulates four categories of spatial planning on the three spheres of government which can also be related to the three urban systems categorised in Section 3.4 (Spatial Planning and Land Use Management Act, 2013:13):

1) Municipal Planning:

- a. Compilation, review and approval of integrated development plans.
- b. Compilation, review and approval of the components prescribed by legislation which falls within the competence of the municipality (includes spatial development frameworks and land use schemes).
- c. Control and regulate the use of land within the relevant municipal area.

2) Regional Planning

- a. Compilation, review and approval of Regional Spatial Development Frameworks (RSDF).
- b. The RSDF should give effect to national and provincial policies, priorities, plans and planning legislation.
- c. Reflect the current state of affairs in the area from a spatial and land use perspective of the region.
- d. Provide basic guidelines for spatial planning, land development and land use management in the area.

3) Provincial Planning:

- a. Compilation, review and approval of Provincial Spatial Development Frameworks (PSDF).
- b. Monitoring if municipalities comply within the Act and provincial legislation with specific reference to the preparation, review, approval and implementation of land use management systems.
- c. Planning for sustainable and efficient execution of their legislation as they relate to the land development and the change of land uses.
- d. Compilation and review of policies and legislation to be implemented on a provincial planning level.

4) National Planning:

- a. Compilation, review and approval of Spatial Development Plans and policies, such as Spatial Development Frameworks (SDF's).
- b. Planning for sustainable and efficient execution by the national sphere of their legislation when referring to land development and the change in land uses.
- c. Compilation and review of policies and legislation which are required for the implementation of national planning, including measures which are designed to support and monitor all other spheres with a specific focus on their performance on a spatial planning level, land development and land use management.

This is an indication that SPLUMA does recognise the three levels of planning, however, the integration of these government spheres is not fully stated. This again raises concerns as SPLUMA does not incorporate the different urban systems. Each category focusses on specific outcomes and functions and the only category which includes all levels of urban systems is on a national planning scale. Furthermore, SPLUMA does refer to resilience with a specific focus on sustainability, which proves that the concept is being explored in South African legislation. Spatial resilience is mentioned in Section 7 (d) of SPLUMA, whereby it is stated that spatial planning and policies should be flexible to accommodate different land use systems and to ensure sustainable livelihoods in communities as they tend to suffer the impacts of economic and environmental shocks (Spatial Planning and Land Use Management Act, 2013:16). From this section, it is clear that the integration of different urban systems is not stated clearly, and the concept of resilience is also not detailed enough to increase regional resilience.

5.5 Conclusion

This section focussed on both international and national policies with an emphasis on regional resilience in different urban systems. The evaluation of international policies provided a platform for resilience as the policies mostly focussed on several goals on a large scale. These development goals were set into place to assist national governments with the compilation and implementation of policies to improve resilience and quality of life for individuals. When the national policies were evaluated, the detail of policies increased, however, there was not sufficient information on how to increase regional resilience in different urban systems.

The purpose of this chapter was to explore both international and national policies and determine the integration of resilience in terms of different urban systems into legislation and the effect it may have on resilience on different scales. It was determined that the legislation and policies do not emphasise the importance of resilience in different urban systems to such an extent to improve regional resilience in different urban systems. If more emphasis is placed on how to

improve regional resilience and to include different urban systems, it could have an immense impact on the improvement of resilience on different scales.

From this chapter, it was evident that more emphasis was placed on the importance of an integrated and coherent approach from different levels of the government as it would be one of the key drivers to improve regional resilience. From the international policies, it was clear that numerous countries include some kind of resilience in their National Policy Frameworks while giving authority to local governments by motivating that local authorities are largely responsible for building resilience as they focus on a specific geographic location. When referring to national legislation and policies, SPLUMA can be seen as the most relevant legislation implemented currently, which provides guidelines on how to integrate different levels of the government. This is important as it provides a platform to improve the integration of different levels of the government which could, in turn, improve regional resilience in different urban systems.

This chapter was important as it provided background and a foundation of different policies from an international and national perspective. Several concepts of this chapter will be used in Chapter Seven when recommendations are made on how to improve regional resilience in different urban systems by keeping the current legislation and policies in mind. The following chapter will consist of both international case studies, which will explore the implementation of resilience in different urban systems.

CHAPTER SIX: INTERNATIONAL CASE STUDIES

6.1 Introduction

This chapter includes the examination of international case studies with specific reference to regional resilience in different urban systems. The first section of this chapter will focus on the methodology used in the empirical study to enable the reader to understand why the case studies were evaluated in a specific manner. This chapter is important as it aims to explore different case studies to determine the methods used and policies which were implemented in different countries in order to improve regional resilience in different urban systems. The following figure illustrates the composition and outline of this chapter:

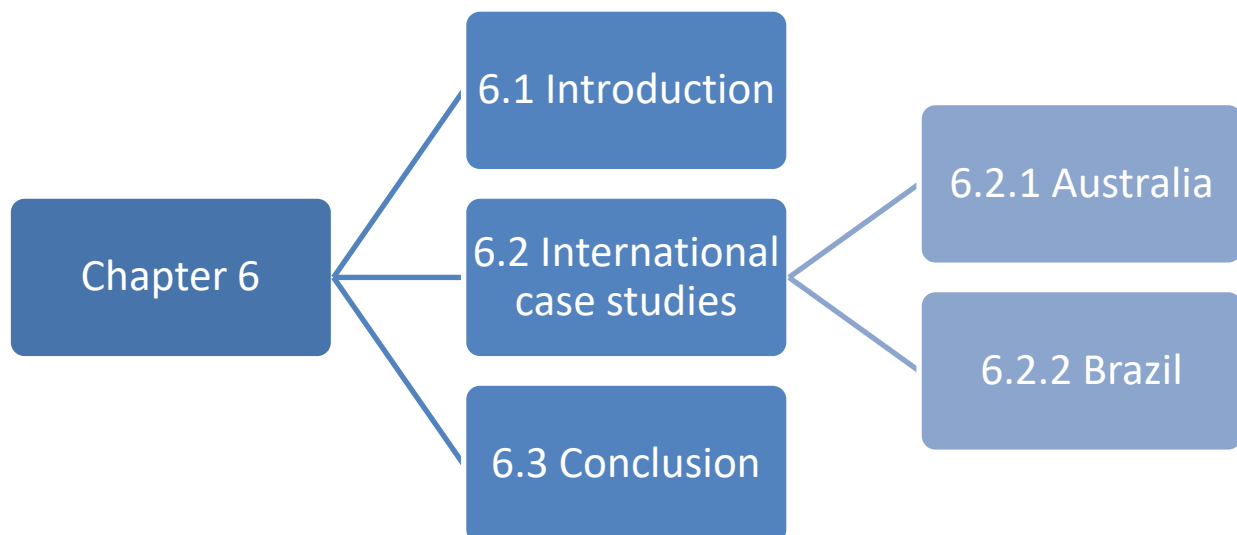


Figure 6-1: Structure of Chapter Six

Source: Own compilation

6.2 International case studies

This section investigates different resilience trends and policies of both developed and developing countries. The first section will focus on a developed country, i.e. Australia's legislation and policies; where the second section will focus on a developing country (Brazil) which both encompasses similar regional characteristics as South Africa. The reason why international case studies were used for both a developed and a developing country is to develop a benchmark with which to measure South Africa (specifically the Northern Cape province) against, with specific reference to regional resilience in different urban systems (refer to Chapter Seven). The case studies will place focus on (i) population distribution when referring to urban systems; (ii)

policies/legislation implemented to improve regional resilience in different urban systems and (iii) mechanisms/ development objectives used to improve regional resilience.

All the counties selected for the case studies form part of the Organisation for Economic Co-operation and Development (OECD), which is an intergovernmental economic organisation whose mission is to promote policies which will improve both the economic and social well-being of people all around the world (OECD, 2018). The OECD intends to provide a platform for governments to collaborate and to seek solutions to common problems. OECD currently has memberships of thirty-six countries with the focus on (i) restoring confidence into markets and institutions; (ii) re-establish healthy finances as it is a basis for future and sustainable economic growth; (iii) foster and support sources of growth through innovation, environmental friendly strategies and the development of emerging economies and lastly (iv) to ensure that people develop the necessary skills to work productively while achieving a high level of job satisfaction (OECD, 2018). This chapter is important to the study as it addresses the second research objective i.e. “Different policies will be examined to improve regional resilience” and the third research objective i.e. “Linkages between urban and rural areas will be evaluated”. This chapter, therefore, aims to identify the linkages between rural and urban areas with a specific focus on urban systems and their rank-size distributions. In addition, this chapter also aims to evaluate different policies implemented/mechanisms used to improve regional resilience in different urban systems. The following section will describe several characteristics of Australia, the spatial distribution of cities and towns and policies which were implemented/will be implemented to improve resilience.

6.2.1 Australia

Australia is located South of Indonesia and is bordered by both the Pacific and Indian Ocean and has no bordering countries. Australia is also the 6th largest country in land area and is the only nation who governs an entire continent (Department of Foreign Affairs and Trade, 2016:6). Furthermore, Australia is successful when referring to the United Nations Development Programme as it was ranked second in their Human Development Report in 2014. Australia’s economy is generally consistent and is ranked as one of the strongest and advanced economies of the OECD countries and is classified as a developed country. The figure below illustrates the location of Australia on a world map:



Figure 6-2: Location of Australia

Source: King & Cole (2018)

6.2.1.1 Background

The continent was partly mapped by French and British navigators in the seventeenth century, but the east coast was only charted and claimed for Great Britain in 1770 by Captain James Cook (Department of Foreign Affairs and Trade, 2016:8). Gold was discovered in New South Wales and Victoria in the 1850's and caused a gold rush of immigrants from all over the world. Economic growth and sustainability can be defined as a sustained increase in the trend level of either the aggregated production in the GDP or average GDP per person (Fourie & Burger, 2009:13). GDP is measured over time and therefore, it can be evaluated either in the short-term (this will indicate cyclical fluctuations around the long-term trend) or in the long-term (indicates the baseline which includes the short-term fluctuations) which is important to keep in mind when evaluating the welfare and wealth of people (Fourie & Burger, 2009:13). Therefore, the GDP can be used to examine the economic growth of several countries and indicate the level of economic development of a country. Australia's economy is diverse and stable with an average of 3.3% GDP growth a year for the last twenty-five years (Department of Foreign Affairs and Trade, 2016:18). They focus on the mining, agricultural, manufacturing and services sectors (Department of Foreign Affairs and Trade, 2016:9). The service sector accounts for the largest part of the Australian economy where it contributes to approximately 60% of the Gross Domestic Product (GDP) with a specific focus on financial services and strong regulations (Department of Foreign Affairs and Trade, 2016:18). The following figure illustrates the key economic sectors of Australia which contribute to its diverse and strong economy:



Figure 6-3: Important economic sectors in Australia

Source: Department of Foreign Affairs and Trade (2016:19)

Figure 6-3 illustrates five of the key economic sectors which Australia focus on i.e. (i) agri-business (ii) education (iii) tourism (iv) mining and (v) wealth management. Australia is focussed on engagement with the rest of the world through common strategic interests and trade and plays an active role in global and regional groups, such as (Department of Foreign Affairs and Trade, 2016:28):

- Asia–Europe Meeting (ASEM)
- Asia–Pacific Economic Cooperation (APEC)
- Association of Southeast Asian Nations (ASEAN)
- Commonwealth
- East Asia Summit (EAS)
- Forum for East Asia–Latin America Cooperation (FEALAC)
- Group of Twenty major economies (G20)
- Indian Ocean Rim Association (IORA)
- International climate change negotiations
- Organisation for Economic Co-operation and Development (OECD)

- Pacific Islands Forum (PIF)
- United Nations (Became a founding member of the UN in 1945)
- World Trade Organisation (WTO)

The organisations, as mentioned above, have an impact on the compilation of policies as they would adhere to the main objectives/ principles as set out by these organisations. Therefore, it is important to note that most of these organisations are focussed on improving economic growth and to encourage trade. Australia can be categorised into six regions: (i) New South Wales; (ii) Queensland; (iii) South Australia; (iv) Tasmania; (v) Victoria and (vi) Western Australia. Each of these regions is then again divided into sub-regions which are not important for the purpose of this study. The following figure illustrates the six regions and their location within Australia:



Figure 6-4: Australian map

Source: King & Cole (2018)

The figure above illustrates the six regions of Australia which would be significant to this section for orientation purposes, especially when focussing on the spatial distribution patterns of the population. The spatial distribution of the population would give an indication of the urban hierarchies found in Australia, where it will be evaluated against Brazil and South Africa in terms of the rank-size rule (refer to Section 3.2)

6.2.1.2 Population distribution characteristics

For the purpose of this study, population distribution was used to illustrate and determine different hierarchical orders and their distribution in the urban system as proposed by Berry (1972). Thus, this study will only encompass the spatial distribution of Australia in terms of their population as a population can be used to measure or determine the hierarchical order of settlements and it was the only way the hierarchy could be determined (refer to Sections 3.2.1, 3.2.2, 3.2.1 and 4.5).

Australia's population growth is most prominent along the coast, in inner-city areas, in outer suburbs and in urban infill areas. Areas which had a population decline include the rural areas (which have been affected by drought), mining areas and the inland (Australian Bureau of Statistics, 2018). The following figure illustrates the population density and remote areas as described above:

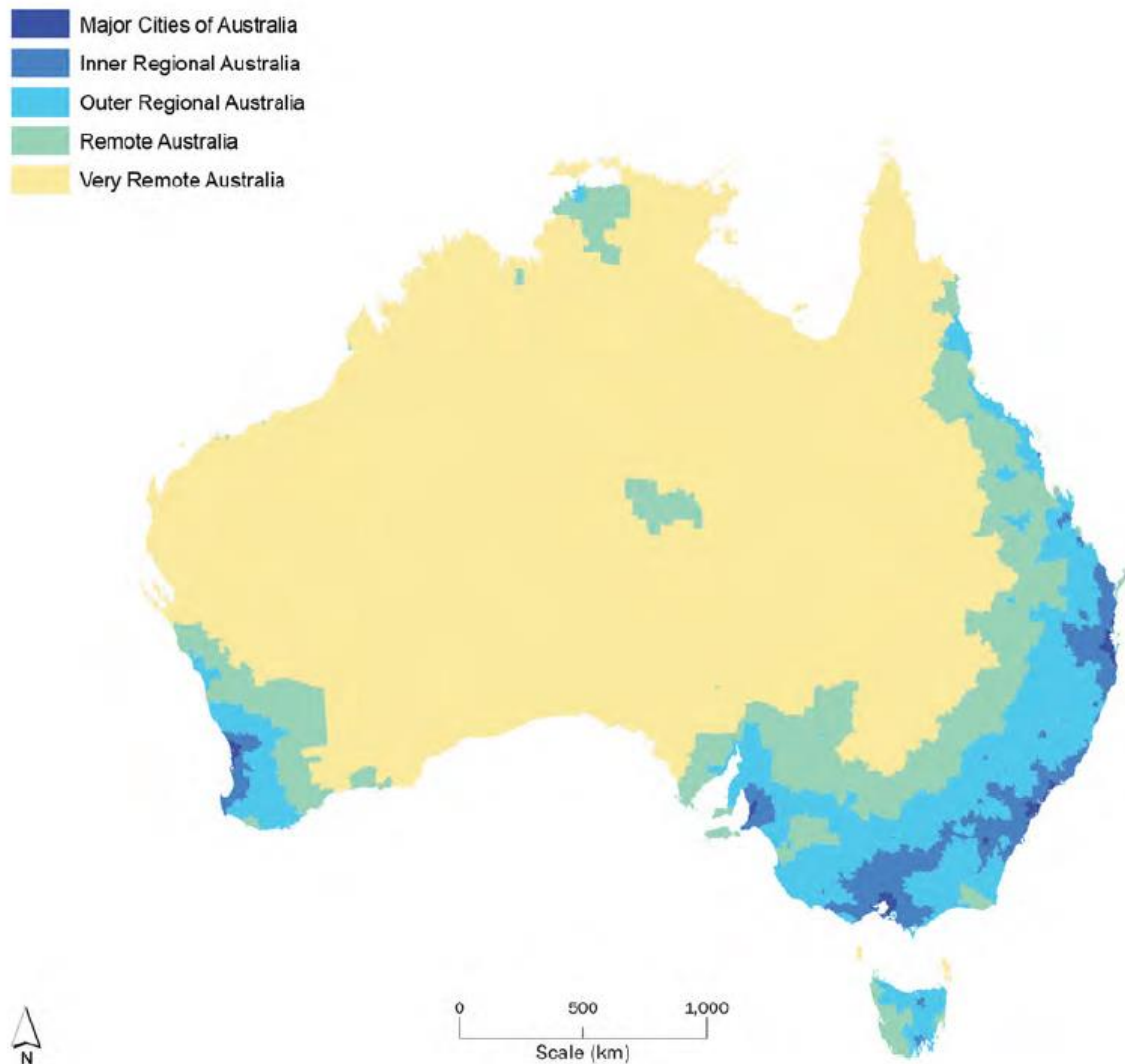


Figure 6-5: Population density and remoteness classes in Australia

Source: Australian Bureau of Statistics (2011)

The figure above illustrates the population density of Australia. It is evident that the highest population densities are generally on the eastern side of Australia along the coast (Queensland, New South Wales and Victoria) with other densely populated areas in the western side (Western Australia) and northern side of Australia (Northern Australia).

The population densities amongst other factors were then used to demarcate Greater Capital City Statistical Areas (GCCSA) and Significant Urban Areas (SUAs). The SUA regions are concentrated in urban areas with a population of >10 000 which generally includes the urban core and some of the surrounding hinterland (refer to Section 3.3). The figure below illustrates the GCCSAs and SUAs identified within Australia:

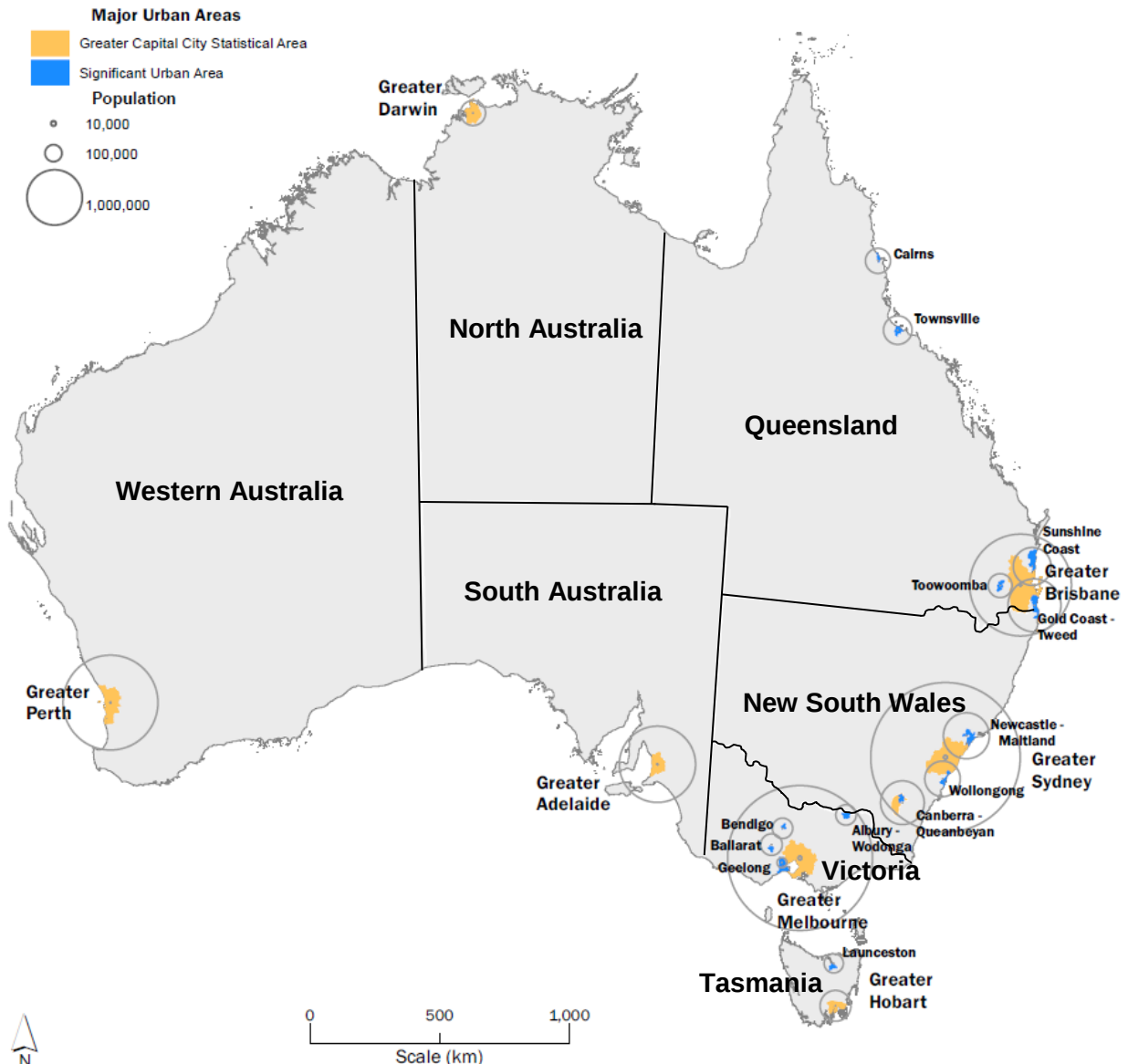


Figure 6-6: Significant Urban Areas of Australia

Source: Adapted from Australian Bureau of Statistics (2016)

The figure above illustrates the seven capital cities identified (excluding Canberra) as Greater Capital City Statistical Areas (GCCSAs) which mainly represents the major urban areas in Australia. The boundaries of the GCCSAs includes individuals who work, shop or even socialise in each city - which includes the individuals who reside in small and rural areas surrounding the major urban areas (refer to Section 3.3.1 and 3.3.2). Furthermore, 13 Significant Urban Areas were identified and do not include the functional labour market which results in a smaller demarcated area (refer to the functions of the different urban systems in Section 3.4). It is important to note that the GCCSAs and SUAs are not bounded to a specific region but cross the border of regions to include the wider urban extent. This proves that regions should not be bound to a specific area and can be categorised according to their functionality and population density.

From Figure 6-6, it is also clear that the spatial scale differs and is influenced by factors, such as population density.

As described in Section 3.2, urban hierarchies can be categorised, amongst other things, according to their population density. Therefore, it could be of significance to this study to evaluate the spatial distribution in terms of population densities to identify different hierarchies located in Australia. Table 6-1 below describes seven different settlement categories together with the population density of each of these settlements and the projected Australian population in 2011.

Table 6-1: Population distribution of different scale settlements in Australia in 2011

	Settlement Category	Population Amount	Projected Population
1	Big cities	>1 million	13 000 535
2	Other cities	80 000-1 million	2 914 838
3	Large regional/ rural	25 000-80 000	1 349 681
4	Small regional/ rural	10 000-25 000	1 337 903
5	Other regional/ rural	<10 000	1 936 494
6	Remote centres	> 5000	251 084
7	Other remote		328 745
Total			21 119 280

Source: Adapted from Australian Bureau of Statistics (2018)

The table above illustrates the population density of Australia with the projections of the population density of 2011. For illustrative purposes, the data as illustrated in the table above were used to compile a column graph to process the data into a form which can be easily compared to similar data from other countries.

This would be of relevance to the study as it indicates the spatial distribution of settlements, especially when focussing on the population density of different category settlements. The figure below, therefore, illustrates the population density found in each of the settlement categories as depicted in Table 6-1 above:

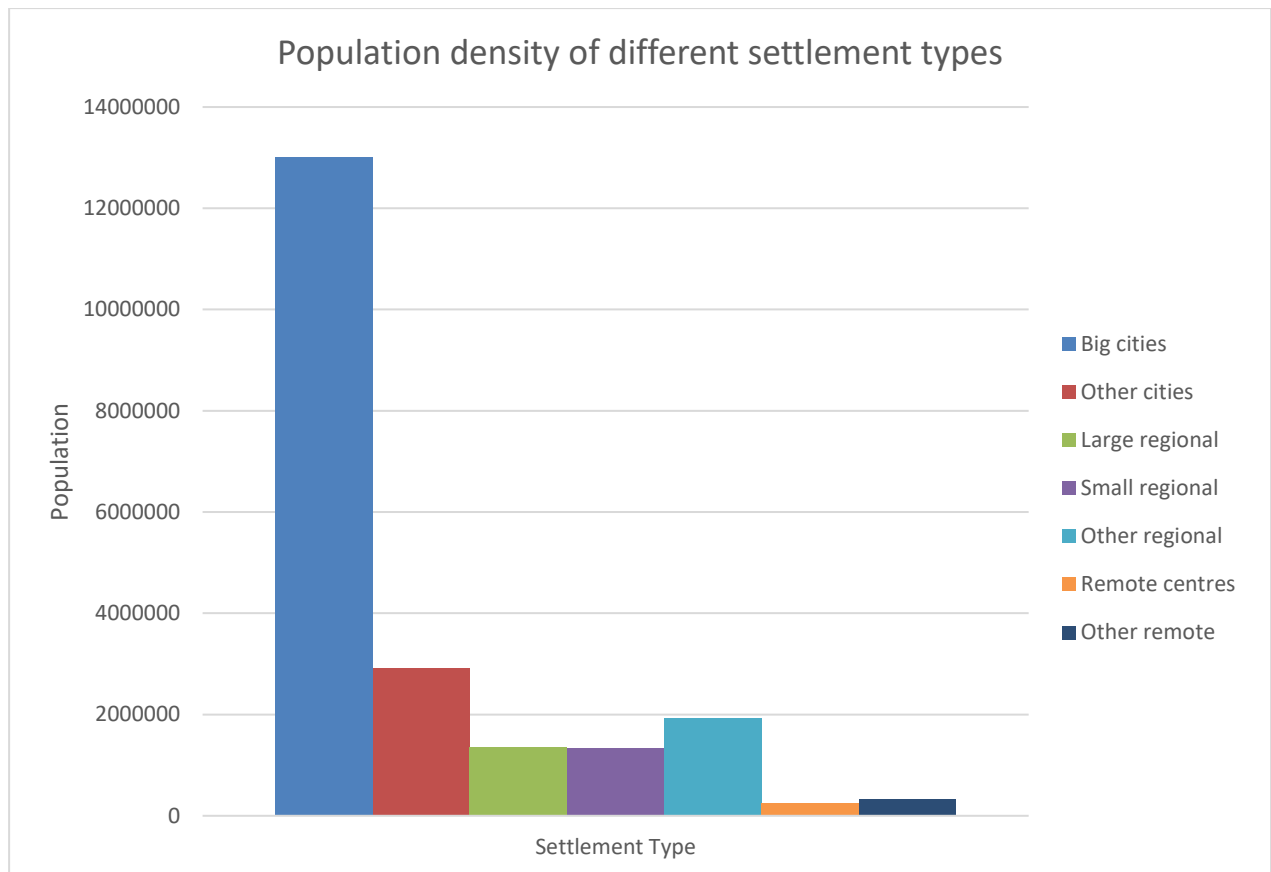


Figure 6-7: Cart illustration of the population density of Australia in seven settlement categories

Source: Own compilation

The figure above illustrates the population density of Australia of 2011 for seven settlement categories which will be compared to Brazil and South Africa later in the study. The Australian Statistical Geography Standard used these settlement distributions and categories and proposed their own Remoteness Areas (RA), which fit the spatial distribution of Australia better. The purpose of these new classifications was to provide a consistent definition which can be used by all Australians. The Remoteness Areas are measured by using the accessibility and Remoteness Index of Australia (ARIA+) and are derived by using the road distance from a point to the nearest urban centre together with migration and population trends to separate it into categories. Thus, these calculations are accurate especially when taking remoteness of areas into account. In this way, the “rurality” and population sizes are taken into account and can give an indication to the Australian government of the current settlement statuses and to assist in service planning, demographic analysis as well as resource allocation (Hugo Centre, 2018).

Therefore, the following table will illustrate more recent population density figures, however, the reader should note that there are only five Remoteness Areas instead on seven as illustrated in Table 6-1. The population distribution figures from 2015 are more recent population figures which will, in turn, provide a more accurate assessment of the current population distributions of different

settlements. These Remoteness Areas will be challenging to compare with other countries as they were specifically designed for the spatial distribution of Australia and other countries would not necessarily categorise their settlement types accordingly. The following table illustrates the population distribution of Australia when referring to the RAs for Australia:

Table 6-2: Population distribution of Australia in 2015

	Description	Population
1	Major Cities	16864416
2	Inner Regional	4302781
3	Outer Regional	2085434
4	Remote	321129
5	Very Remote	204017
Total		23 777 777

Source: Australian Bureau of Statistics (2018)

For illustrative purposes the data is depicted above was again illustrated by using a column graph:

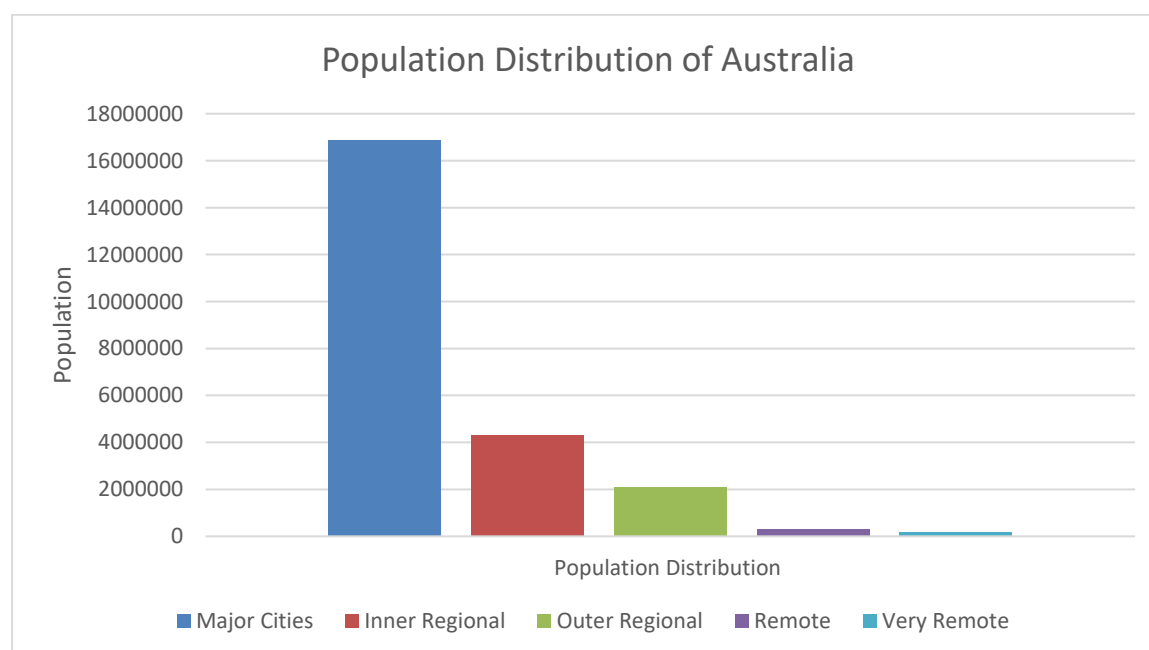


Figure 6-8: Graph illustrating the population density of Australia in 2015 according to their RA

Source: Own compilation

Figure 6-8 above illustrates the population distribution of the five RAs in Australia as identified by The Australian Statistical Geography Standard. When comparing Figure 6-7 and 6-8, it is clear that the spatial distribution of the different settlement categories is lower in Figure 6-8 than 6-7 and this could indicate that the rural population is smaller than expected. The following section will evaluate the designing process of Australian policies and will also identify the main development objectives when referring to regional resilience in different urban systems.

As described in Section 3.2 and 4.5, urban hierarchies can be categorised according to their population density. Therefore, it could be of significance to this study to evaluate the spatial distribution in terms of population densities to identify different hierarchies located in Australia. Figure 6-9 below illustrates the population density of the fifty largest cities in Australia. Only 50 cities were used in the calculations as the rank-size rule is mainly focussed on the largest cities, while incorporating other cities to determine the type of hierarchical distributions (refer to Figure 3-2). Furthermore, the rank-size rule as described in Section 3.2.1 was also included in the dataset to illustrate the ideal hierarchical distribution of the country.

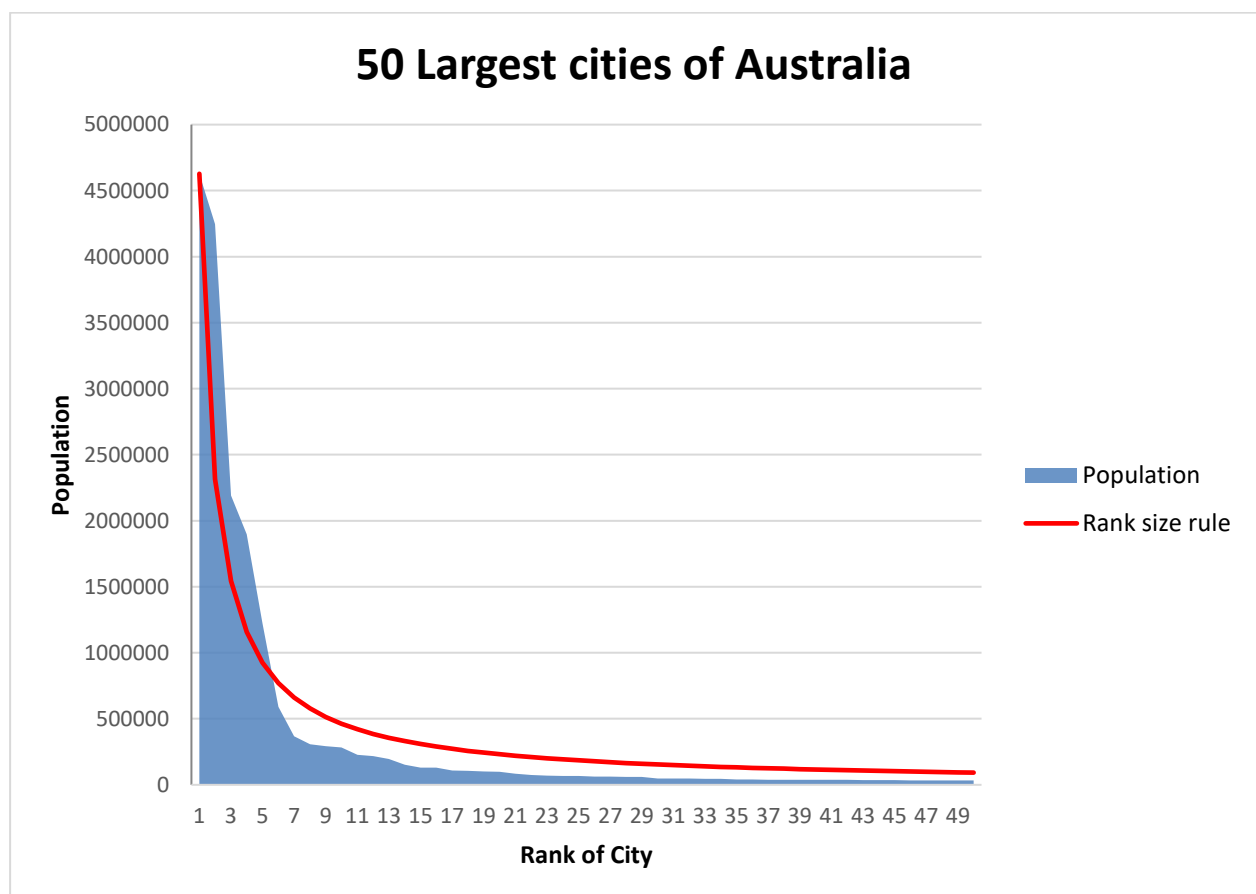


Figure 6-9: 50 Largest cities in Australia

Source: Own compilation from Berry (1972) and the World Population Review (2018)

From the figure above, it is clear that the Australian population is larger than predicted for the six largest cities as it does not conform to the rank-size rule. Furthermore, from the figure above the smaller cities are also generally smaller in population size than expected, according to the rank-size rule. If the data is converted into a logarithm, the rank-size distribution will illustrate the type of distribution as discussed in Section 3.2.1:

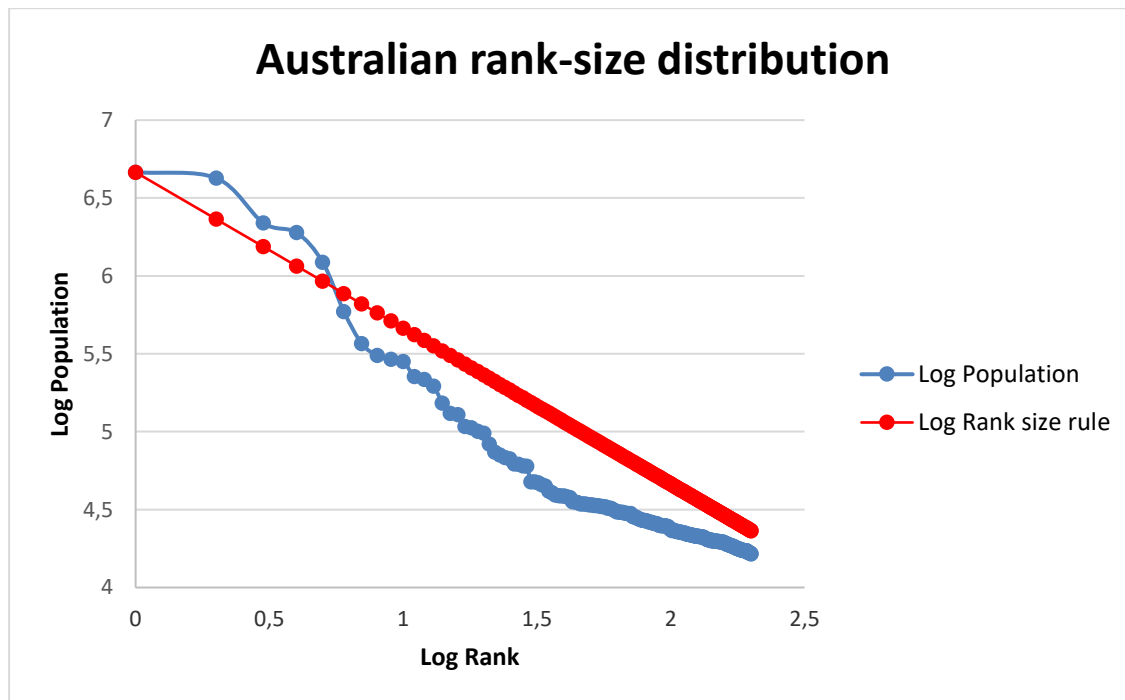


Figure 6-10: Australian rank-size distribution

Source: Own compilation from Berry (1972) and the World Population Review (2018)

The figure above illustrates that the largest cities of Australia can be categorised as a convex distribution (refer to Section 3.2.1), as the population size is larger than expected according to the rank-size distribution but is expected for a developing country as described in Section 3.2.1. The remaining cities follow a log-normal distribution even though the population is slightly less than estimated. According to Johnson (1980), a convex distribution is generally due to low urban system integration and the log-normal distribution indicates integration of the urban system.

6.2.1.3 Policies

This section will focus on the process the Australian government follows to develop and implement regional policies. This section is of importance to this study as it could provide an indication as to how developed countries (i.e. Australia) structure and implement their rural policies. These concepts can be used later in the study to recommend policy interventions and implementation on a South African level.

6.2.1.3.1 Policy Design Process

This section is important as the concepts of the policy design process of the international case studies of both developed and developing countries will be used to recommend concepts to ensure efficient and effective policy designs for South Africa. The approach to be taken by international countries could benefit South Africa as these case studies also encompass similar challenges which South Africa is currently facing.

Australia is one of the most urbanised countries in the world, where it is estimated that 89% of the population resides in urban areas. This high urbanisation rate contributes to several urban challenges (Webb *et al.*, 2018) which are illustrated in the figure below:

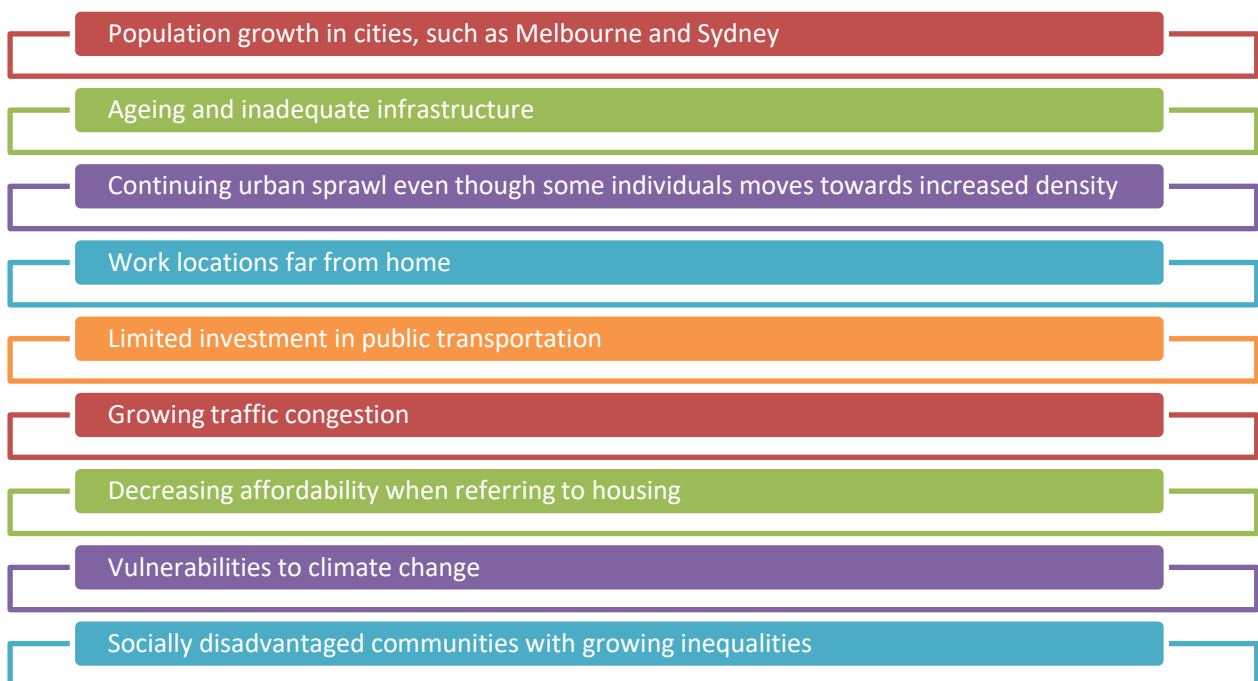


Figure 6-11: Current and emerging challenges for Australia

Source: Adapted from Webb *et al.* (2018)

The figure above illustrates the current and emerging challenges of Australia, especially when referring to the population who resides in urban areas. These challenges pose a threat to the liveability as they could all influence the quality of life of the residents. Even though these challenges pose a threat to the liveability, the findings of the latest liveability index concluded that Melbourne ranks as the second most liveable city in the world (The Economist Intelligence Unit, 2018:2). Furthermore, other Australian cities also placed high of the hundred and forty cities surveyed for the liveability index of the world where Melbourne placed second, Sydney fifth and Adelaide tenth. The categories for which the liveable cities were measured against is (i)

infrastructure; (ii) stability; (iii) education; (iv) healthcare and (v) culture and environment (The Economist Intelligence Unit, 2018:2). This strengthens the idea that Australia overall has sound policies and principles in place to improve the livability of their residents and these measurements also interlinks with regional resilience as described in Section 4.4.

Australia also strives to include several of the key challenges as set out in the Strategic Research Agenda 2014 from Future Earth. Future Earth can be described as a global research platform which is designed to provide knowledge which is required to support the transformation of areas towards sustainability (Future Earth, 2014:3). The Strategic Research Agenda of 2014 also intends to provide guidance for solutions with reference to research orientated problems to meet the global societal challenges as identified in the Future Earth 2025 Vision (Future Earth, 2014:3). The Strategic Research Agenda of 2014 identified eight key focal challenges where challenge number four is relevant to the study:

4

Build healthy, resilient and productive cities by identifying and shaping innovation which will combine improved urban environments and lives with declining resource footprints, and provide efficient services and infrastructures which are robust to disasters

Figure 6-12: Key focal challenge four relevant to global sustainability challenges

Source: Future Earth (2014:6)

The figure above directly refers to the resilience of cities and **the provision of infrastructure and services** which are robust. Sustainable urban development was then identified as a core theme for Australia by national and state level representatives and local council representatives of both inner city and urban councils. This co-design process led to the identification and contact with stakeholders and a review of several metropolitan strategies and plans for the national capital and each state capital with, amongst others, the focus on the review on urban systems and transformation to ensure a more holistic view of urban systems. With extensive research, it was identified that a more systems-oriented and transformational approach should be taken for Australian urbanisation. The approach to guide the decision-making which progressively developed through participation by several stakeholders and entities was identified as three phases (i) understanding context and goals; (ii) framing knowledge priorities and (iii) developing knowledge and solutions; as illustrated in the figure below:

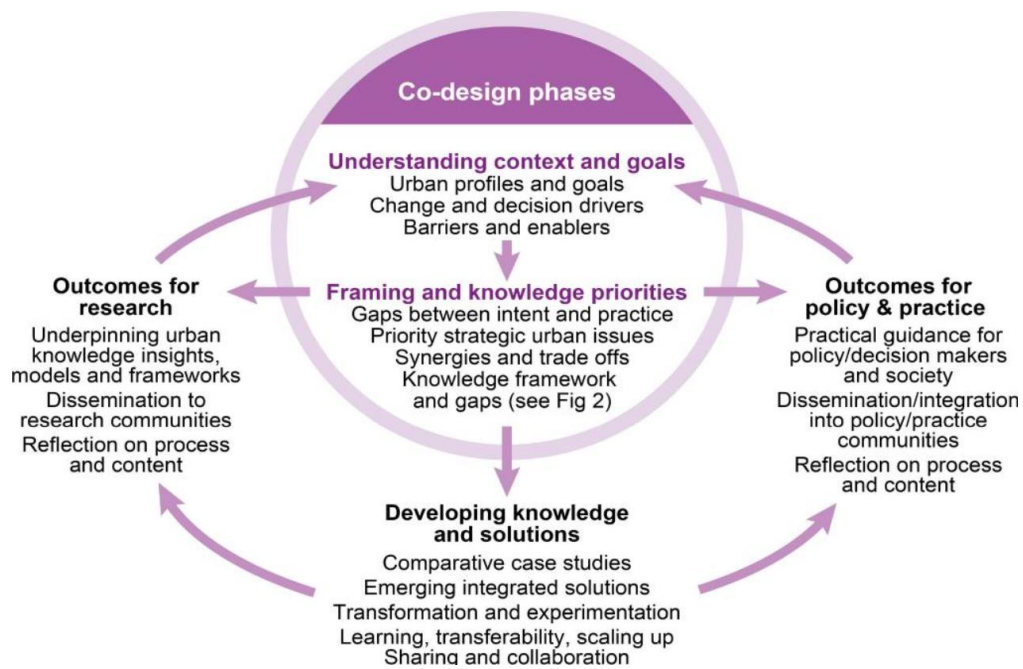


Figure 6-13: Co-design process used with stakeholders

Source: Webb *et al.* (2018)

Figure 6-13 illustrates the process to be followed by sustainable urban development through the design process with several stakeholders. When these phases are followed, two outcomes are expected. (i) Outcomes of policy and practice which can be used as practical guidance for policies which will assist the government, investors, the community etc. and (ii) outcomes for research which provides insights, models and frameworks that would contribute to collaborative research in the future. According to Webb *et al.* (2008), these two outcomes ensure a flexible process which is vital when dealing with complex systems. This approach is compatible with transdisciplinary research for complex and challenging issues, such as sustainable urban development, as several definitions and terminology exist (Webb *et al.*, 2018). This approach also ensures that the process to be followed is consistent, open and inclusive, which leaves room for iterative and flexible thinking, encourages diversity of knowledge and experience, which facilitates knowledge integration.

By using the above-mentioned approach, a framework for sustainable urban development was developed which also aligns with the Sustainable Development Goals (refer to Section 5.2.1). The sustainable development framework does not only include the use and impacts of sustainable resources, but also the need for livable, inclusive, equitable and resilient development. The figure below illustrates the knowledge framework for sustainable development for urban systems which is connected across different urban scales:

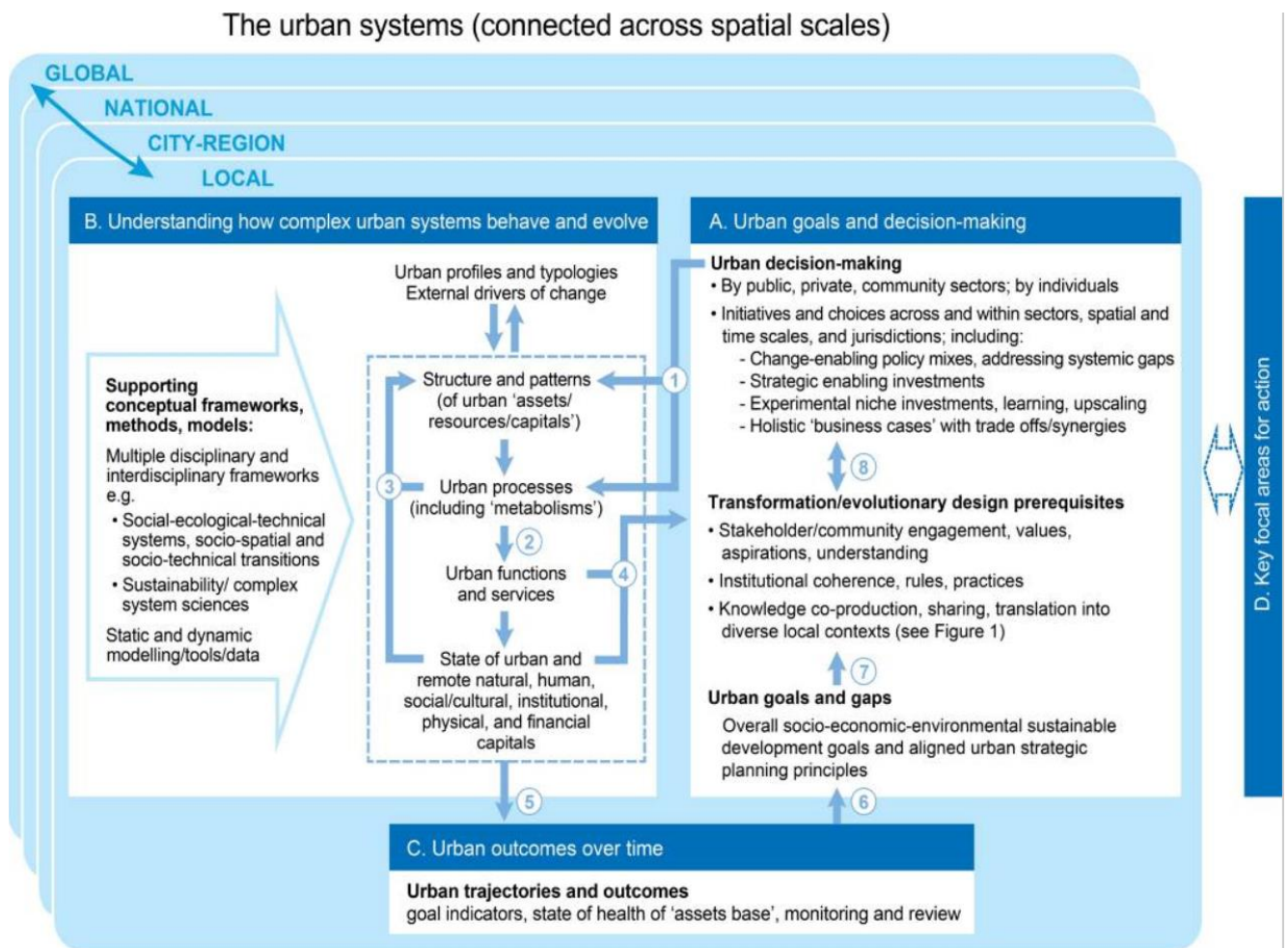


Figure 6-14: Knowledge framework for sustainable urban development

Source: Webb et al. (2018)

Figure 6-14 above illustrates the proposed knowledge framework for sustainable urban development which was developed through the co-design process, as illustrated in Figure 6-13. This proposed framework as illustrated in Figure 6-14 is evolutionary as it identified linkages between (number one) urban decisions at all levels having a direct impact on the spatial patterns and structure of urban areas as well as the urban system (number two) the level of functions and services of urban areas over a period (number three) feedback of the services and functions of urban areas and also identifies the impacts or outcomes of the functions and services over a period (see number four, five and six). These impacts will in return influence future decision-making and assist with the compilation and implementation of future policies. The figure also illustrates the inclusion of international goals, such as the Sustainable Development Goals (number seven) and the decision-making process where the participation of all stakeholders is vital to recognise, explore, accommodate and respond to the nature of complex urban systems (Webb, et al., 2018).

As mentioned in Section 3.4, urban systems can be described as multiple and interconnected spatial systems which function on different scales (local, metropolitan, regional, national and global). Figure 6-14 therefore, illustrates the knowledge framework of sustainable urban development, which consists of Component A, Component B, Component C and Component D (which are described below):

- Component A: Urban goals and decision-making

This component includes the facilitation of transformative and integrated urban system strategies. It is proposed that the decision-making is goal orientated which is compatible with both national and international goals, such as the SDG's (refer to Section 5.2.1) and the New Urban Agenda (refer to Section 5.2.2). By incorporating these goals and their interdependencies, together with the combination of sustainability to individual communities as well as a gap analysis, they offer a platform to assess urban priorities and assist with the addressing of trade-offs and synergies. Stakeholder engagement of all decision-makers (individual, institutional as well as political spheres) are required for short-, medium- and long-term actions to ensure sustainable development.

- Component B: Understanding the complexity of urban systems and how they behave and evolve

Section 4.5.2 described the complexity of urban systems and it should be incorporated when strategies and frameworks are developed. For instance, urban profiles can be described as unique in terms of their stage of development (refer to Chapter Two) rate of urbanisation (refer to 3.2.3), urban form, location and function (refer to Sections 3.2 and 3.3). Furthermore, it should also be noted that urban areas are open systems which have several interactions with regions and beyond and therefore, policies and strategies should be developed to strengthen the urban system overall by means of national, regional and local policies.

- Component C: Urban outcomes

An urban system is dependent on numerous factors and it is challenging to project the outcomes. It is, therefore, important to guide policies and frameworks in such a manner that goals could be achieved. Flexible approaches should, therefore, be implemented on a multi-governance level as a top-down and command and control approach is not necessarily the most effective approach when referring to the implementation of frameworks and policies.

- Component D: Key focal areas which require action

The last component refers to areas which should be identified for action. These areas should be identified as focal areas where both decision-makers and policies would have a chance to successfully guide sustainable urban transformation. The focal areas identified for Australia are described in the following section.

6.2.1.3.2 Implementation of Policies and Frameworks

The following figure illustrates six strategic decision-making areas which could contribute to sustainable urban development in Australia as mentioned in Section 6.3.1.2 (key focal areas which require action):

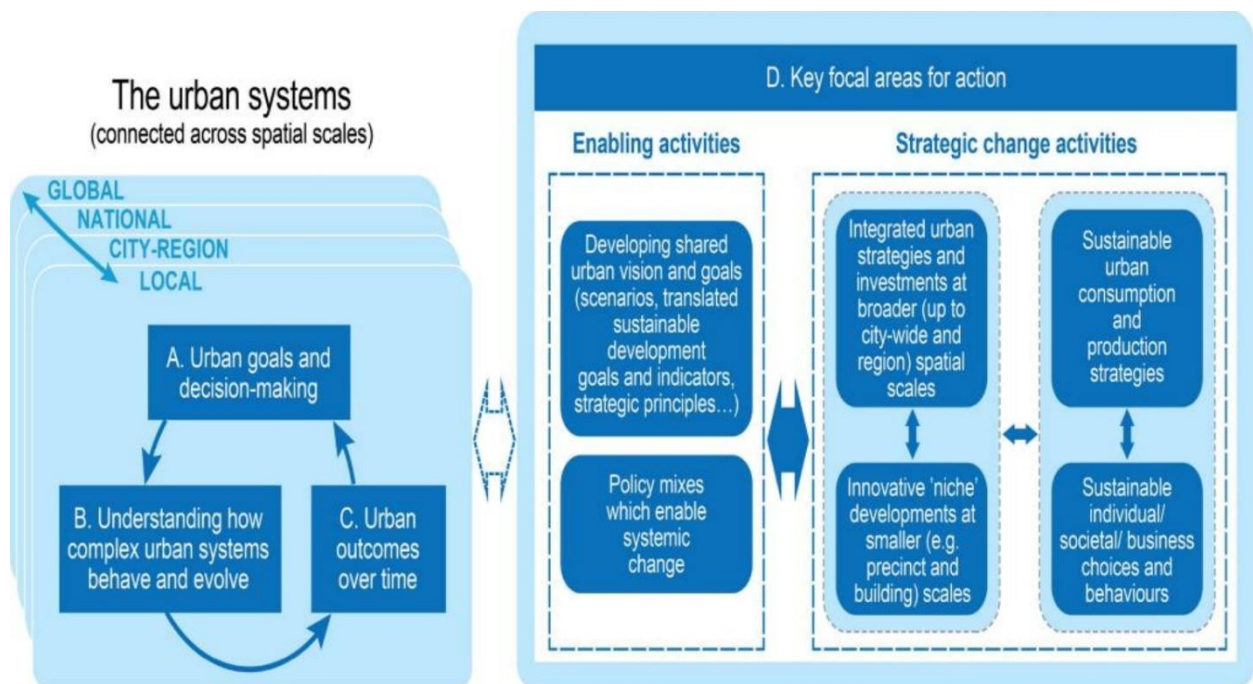


Figure 6-15: Key focal areas which requires action

Source: Webb et al. (2018)

The figure above is elaborative on Component D: Key focal areas which require action (refer to Section 6.3.1.2) which were identified in the co-design process with the relevant stakeholders. In the process, it was recognised that even though locally driven initiatives at precinct levels demonstrate the potential for new approaches, the value of such initiatives can be enhanced by complementary strategies which encourage sustainable development. Nevertheless, the focus was still placed on transformative change across broader spatial scales to include the metropolitan region across several sectors.

6.2.1.3.3 Development objectives

Australia's policies are dedicated to enhancing stability through economic growth, promoting prosperity and to reduce poverty (Department of Foreign Affairs and Trade, 2016:42). The policies are generally focussed neighbourhoods as they are of opinion that these make the biggest difference. The priority areas of Australia's investment are as follows:

Priority areas of Australian investment	Agriculture, fisheries and water
	Building resilience
	Education and health
	Effective governance
	Gender equality and empowering women and girls
	Infrastructure, trade facilitation and international competitiveness

Figure 6-16: Priority areas of Australian investment

Source: Adapted from the Department of Foreign Affairs and Trade (2016:42)

Figure 6-16 illustrates the priority areas identified for Australian investment. These priorities are significant to the study as they directly refer to building regional resilience, effective governance and lastly infrastructure, trade facilitation and international competitiveness. These priorities can be seen as mechanisms which can be used to improve regional resilience in different urban systems (refer to Sections 3.2, 3.3, 4.2.2, 4.3 and 4.4). Australia has a strong regional component and therefore, the Australian government also introduced a regional development initiative in 2008 to bring all levels of government together and to enhance the development of regions within Australia (refer to Section 6.2.1.3.2). Furthermore, the Australian government committed to releasing a Regional Development Policy which anticipates a range of key issues which includes the following:

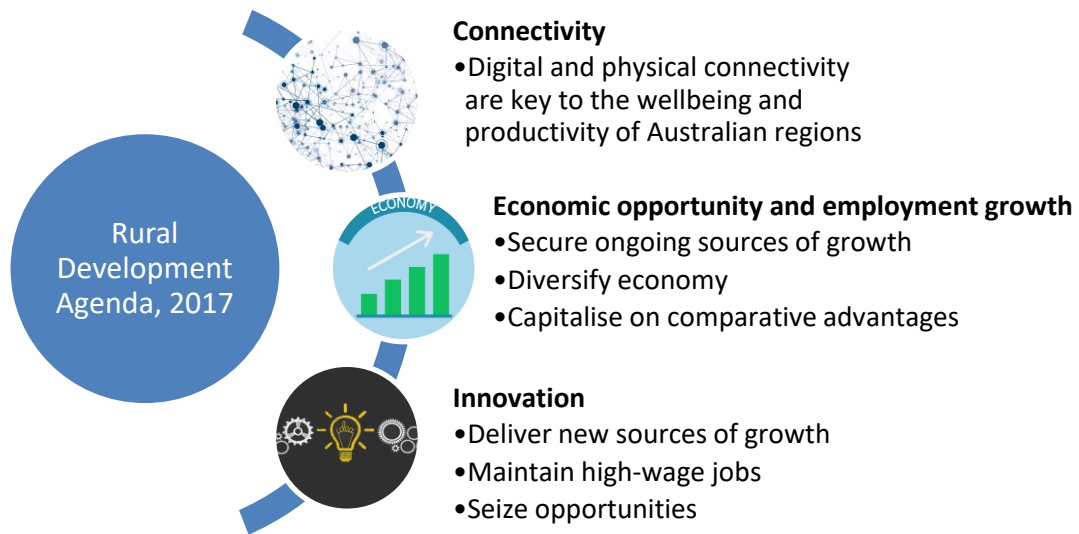


Figure 6-17: Rural Development Agenda, 2017

Source: Adapted from the Department of Infrastructure and Regional Development (2016:20)

Figure 6-17 illustrates the three main objectives which will be included in the Rural Development Agenda, 2017 i.e. (i) Connectivity; (ii) Economic opportunity and employment growth and (iii) Innovation (Department of Infrastructure and Regional Development, 2016). This again indicates that Australia is focussed on regional development by improving infrastructure and promoting economic opportunities by means of innovation (which is categorised as a component to increase resilience as described in Section 4.3). Another programme Australia initiated to improve regional resilience is the Regional Australian Institute (RAI), which is a leading inquiry programme that targets issues of importance for both policymakers and Australian regions. The RAI focusses on three regional and town projects which are illustrated in the figure below:



Figure 6-18: Projects to be completed by RAI to improve regional development

Source: Regional Australia Institute (2018)

Figure 6-18 illustrates three identified projects to be completed to the Australian government to improve regional development. These projects were identified as it would assist how policies are developed and to investigate how regions respond to opportunities provided by the Australian government (Regional Australia Institute, 2018). It is important to note that the projects are constructed in such a way to (i) understand how cities and towns interact within a region; (ii) to identify the current policies implemented to improve regional development with specific focus on smaller cities and towns and lastly (iii) to investigate the effect these policies have on regions. They also intend to provide a framework to guide the government to develop policies in such a manner to complement the region and not only the urban areas. This approach could improve regional resilience significantly as Australia is not only focussed on the development of major urban areas but intends to include hinterlands and to improve connectivity of rural areas to provide economic opportunities and to ensure regional growth (refer to Section 4.4.1).

In short, Australia is currently focussed on developing a holistic approach to include different role players (academics, the private sector as well as government) to develop policies on different spatial scales. Regional policies generally include regional development and facilitates investment opportunities on connectivity (infrastructure), economic opportunities (economic growth especially by means of trade) and innovation (to develop the most efficient and productive products) which can all be directly linked to the concepts of resilience as described in Section 4.4

There is significant investment in collaborative research on different spatial scales which indicates that Australia is following a pro-active (bottom-up approach) when referring to the development of regions. Investment opportunities are also evaluated to the development of the broader region and are not only focussed on a singular major city. Australian policies also include the concept of polycentric regions and recognise that rural and urban systems are strongly connected (refer to Section 4.4.2).

6.2.2 Brazil

Brazil is located within South America and has several bordering countries, such as Argentina, Bolivia, Columbia, Guiana, Guyana, Paraguay, Suriname, Uruguay and Venezuela. Brazil is also bordered by the Atlantic Ocean on the eastern side. Brazil currently has the seventh largest economy in the world (OECD, 2018:4) and is categorised as a developing country; it is also part of the BRICS (Brazil, Russia, India, China and South Africa) countries which was identified as leading emerging economies and political powers on both regional and international levels (Morazan *et al.*, 2012:4). The figure below illustrates Brazil's location on a world map:



Figure 6-19: Location of Brazil

Source: King & Cole (2018)

6.2.2.1 Background

Brazil has a unique settlement pattern as Portuguese colonisers took over Brazil for the purpose of extracting natural resources in the 1500s. An agricultural extractive economy was, therefore, established and urban areas developed to serve as launch pads for the exploitation of the hinterlands, ports to ease world trade and defensive strongholds to defend the land from other colonising powers. This resulted in the development of cities and towns along the coastline as it created departure points and acted as the first line of defence. The exploitation of the natural

resources resulted into early urban transition as Brazil shifted from rural-agricultural to urban-industrial (refer to Section 2.3.3) by the 1950s (Martine & McGranahan, 2010:5-7). Brazil depended on high exports on a variety of materials, such as brazilwood, diamonds, gold, rubber, sugar, coffee and cattle.

Today, Brazil is a large and populous country which had been categorised as a developing country for several decades, but which has now largely completed its urban transition (refer to Section 2.4.1). Cities are important for Brazil's economy as they contribute approximately 90% to their Gross Domestic Product (GDP). The cities are becoming more diversified and it is estimated that Brazil is currently in a "late transitional society stage" (refer to Section 2.4.1) as most of the citizens live in urban areas and the rate of urban growth has slowed (Martine & McGranahan, 2010:5).

As mentioned in Section 6.2, Brazil is part of the OECD countries, which aims to ensure financial sustainability through various platforms, which in turn can be directly associated with resilience (refer to Section 4.2). The following table illustrates the GDP of the developing countries which form part of the OECD countries from 2004 until 2017:

Table 6-3: Key economic indicators

	Average 2005-14	2015	2016	2017
	Per cent			
Real GDP growth ¹				
World ²	3.8	3.3	3.1	3.6
OECD ²	1.5	2.4	1.8	2.4
United States	1.5	2.9	1.5	2.2
Euro area	0.8	1.5	1.8	2.4
Japan	0.6	1.1	1.0	1.5
Non-OECD ²	6.2	4.0	4.1	4.6
Brazil	3.5	-3.8	-3.6	0.7
China	10.0	6.9	6.7	6.8
Colombia	4.7	3.1	2.0	1.7
Russia	3.5	-2.8	-0.2	1.9
South Africa	3.1	1.3	0.3	0.7
Output gap ³	-0.9	-1.4	-1.2	-0.5
Unemployment rate ⁴	7.2	6.8	6.3	5.8
Inflation ^{1,5}	2.0	0.8	1.1	1.9
World real trade growth ¹	4.7	2.7	2.6	4.8

Source: Adapted from the OECD (2017a)

Table 6.1 illustrates the GDP with a specific focus on Brazil and South Africa as they achieved a similar percentage of GDP growth in 2017. It is also important to note that Brazil had a negative

GDP in 2015 and 2016 which indicates that Brazil presented economic resilience as the economy was able to produce a positive GDP in 2017 (this phenomenon will be evaluated later in the study). According to OECD (2018:36-37), Brazil's economy experienced a recession in 2016 and recovered in 2017 by means of a driving agricultural sector and broad-based economies (refer to Section 4.4 i.e. concepts which improve regional resilience).

According to the Statistics Portal (2018), Brazil's GDP largely exists out of Services, Industry and Agriculture which encompasses the following main industry sectors:

- Services: Telecommunications, internet, insurance etc.
- Industry: Automobile, machinery, petrochemicals, electronics, cement, textiles, mining, food and tourism.
- Agriculture: Coffee, rice, corn, sugarcane, cocoa, citrus fruit, beef, soybeans and cacao

The following figure illustrates the share of economic sectors of Brazil from 2007 until 2017:

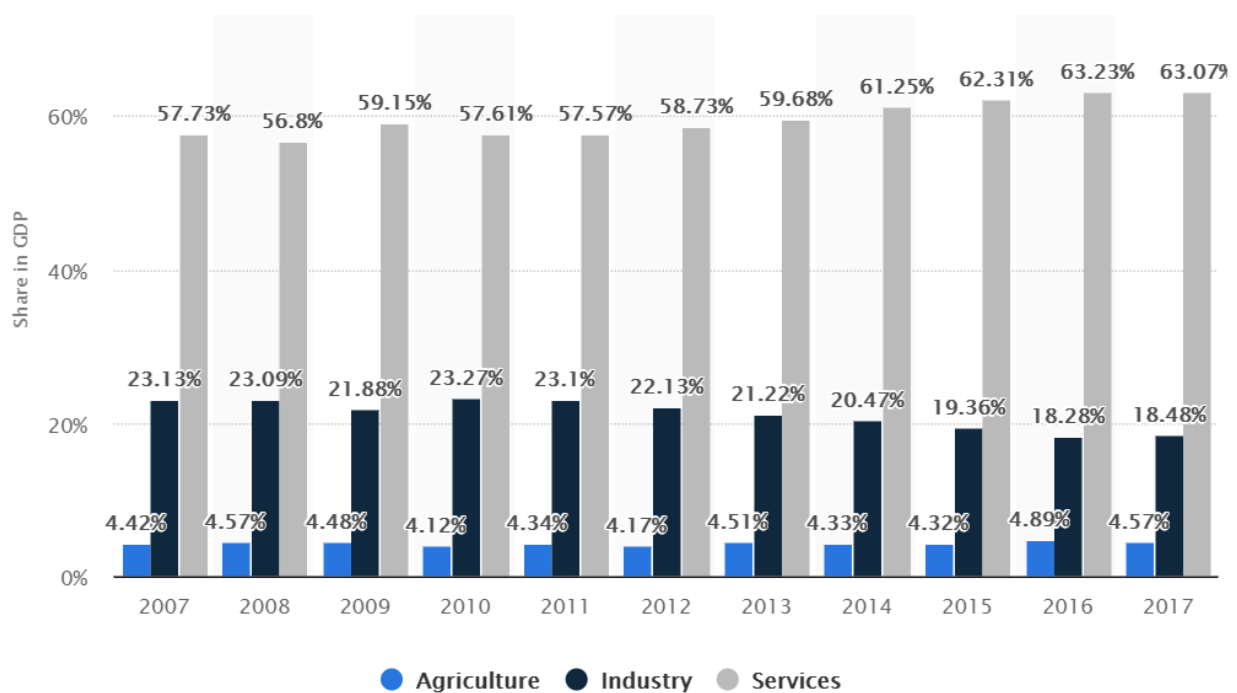


Figure 6-20: Economic sectors of Brazil from 2007 until 2017

Source: The Statistics Portal (2018)

The figure above illustrates the main economic sectors which contribute to Brazil's GDP. What is interesting is the fact that services increased from the year 2010 until 2016 while industries declined from 2010 until 2016 and are currently busy strengthening. When applying the concepts of economic growth as set out in Section 2.4.1, it is apparent that Brazil's economy has transformed from agricultural (primary sectors) to industries and services (secondary and tertiary

sectors) which is an indication that their economy is moving towards the trend of other developed countries. Similar to Australia, Brazil is also a large participator in international organisations to strengthen their economic standing, such as (Central Intelligence Agency, 2018):

- Bank of International Settlements (BIS)
- BRICS
- Food and Agriculture Organisation (FAO)
- Group of 20 Major Economies (G20)
- International Bank of Reconstruction and Development (IBRD)
- International Chamber of Commerce (ICC)
- International Development Organisation (IDA)
- International Fund for Agricultural Development (IFAD)
- International Organisation of Standardisation (ISO)
- United Nations (UN)
- United Nations Conference Trade and Development (UNCTAD)
- United Nations Industrial Development Organisation (UNIDO)
- World Federation of Trade Unions (WFTU)
- World Trade Organisation (WTO)

These are only the most relevant organisations for this study and Brazil participates in numerous other international organisations. From the organisations listed above, it is evident that Brazil is focussed on strengthening their trade relations and their industrial sectors. This, in turn, will have an impact on the objectives and focus of their policies as it will also seek to promote the industries and sectors as mentioned above.

Brazil is officially divided into five regions i.e. (i) Northern region; (ii) Northeast region; (iii) Centre west region (iv) Southeast regions and (v) the Southern region where it can be divided into 26 states which are not relevant for the purpose of this study. The following figure illustrates the five regions of Brazil:



Figure 6-21: Map of regions, states and State capitals of Brazil

Source: Martine & McGranahan (2010:4)

Figure 6-21 should be kept in mind as the following section will focus on the spatial distribution of the population of Brazil. The figure above is, therefore, important for orientating the reader spatially in Brazil.

6.2.3 *Population distribution characteristics*

As mentioned in Section 6.2.1.2, the population distribution was used to illustrate and determine different hierarchical orders as described by Berry (1972) in Sections 3.2 and 3.2.2. The population distribution will, therefore, be used to illustrate different hierarchical orders and their distribution in the urban system. The study will only encompass the spatial distribution of Brazil in terms of their population as a population can be used to measure or determine the hierarchical order of settlements and it was the only way the hierarchy could be determined. Furthermore, when referring to Section 4.5.4 the structural optimisation of resilience also includes population characteristics and population growth which in turn could be linked to improve resilience in different urban systems.

Brazil has an estimated population of 190 million people with an uneven distribution of the population. A large number of the population lives close to the coast which, in turn, leaves the inland vast and spacious. Brazil's large cities still act as a magnet for individuals from rural areas today even though the Brazilian government pursued policies to encourage individuals to move away from the densely populated coastal cities (Ignazzi, 2015). The following figure illustrates the population density of Brazil:

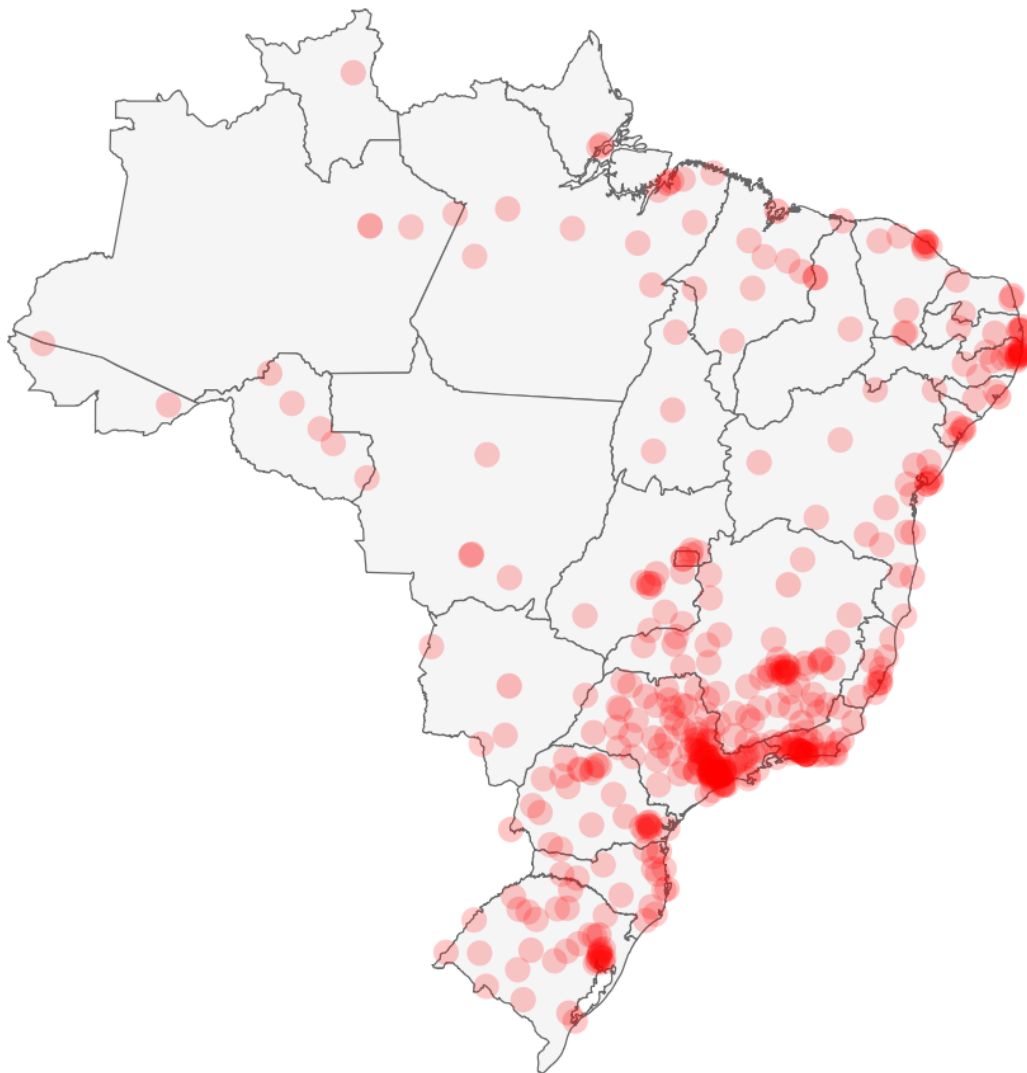


Figure 6-22: Population density of Brazil

Source: World Population Review (2018)

The figure above clearly illustrates the high-density population trend along the coastal areas of Brazil. Brazil's cities produce different types of goods and services and encompass different production patterns across the urban hierarchy (refer to Section 3.2), which influences the production costs i.e. transportation costs, production technology etc. Therefore, urban areas generally have a variety of economic activities and it is evident when looking at the socioeconomic

indications which prove that the South and Southeast regions have a more active economy than the North and North-eastern parts of Brazil.

Brazil also has a large urbanisation rate, where it is estimated that approximately 84% of the population resides in urban areas and about 16% reside in rural areas (Ignazzi, 2015). This poses great pressure on governments, especially when referring to the provision of housing and services for individuals who reside in cities. The following figure illustrates the growth of cities in Brazil together with an indication of which cities are currently declining in Brazil:

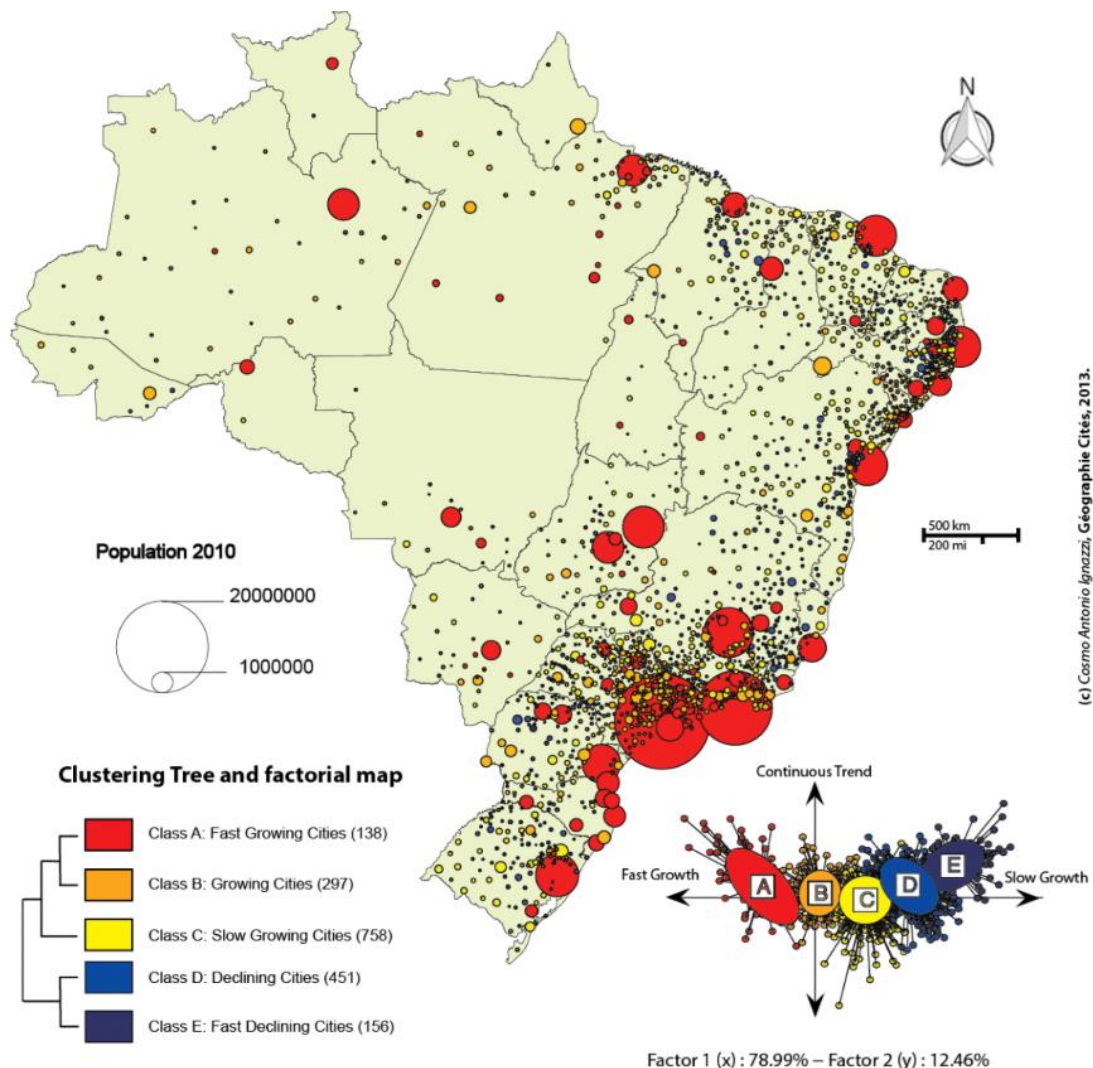


Figure 6-23: Trajectories of cities in Brazil from 1872-2010

Source: Ignazzi (2015)

From Figure 6-23, the spatial distribution of different size cities is illustrated together with an indication if the cities are growing or declining. Most of the cities in Brazil is undergoing fast population growth and a small number of cities are currently experiencing a decline in population growth. It is also important to note that the identified areas of population growth mainly include

the city and its functional hinterland, as a large number of the population resides in close proximity to cities but not necessarily within the city itself. Furthermore, Figure 6-24 illustrates the population trend of Brazil from data acquired in 2015. The figure below illustrates the population trend of both the rural and urban population of Brazil.

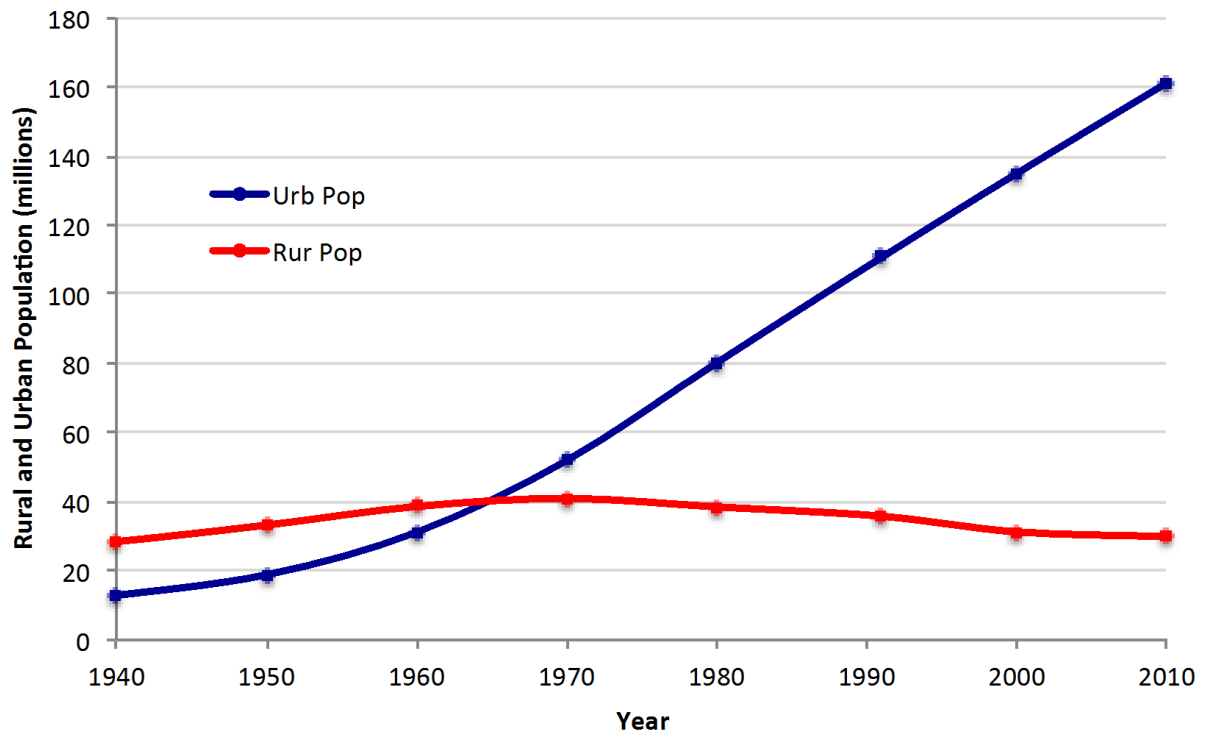


Figure 6-24: Urban versus rural population in Brazil

Source: Ignazzi (2015)

The figure above illustrates that Brazil is still experiencing high population growth within urban areas whereas the population growth in rural areas declined from the 1970s until the 2000s. However, it seems that the rural population stabilised from the year 2000 to 2010; this could be due to the implementation of effective rural policies or due to attractive rural opportunities. These policies and opportunities will be described in Section 6.2.4.

In order to determine the hierarchical distribution of Brazil, it was necessary to determine the population found in the largest cities of Brazil and therefore, the population density of the 50 largest cities of Brazil was obtained and illustrated in Figure 6-25. Furthermore, the rank-size rule was also determined with the incorporation of the population densities and was plotted below:



Figure 6-25: 50 Largest cities of Brazil

Source: Own compilation from Berry (1972) and the World Population Review (2018)

From the population figures obtained, the current population of the 50 largest cities of Brazil was plotted together with the “ideal” population distribution as described by the rank-size rule. The figure above illustrates that the three largest cities in Brazil follow the rank-size rule where the fourth city is smaller than estimated, according to the rank-size rule. However, when considering the smaller cities, the size of the cities is somehow larger than expected, according to the rank-size rule. When measuring the Brazilian population distribution against the Australian population distribution, a more even and normal population distribution is evident in the Brazilian population distribution context. Figure 6-26 used the population data as well as the rank-size rule and applied the log function in order to illustrate the population distribution as described in Section 3.2.1. The log population distribution of Brazil is, therefore, illustrated as follows:

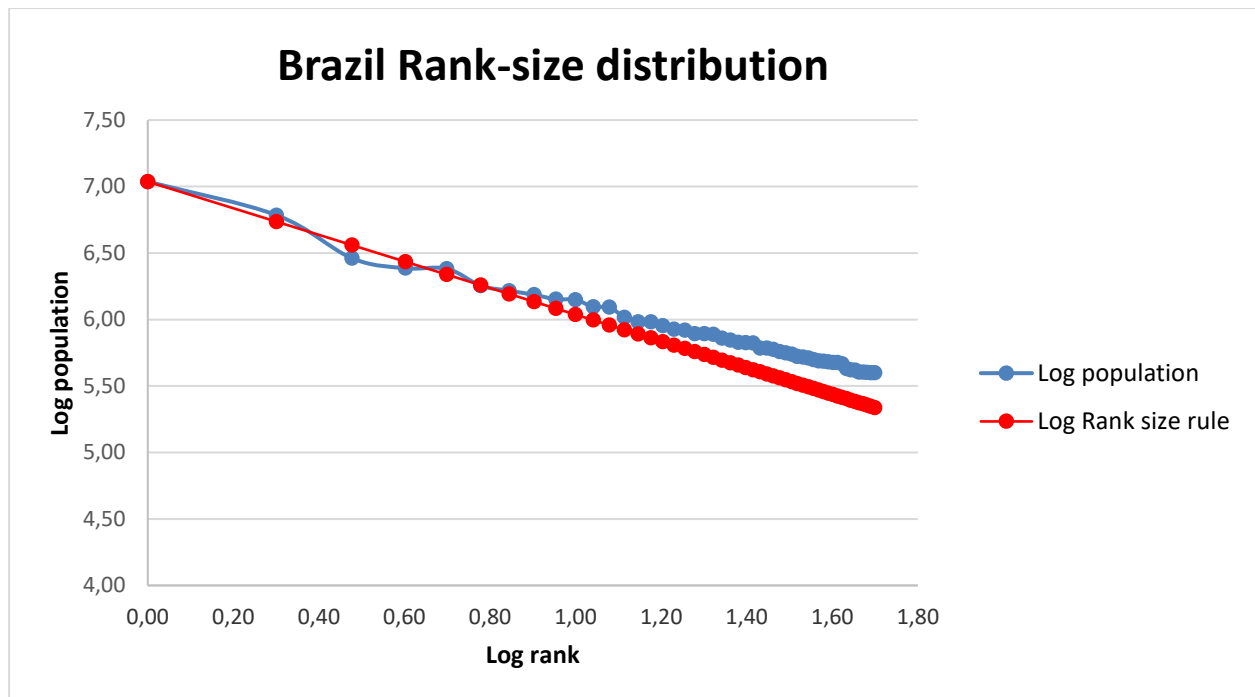


Figure 6-26: Log rank-size distribution of Brazil

Source: Own compilation from Berry (1972) and the World Population Review (2018)

As illustrated in Figure 6-26 the population distribution of Brazil can be described as a log-normal distribution. This indicates that Brazil generally has a well-integrated spatial distribution system when referring to urban systems. This poses great opportunities for economic growth as the population distribution is normal. It indicates that the spatial system over different hierarchies is balanced and that the city versus rural areas are satisfying. The spatial distribution and hierarchies are generally affected and manipulated by policies and instruments implemented on national, regional and local government spheres. Hence, the following section will investigate the different regional policies and instruments implemented by the Brazilian government in order to improve regional resilience in different urban systems.

6.2.4 Policies

This section will focus on the development process of policies implemented in Brazil with specific reference to regional policies. This section is important as it can be used to evaluate two developing countries and their policies with one another.

6.2.4.1.1 Policy Design Process

Regional Development policies generally follow a public policy cycle which can be categorised into five stages as illustrated below:

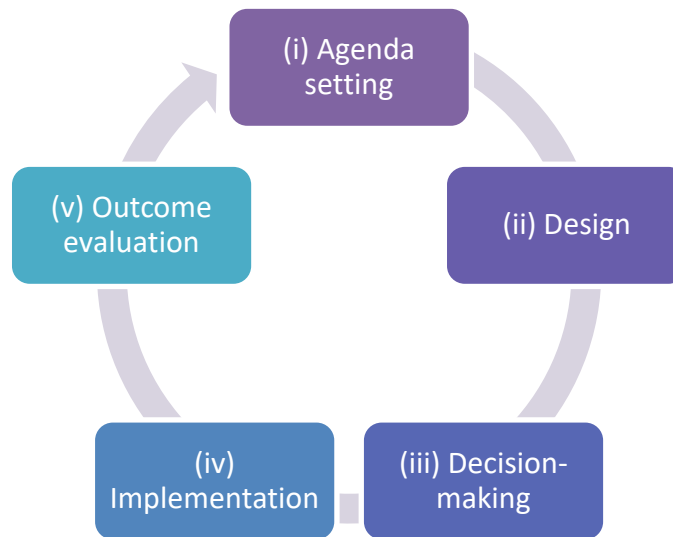


Figure 6-27: Policy cycle

Source: Adapted from Resende (2013:214)

As depicted in Figure 6-27 there are generally five stages of policy formulation where problems are first identified, then placed on an agenda where policies are then developed and implemented and, lastly, evaluated against the effectiveness and efficiency of the policy to either restart the process or to terminate the policy. The (v) outcome evaluation connects with the (i) agenda setting to serve as an input for the entire policy cycle. The policy cycle can be described as follows when referring to Brazilian policies.

i. Agenda setting

Brazil faces numerous challenges in terms of inequalities of the spatial distribution of the population within their regions (refer to Section 6.2.3) (Resende, 2013:214). These inequalities had a significant impact on rural areas as they faced a high level of migration to larger cities as described in Section 6.2.3.

ii. Design

The design stage aims to define the objectives of the policy; hence it will identify what should be achieved with the policy. This stage generally includes the formulation of several alternatives and approaches in order to meet the objectives of the set policy. The design stage of Brazilian policies was influenced by theories, which argued that market failures should be corrected by incentives or subsidies to agricultural and industrial sectors in lagging regions (Resende, 2013:215).

iii. Decision-making

The decision-making stage typically includes the final adoption of the policy and as described above, Brazil has a long history of government attempts to intervene with spatial distribution by using urban policies. The Brazilian government generally attempted to intervene with the population distribution on a large scale, by promoting the expansion of Parana agricultural frontier from 1930 to 1940; and in 2015 a regional planning agency was created for the north-eastern region named Superintendência de Desenvolvimento do Nordeste (SUDENE). In addition, the Brazilian government also planned the city of Goiania with a new capital, Brasilia, to encourage population deconcentrating from the coastal cities (refer to Figure 6-21 and Figure 6-22) whereafter other programmes followed i.e. in the Amazon region (Martine & McGranahan, 2010:45).

iv. Implementation

The Implementation stage includes the organisation responsible for the policy to be executed. The implementation could be categorised into bottom-up, top-down and hybrid approaches. Funding is a large implementation tool to improve regional development and designated funds and banks are identified to manage the funds allocated to mainly agricultural and industrial sectors (Resende, 2013:215).

v. Outcome evaluation

Even though the programmes as mentioned above were implemented, the migration towards the coastal regions continued and the Brazilian government decided to turn its attention to organising urban growth. Agencies were then created to act on a small scale with a specific focus on the provision of housing and territorial planning, which was limited to urban areas (Martine & McGranahan, 2010:46). Masterplans were then designed to stimulate growth in major cities and to assist with infrastructure planning and investment to serve the expanding cities.

In 1974, an agency named the National Commission for Metropolitan Areas and Urban Policy (CNPU) was created with a broader mandate which was to coordinate an integrated planning system for the identified metropolitan areas and to promote the growth in medium-sized cities. Over the years, the CNPU was transformed to the National Council for Urban Development (CNDU) which aimed to incorporate urban policies and frameworks into the National Development Plan (Martine & McGranahan, 2010:47). All of the above-mentioned agencies and policies did not have the intended impact on the spatial distribution of Brazil and discussions moved away from the previous top-down approaches and focussed on social participation. The CNDU then reformulated its approach to incorporate greater public participation when formulating and

implementing policies. Urban policies of Brazil are, therefore, the foundation of making democracy a working reality and to address social inequalities. This proves that the policy cycle continued after the outcome evaluation stage as it moved towards the agenda setting once again.

The policy design process is important to the study as it influences the type of policies to be implemented as well as the objectives identified. The following section will examine the policies implemented and development objectives which were identified to improve regional resilience and development in Brazil.

6.2.4.1.2 Implementation of policies and frameworks

Due to Brazil's unique regional development history, the Brazilian government is focussed on implementing policies and frameworks with the aim of allocating resources more efficiently (Resende, 2013:205). The national government also proposed governing bodies which would be responsible for the coordination of all private and public investments of the said region.

The Brazilian government uses governing bodies to assist with the implementation of policies which takes all the financial responsibilities of tax incentives, infrastructure investment, grants etc. These regional development funds are proposed to promote economic and social development in regions of Brazil (Resende, 2013:205). It could, therefore, be derived that Brazil uses a top-down approach when referring to the implementation of policies. Furthermore, they also make use of sub-funds or governing bodies to assist with the managing and procurement of finances. The fund, on the other hand, uses a bottom-up approach by identifying the needs and requirements of the businesses and industries located in its region.

This could be of significance to the study as Brazil is also classified as a developing country and encompasses similar challenges to which South Africa faces. By using a combination of a top-down and bottom-up approach, the different government spheres will be able to develop policies where sub-funds or governing bodies could assist with the implementation thereof. This approach could be useful to increase regional resilience as the needs of the businesses and settlements would be identified on a smaller scale, where the relevant government sphere could assist with the policy design and implementation to assist with the challenges the regions are currently facing.

6.2.4.1.3 Development objectives

National Policy for Regional Development (PNDR) was established in 2007 as it was speculated that the inequalities in the regions of Brazil weakened and prevented national integration and therefore, priority areas were identified with economic weaknesses and stagnation (Santos *et al.*, 2017:8). Due to integration and implementation challenges of the PNDR, a revised PNDR II was

released in 2013. It was within the scope of national integration, overcoming regional inequalities and social democratisation. The PNDR II was developed by using principles, such as multidimensionality and transversivity and categorised the regions in Brazil into micro-regions which would be eligible for funding applications (Santos *et al.*, 2017:9). Figure 6-28 summarises the main objectives identified in the PNDR II of 2013:

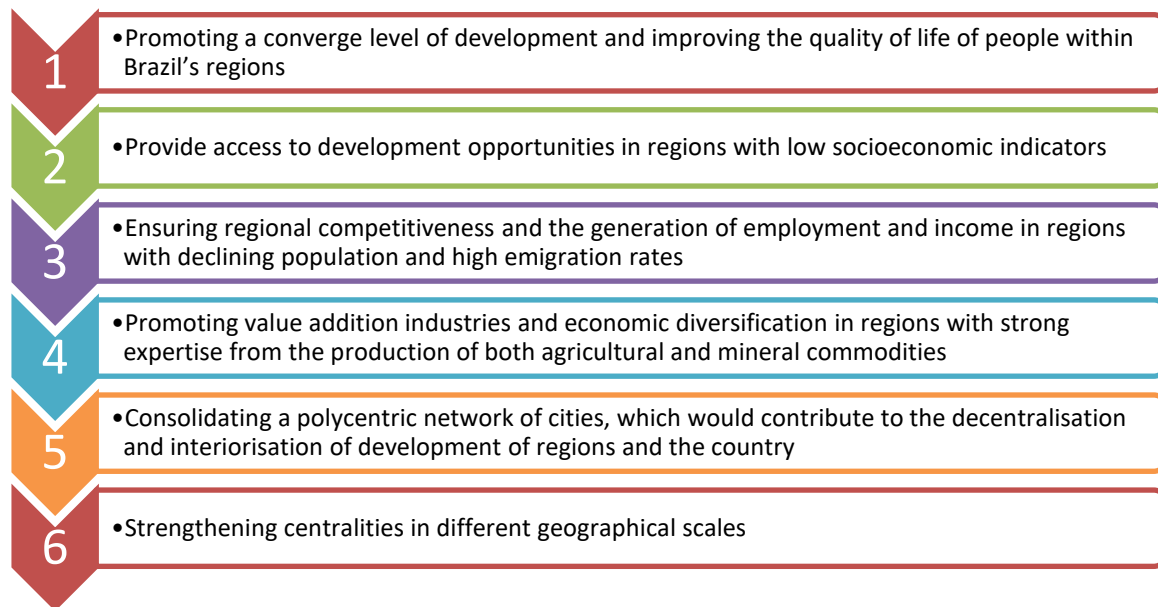


Figure 6-28: PNDR II Policy objectives

Source: Adapted from Santos *et al.* (2017:9)

Figure 6-28 illustrates the main objectives of the PNDR II policy and it is considered that the revised policy comprised of a higher level of public participation on the regional development processes as well as within the governance of public policies. The PNDR II also includes public participation on different spatial scales, such as national, regional and local scales. The figure below illustrates the social fields and instruments to be used in the PNDR to improve regional development:

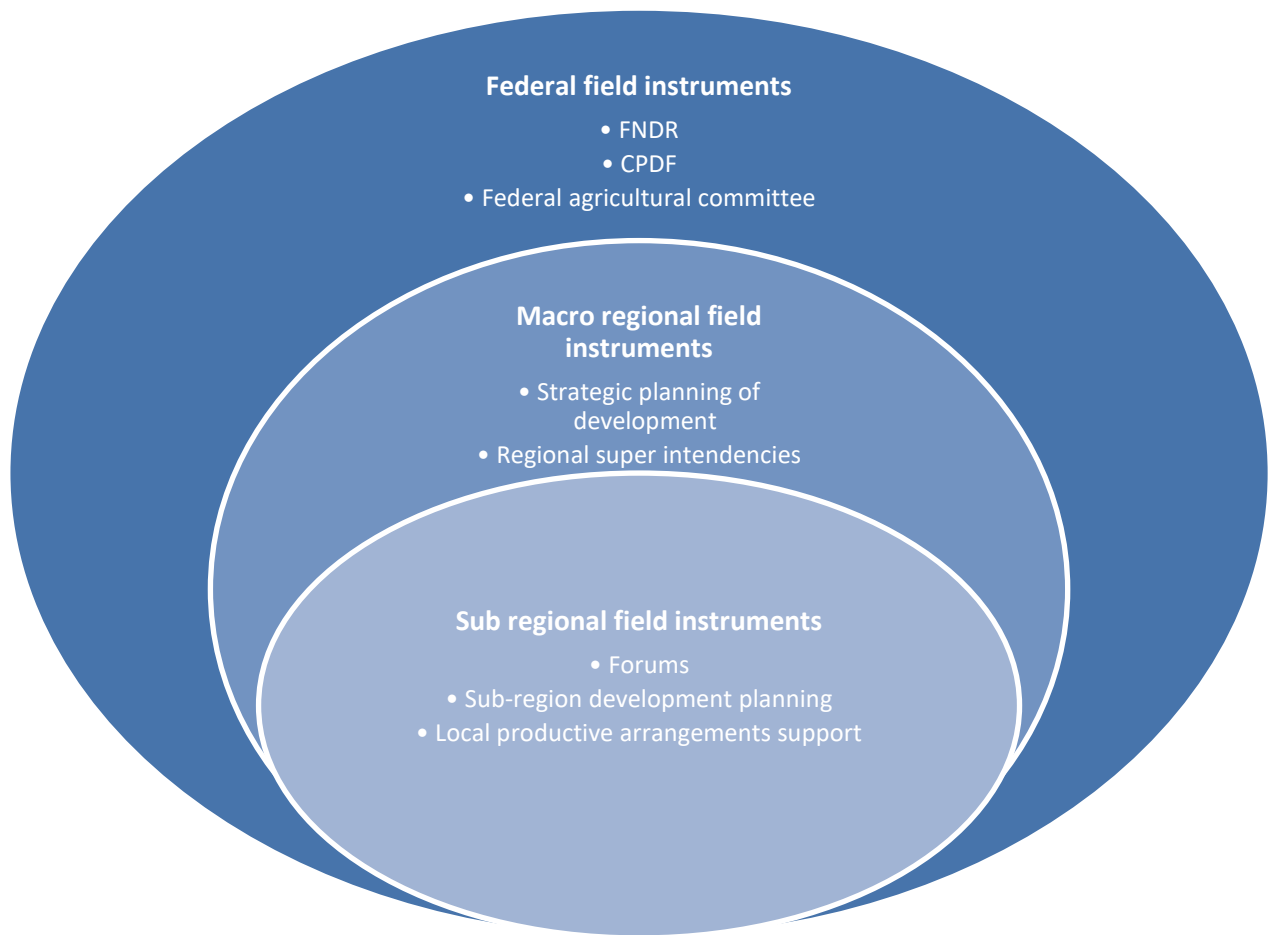


Figure 6-29: Policy instruments implemented on different spatial scales

Source: Adapted from Santos *et al.* (2017:9)

As depicted in Figure 6-29, there are three main spatial scales to be implemented by using the instruments as set out in the PNDR (Santos *et al.*, 2017). Furthermore, Brazil also uses the following instruments on a national scale as an incentive planning mechanism to reduce regional imbalances/investment decisions either through industrialisation or infrastructure investment (Ferreira, 2004).

- The Constitutional funds

Brazil uses a percentage of their income taxes from both firms and individuals as well as tax from industrialised goods to fund projects to improve both economic and social development. Agricultural producers, which are categorised as small and other producers who use raw material and is labour intensive have preferential treatment (Ferreira, 2004:13-15). Other investment programmes, such as FINAM (for the Amazon region) and FINOR (Northeast region) were also created which were also based on tax funds. The aim of these funds was to invest in areas or businesses which were categorised as strategically important.

- Creating Free Trade Zones

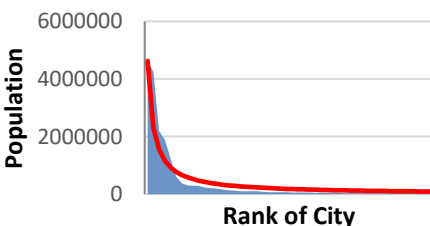
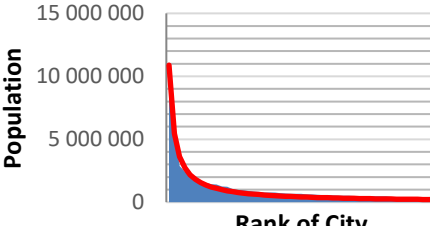
A Free Trade Zone (FTZ) was established by the federal government to create an industrial, commercial and farming centre located in the Amazon region (Ferreira, 2004:27). This FTZ was proposed to create numerous job opportunities while integrating the Amazon region's economy with the rest of Brazil. This zone led to a significant increase in job opportunities, exports and acted as a major attraction for industrial firms. Hence, today the FTZ is the primary location for electronic equipment factories in Brazil and also encompasses other industries, such as motorbike sectors, the manufacturing of plastic and chemical industries.

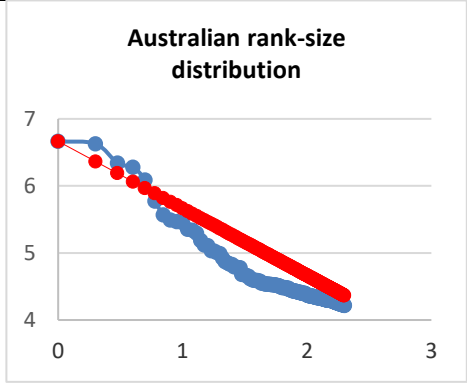
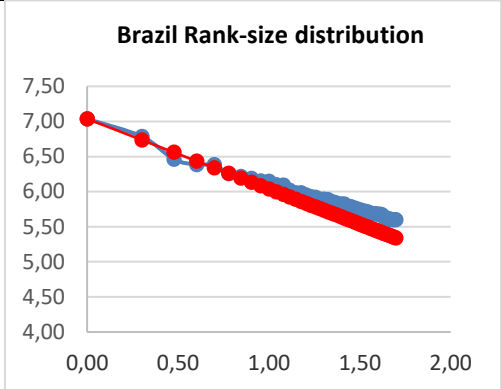
These instruments and mechanisms used by Brazil can largely be described as a top-down approach which focusses on funding/investing in smaller towns and primary sectors, such as agriculture and the utilisation of raw materials in labour-intensive industries. This results in the growth of small towns and sparsely populated regions as the town can provide job opportunities and achieve economic growth in the long-term. This type of policy structuring and policy implementation could be the reason why Brazil's spatial distribution in terms of the rank-size rule is largely log-normal (refer to Section 6.2.3).

6.3 Conclusion

This chapter evaluated two international case studies, one developed country i.e. Australia and one developing country i.e. Brazil, which encompasses numerous similar characteristics to South Africa. This chapter will be important as several concepts will be used from both Australia and Brazil to form recommendations and conclusions on how to improve regional resilience in different urban systems. The following table provides a summary of the international case studies investigated in this chapter:

Table 6-4: Summary of international case studies

	Australia	Brazil
Population distribution characteristics	50 Largest cities of Australia 	50 Largest cities of Brazil 

Log population distribution characteristics	 Australian rank-size distribution	 Brazil Rank-size distribution
Level of development	Developed country	Developing country
Policy implementation	Bottom-up approach (Co-design Process)	Top-down approach and bottom-up approach
Focus on resilience	Yes, directly approaches resilience in urban systems, especially when referring to policy implementation	Does not focus directly on regional resilience in urban systems, however, the government designed and implemented fund managers to act as a “link” between the national government and local businesses/industries located within the region.

Source: Own compilation

The table above illustrates and describes the different spatial distributions of both Australia and Brazil. From the table above, it is evident that Australia focusses on improving regional resilience specifically by including urban systems and uses a co-design process for the implementation of policies. On the other hand, the Brazilian government makes use of a fund manager which acts as a link between the national government and businesses located in the region. This ensures that the needs of the local businesses and industries are addressed while using guidelines and policies implemented on a national scale. Furthermore, Brazil is also focussed on managing their population distribution carefully by using incentives to minimise migration towards urban areas and uses a polycentric approach to achieve higher resilience (refer to Section 4.2.2 and 6.2.4).

From the population analysis, combined with the hierarchical distributions, it was interesting to note the spatial distribution characteristics of both the developed and developing countries. It was also evident that it is important to investigate the background of the countries as it had a significant impact on the spatial distribution of the populations on different hierarchical distributions. Furthermore, it was also evident that the formulation process of the policies and the

implementation and mechanisms used in the policies had a direct influence on the spatial distribution patterns of the population in the urban system. For instance, Australia was discovered by travellers and has an extremely open policy for migration and this has a direct impact on the spatial distribution of their cities as the cities grow in a less structured and controlled manner. Brazil, on the other hand, is extremely focussed on their agricultural sector within their policy objectives and this results in a larger rural population than is expected according to the rank-sized rule (refer to Section 6.2.3 and 6.2.4). When referring to Section 4.2.2, the four fields of resilience were addressed in the policy design and implementation of both the international case studies, however, Australia was mainly focused on engineering (infrastructure investment i.e. to improve connectivity), ecological (promotion of green infrastructure and innovation) and social resilience (settlement structures) where Brazil was mainly focussed on engineering (infrastructure investment i.e. connectivity and secondary economic activities), economic (Free Trade Zones, diversification of the economy) and social resilience (minimising the migration of individuals, following a bottom- up approach via fund managers). This chapter, therefore, confirmed that different policies implemented results in different spatial distributions for policies can either encourage or discourage migration in spatially targeted areas which, in turn, could lead to an improvement of regional resilience. As mentioned in Sections 6.2.1.2 and 6.2.3, population data were used to determine the hierarchical orders as the researcher found it easier to illustrate and determine the spatial distribution of settlements according to their hierarchy. In addition, only the 50 largest cities of each country were identified and illustrated as the spatial significance according to the rank-size rule mainly focusses on the largest cities, and as the population sizes tend to decrease, so does the significance when illustrated in terms of a logarithm. The following chapter will explore the South African background and population distribution and will also include a more detailed policy examination, as the focus will be policies and mechanisms used to improve regional resilience on a regional/ provincial scale.

CHAPTER SEVEN: NATIONAL CASE STUDY

7.1 Introduction

This chapter includes a national case study with specific reference to regional resilience in different urban systems. The first section of this chapter will focus on the national background to enable the reader to understand the population distribution of the South African population and it will also encompass different hierarchies of cities and towns in South Africa and their population figures. The following section will then focus on a regional level i.e. the Northern Cape province as a study area and examine the policies implemented on a regional scale to improve regional resilience in different urban systems. Figure 7-1 illustrates the composition and outline of this chapter.

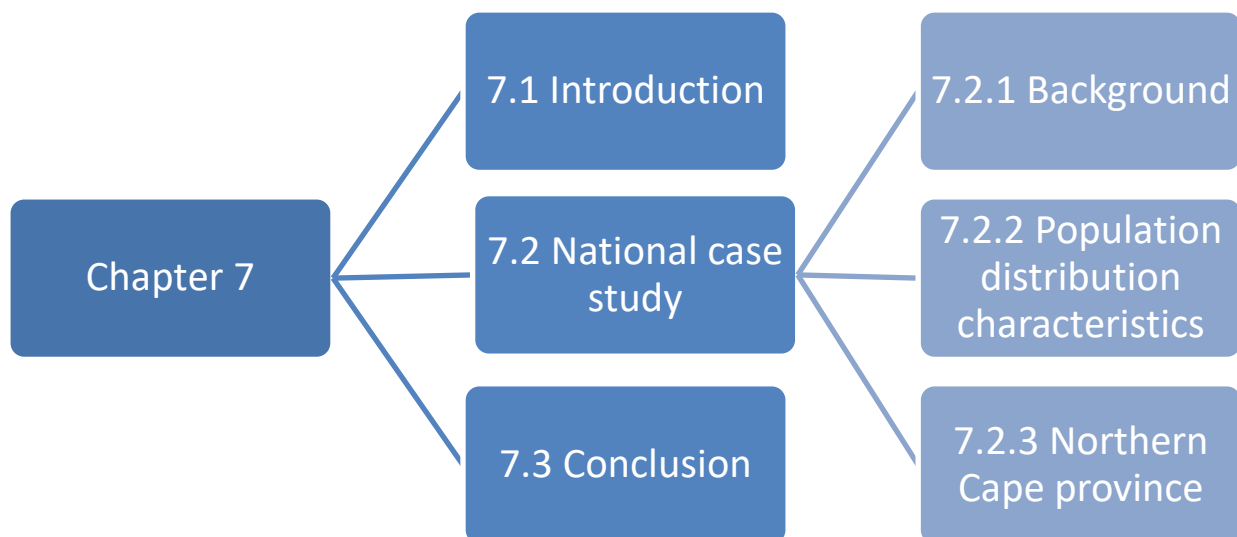


Figure 7-1: Structure of Chapter Seven

Source: Own compilation

7.2 National case study

South Africa is bordered by Botswana, Lesotho, Mozambique, Namibia, Swaziland and Zimbabwe and generally has a semi-arid (dry) climate; it varies from subtropical to the Mediterranean to the coast. South Africa is also known for its richness in natural resources, such as antimony, chromium, coal, copper, diamonds, gold, iron ore, manganese, natural gas, nickel,

platinum, phosphates, rare earth, tin, salt, uranium, vanadium, etc. Figure 7-2 illustrates South Africa's location on a world map:



Figure 7-2: Location of South Africa

Source: King & Cole (2018)

South Africa has several agreements with both developed and developing countries worldwide as it is located centrally and designed around multilateral cooperation; which is related to sustainable development (United Nations, 2002:1). South Africa is part of the following memberships which have an impact on regional policy formulation (Konrad Adenauer Foundation, 2018:2):

- United Nations (UN)
- BRICS (refer to Section 6.2.2.1)
- New Partnership for Africa's Development (NEPAD)
- Southern Africa Development Community (SADC)
- Commonwealth
- World Trade Organisation (WTO)
- Food and Agriculture Organisation (FAO)
- United Nations Conference on Trade and Development (UNCTAD)
- Economic Commission of Africa (ECA)

South Africa is part of other memberships as well, however, for the purpose of this study only the memberships which could have an impact on regional development and policy formulation were identified.

7.2.1 Background

The ancestors of the Khoisan already lived in Southern Africa when a Portuguese explorer Bartholomeu Dias reached Mossel Bay (located in the Western Cape Province) in 1487, whereafter the Dutch founded a refreshment station at the Cape of Good Hope (located in the Western Cape). After many years (around 1867), diamonds were discovered in Kimberley (Northern Cape province) and mining industries developed within the area (Thompson, 2001:110). In 1886, a major discovery was made as gold mining industries developed in Johannesburg (Gauteng province) and the discovery of gold led to a gold rush; the population density increased significantly in the Gauteng Province (refer to Figure 7-3).

When referring to the province orientation in South Africa, it can be categorised into nine provinces/regions, which are the Eastern Cape, Free State, Gauteng, Kwazulu-Natal, Limpopo, Mpumalanga, North West, Northern Cape and Western Cape. The figure below illustrates the location of the nine provinces within South Africa:



Figure 7-3: Map of South Africa

Source: Adapted from King & Cole (2018)

Figure 7-3 illustrates the location of the nine provinces of South Africa. As illustrated in Figure 7-3, the Gauteng Province is the smallest in size while the Northern Cape Province is the largest. With regards to South Africa's GDP it is clear that South Africa did not obtain such a high percentage of GDP as Brazil (refer to Section 6.2.2). The table below illustrates the GDP of South Africa from 2005 unit 2017:

Table 7-1: Economic indicators

	Average 2005-14	2015	2016	2017
	Per cent			
Real GDP growth ¹				
World ²	3.8	3.3	3.1	3.6
OECD ²	1.5	2.4	1.8	2.4
South Africa	3.1	1.3	0.3	0.7
Output gap ³	-0.9	-1.4	-1.2	-0.5
Unemployment rate ⁴	7.2	6.8	6.3	5.8
Inflation ^{1,5}	2.0	0.8	1.1	1.9
World real trade growth ¹	4.7	2.7	2.6	4.8

Source: Adapted from the OECD (2017a)

Table 7-1 illustrates the GDP with a specific focus on South Africa. From 2015 to 2017 there is a clear indication of a declining GDP. This trend is not favourable for the South African economy and Chapter Eight of this study will attempt to provide recommendations on how South Africa's GDP can be improved. Furthermore, the key economic sectors which contribute to the GDP are depicted in the image below:

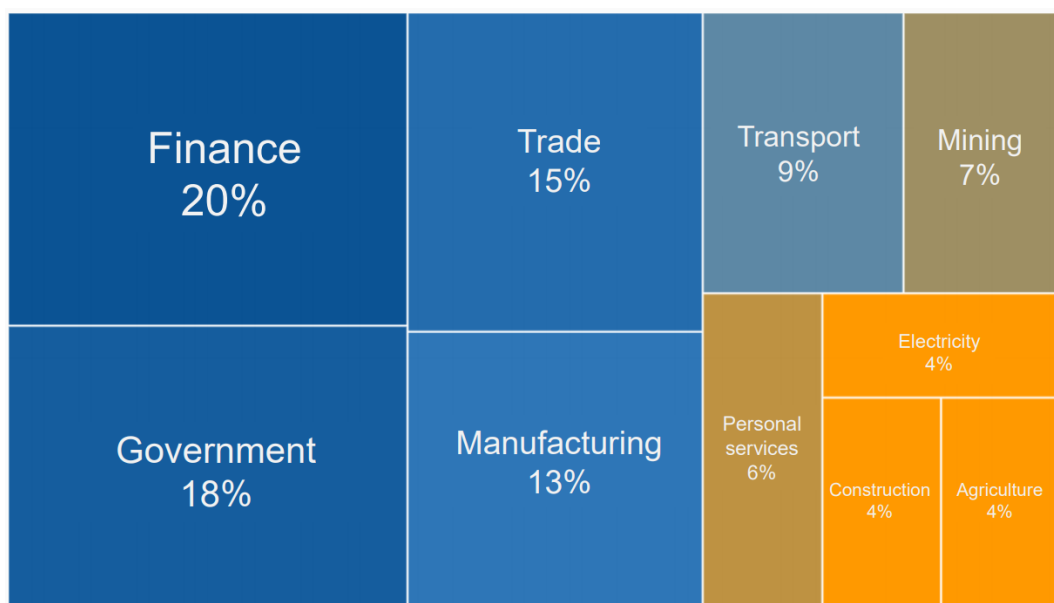


Figure 7-4: Key economic sectors of South Africa

Source: Statistics South Africa (2018)

The figure above is an illustration of the percentage contribution of the key economic sectors of the second quarter of 2018. Even though South Africa is rich in natural resources, it is still categorised as a developing country due to its economic growth and development (refer to Section 6.2.2.1). According to the OECD (2017:11), South Africa faces the following challenges:

Table 7-2: Summary of South Africa's development across several sectors

Main Findings
Effectiveness of government spending should be increased.
Economic integration is slow which reduces the growth potential of regions/intra-regional trade is low.
Weak production trade links indicate a lack of infrastructure and institutions, skill shortages, monopolistic behaviours and regulatory barriers.

Source: Adapted from the OECD (2017:10-11)

Table 7-2 identified some key issues which hinder the development of South Africa, especially when referring to the spatial integration of different urban systems. According to the OECD (2017:32), high regional economic integration has the potential to improve economic growth and to increase job opportunities. South Africa became significant to world trade with the discovery of natural minerals, such as gold and diamonds and these discoveries had a significant impact on the spatial distributions of populations found in South Africa (refer to Section 3.2.1). In addition, Chapter Eight in the NDP (refer to Section 5.3.1) also identified several spatial challenges i.e. (i) transforming of the national space; (ii) inequalities and differences within rural areas; (iii) urban efficiencies and lastly (iv) weak capabilities of spatial governance (National Planning Commission, 2011:261). These are all spatial challenges which South Africa faces which impact the spatial distribution of the population, the location of businesses and industries and the provision of services etc. The following section, therefore, aims to provide information on the spatial distribution of South Africa to enable the reader to understand the different spatial scales and their distributions.

7.2.2 Population distribution characteristics

As mentioned in Sections 6.2.1.2 and 6.2.3, the population distribution was the only way to determine different hierarchical orders in the urban system. This concept was derived from Berry (1972) as described in Sections 3.2.1 and 3.2.2. Therefore, this section will encompass the population distribution in the South African context to determine the spatial distribution of the population, which can be used to determine and recommend policies to be implemented to

improve the spatial distribution which in turn will increase the regional resilience in different urban systems.

It is estimated that approximately 78% of the South African population resides within cities (Van Huyssten *et al.*, 2016) as the discovery of minerals led to a large number of migrants in search of wealth (refer to Section 7.2.1). To categorise the different sizes of cities, the Council for Scientific and Industrial Research (CSIR) developed a settlement typology as part of the National Spatial Trends Overview Project in 2008-2009 to develop an inclusive National Urban Development Framework (refer to Section 5.3.3). They indicated that from the 78% of the population who reside in towns and cities in South Africa, 42% resided within the four city regions namely Gauteng, Cape Town, eThekweni and Nelson Mandela Bay in 2011 (Van Huyssten *et al.*, 2016:1). It is, therefore, of utmost importance to address the challenges within the network of towns and cities (refer to Section 3.4). The CSIR's settlement typology provides a mechanism for profiling, identifying, calculating and analysing numerous development information and trends in terms of high density residential rural areas and the range of towns and cities. This, in turn, would assist the government with spatial planning, analysis and modelling with the focus to strengthen strategic regional and interregional planning, as well as resource allocation and intergovernmental planning (refer to Section 8.3.1, 8.3.2 and 8.3.3). The functional settlement typology enables stakeholders to understand and analyse the network of towns and cities and their hierarchical and functional relationships with one another (Van Huyssten *et al.*, 2016:1).

The functional settlement typology was developed by taking the functional role of a city, in terms of its regional context, into account. It is important to note that the categories as set out below include not only the settlement, town or city itself but the functional area and its close surroundings (Van Huyssten *et al.*, 2016:4). This ensures that the formal economy is not only considered, and that the extent of the population and the functional role of the bigger town area is also accommodated, as it provides access to several opportunities and services (refer to Section 3.2 and 3.3). The following figure illustrates the different settlement types of South Africa as described above:

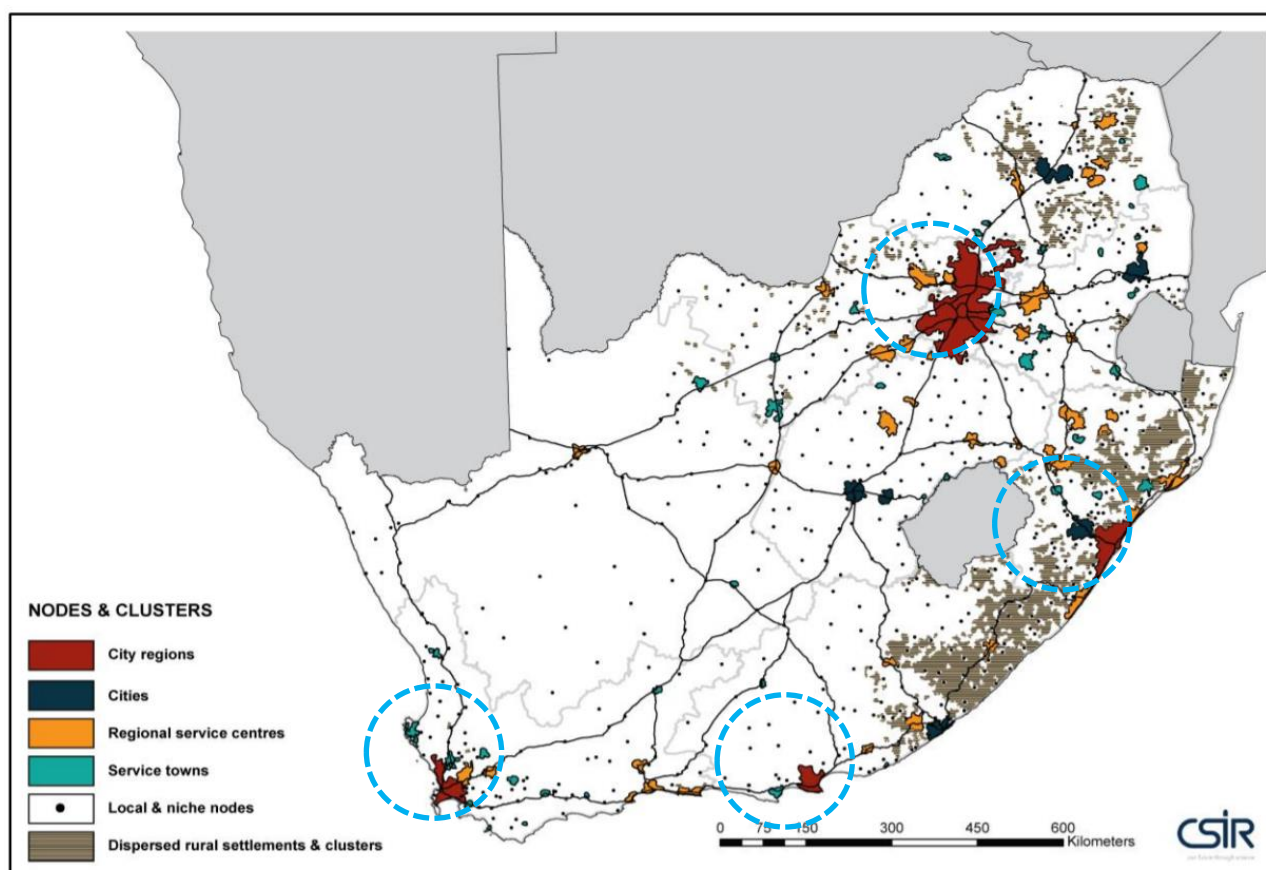


Figure 7-5: South African settlement typologies

Source: Adapted from Van Huyssten *et al.* (2016:4)

The figure above illustrates the different typologies as calculated and categorised by the CSIR with a specific focus on South Africa. From the figure, it is evident that four dominant city regions exist and that the South African population is mainly concentrated in the four city regions (refer to Section 2.3.3 and 5.3.2). The following table describes the different settlement typologies found in South Africa:

Table 7-3: Functional settlement typology categories

Type	Category	Population	Service Index	Notes	Examples
1	City Region Areas	> 1 Million	>7		- Global city region: Gauteng - Coastal city region: Cape Town, eThekweni, Nelson Mandela Bay
2	City Areas	500 000-1 million	2-5	Includes metro's and secondary city areas	Mangaung, Polokwane, Pietermaritzburg etc.
3	Regional Service Centres			Bigger than medium-sized towns with key roles in the surrounding hinterland	

	Regional Centre 1	300 000-500 000	1-2	High population numbers as well as high economic activity	Rustenburg, Richards Bay, Witbank etc.
	Regional Centre 2	100 000-300 000	>0.3	High population in densely settled areas	Tzaneen, Queenstown, Grahamstown etc.
	Regional Centre 3	40 000-100 000	>0.25	Low population although it plays a key role in surrounding areas	Kimberley, Worcester and Upington
4	Service Town	>20 000	0.065-0.25	Medium- to smaller-sized towns: Significant role in the hinterland	Groblersdal, Bothaville, Lichtenburg, Piet Retief etc.
5	Local and Niche Towns	Varies widely	0.001-0.065		- Local Town: Alice (Eastern Cape), Koppies (Free State) - Niche Town: Clarens (Free State, Riebeeck-Kasteel (Western Cape) etc.
6	High-Density Settlement Areas	>100 people/square km >10 people/square km plus economic activity in the service sector		- Identified as high-density settlement areas - High levels of access to household income - Areas generally have little economic activity - No consolidated nodes - Extended morphological structure	
7	Rest of South Africa	Less densely populated areas/ Sparse population areas			- Mountains - National Parks

Source: Adapted from Van Huyssten *et al.* (2016:5-7)

The settlement typology as depicted in the table above has been used in numerous analyses of urban growth and demographic profiles (Van Huyssten *et al.*, 2016:8). This raises the importance of settlements, towns and urban areas in the development of South Africa when referring to the urban and rural agenda (refer to Section 3.2.2). The typologies as described above will be of great significance later in the study as the settlement typology is used as a guideline for all strategic documents and policies in South Africa (refer to Section 5.3.2). It provides a guideline on the different settlement types located in South Africa and places the settlement types into different hierarchical functions which can be used to improve regional resilience in different urban systems by means of development objectives and investment opportunities (refer to Section 4.5.1, 4.5.2, 4.5.3 and 4.5.4).

The figure below illustrates the population density for the 50 largest cities in South Africa (as calculated for the two international case studies in Section 6.2.1.2 and 6.2.3). The rank-size rule was also applied to provide the reader with a benchmark to evaluate the different hierarchies found in South Africa:

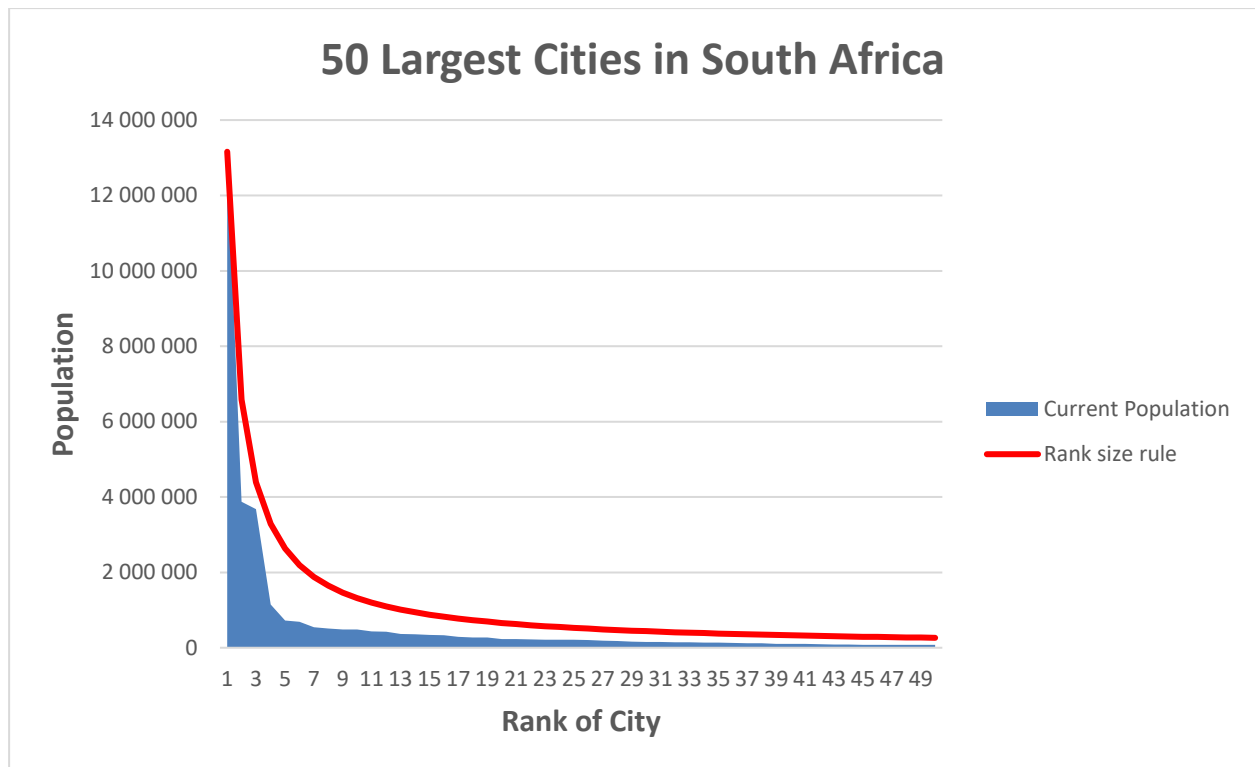


Figure 7-6: 50 Largest cities of South Africa

Source: Own compilation from Berry (1972) and Van Huyssten *et al.* (2016:5-11)

Figure 7-6 illustrates the population distribution of the fifty largest cities in South Africa. The data as illustrated above indicates the following:

- South Africa encompasses one exceedingly large city with a population more than twice as large as the city one rank lower (Gauteng City Region).
- South Africa has four cities which are significantly larger than cities one rank lower (this occurrence can be directly linked to lower stability in urban systems as described in Section 4.5.1).
- South Africa does not encompass sufficient medium-sized cities according to the rank-size rule (medium sized cities can be categorised as a “link” between small and large cities and this will decrease the complexity in urban systems which is a mechanism to improve resilience in different urban systems as described in Section 2.3.1 and 4.5.2).
- The rural areas/ smaller cities and towns found in South Africa are smaller than predicted (this poses a concern as structural optimisation could lead to an increase in resilience in different urban systems as described in Section 4.5.4).
- Low spatial integration is visible as one city dominates the spatial structure of South African cities (this is problematic as connectivity could increase resilience in urban systems as described in Section 4.5.3).

By using the population data of the largest cities and calculating it by using the logarithms as described in Section 3.2.1, the population distribution of South African cities can be illustrated. This will determine if the above-mentioned indicators are correct when arguing that South Africa encompasses a primate distribution. Figure 7-7 therefore, illustrates the population distribution of South Africa's 50 largest cities:

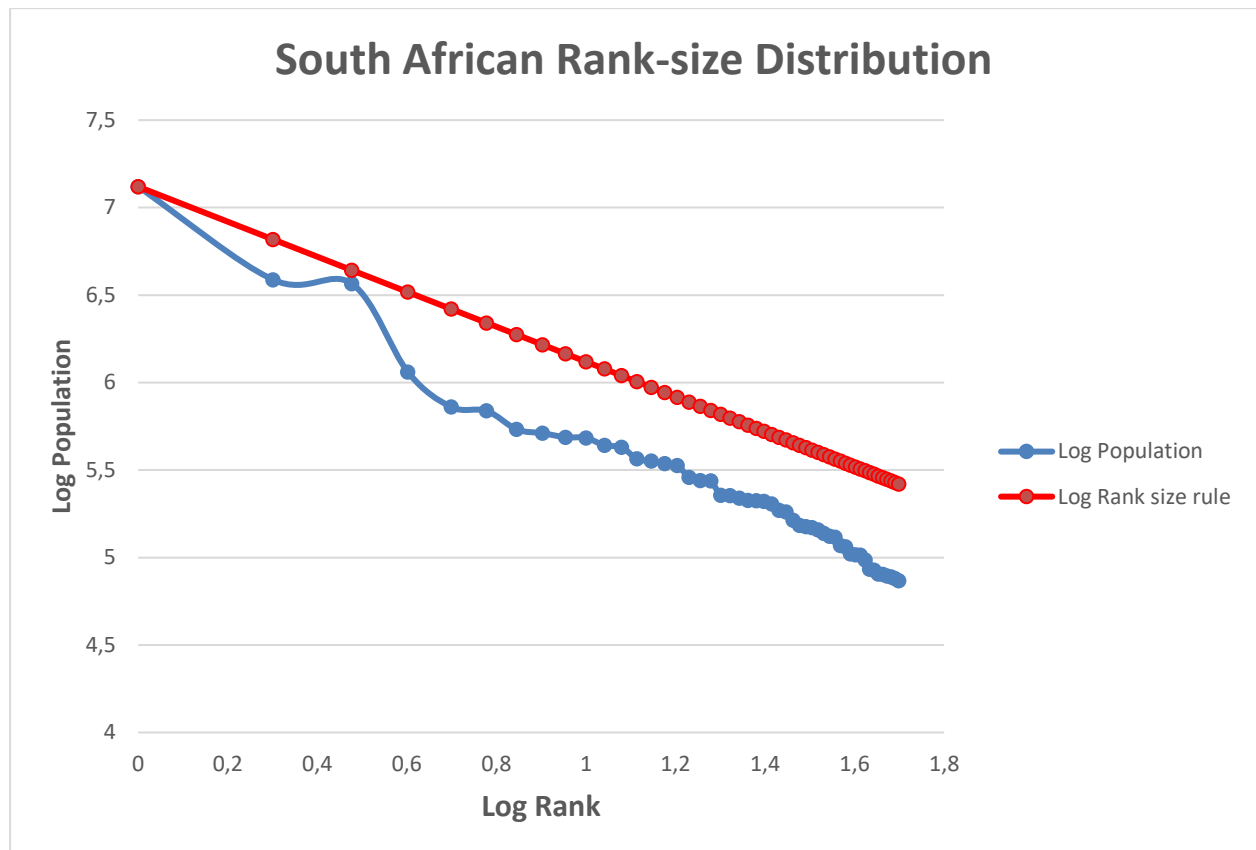


Figure 7-7: Log rank-size distribution of South Africa

Source: Own compilation from Berry (1972) and Van Huyssten *et al.* (2016:8-11)

From Figure 7-7 it is clear that South Africa has a dominant city which is the Johannesburg City Region. The high population density is largely the result of the migration of people when gold was discovered as described in Section 7.2.1. What contributed to the continued growth of Johannesburg could be the establishment of supporting industries and the diversification of Johannesburg's economy (refer to Section 2.3.3, 2.4.2 and 3.3). Furthermore, it is also evident that the remaining metropolitan areas as illustrated in Figure 7-5 i.e. (ii) Cape Town City Region; (iii) eThekweni City Region and (iv) Port Elizabeth City Region have a significantly higher population density than the city of the following rank. This also indicates that South Africa has four strong metropolitan regions and a lack of medium- and smaller-sized cities (which in turn has a negative impact on resilience in urban systems as described in Section 4.5). This data is,

however, on a large scale as it encompasses data of the whole South Africa, but it still provides a clear indication of the spatial distribution tendencies of the South African population.

As set out in Objective Two of the study, the study aims to examine different policies to improve regional resilience in different urban systems (refer to Section 1.3). The main policies on the national level were discussed in Chapter five and this section, therefore, aims to evaluate the policies implemented on a regional level. The Northern Cape province was, therefore, identified for the study as it has a strong rural component and several strategies exist to improve regional development. The following section will thus focus on the characteristics of the Northern Cape province as well as the policies which are implemented on a regional scale.

7.2.3 Northern Cape province

The previous sections focussed on a national level to obtain a holistic view of the background and key economic sectors, the population distribution as well as the policy formulation, design and implementation processes (refer to Section 5.3). The purpose of this study is, however, to explore regional resilience in different urban systems and therefore, it would be of significance to explore a region (province) within South Africa in terms of its resilience and the policies which are implemented to improve the regional resilience. This would provide the reader with adequate background and an understanding on both a national and regional level. While Chapter Five examined different international policies and regional policies implemented on a national scale to improve regional resilience, the policies implemented on a regional scale are yet to be determined. Therefore, it would be a significant contribution to exploring provincial policies implemented on a smaller scale to conduct a more detailed investigation in terms of policy implementation instruments to improve regional resilience. The Northern Cape province and its provincial strategies and instruments/mechanisms will thus be explored in this Section.

7.2.3.1 Background

The Northern Cape is the largest province, consisting of 29.7% of South Africa's surface area. It is South Africa's most arid province with some areas receiving less than 200mm rainfall a year. The Northern Cape consists largely out of semi-desert and desert areas (Department of Rural Development and Land Reform, 2010). Even though the Northern Cape encompass a large surface area, it has the smallest population of all the provinces in South Africa.

The Northern Cape is known for its richness in minerals and contributes largely to the South African GDP via the mining and quarrying sector (Department of Rural Development and Land Reform, 2010:2). The following figure illustrates the GDP of all the provinces of South Africa:

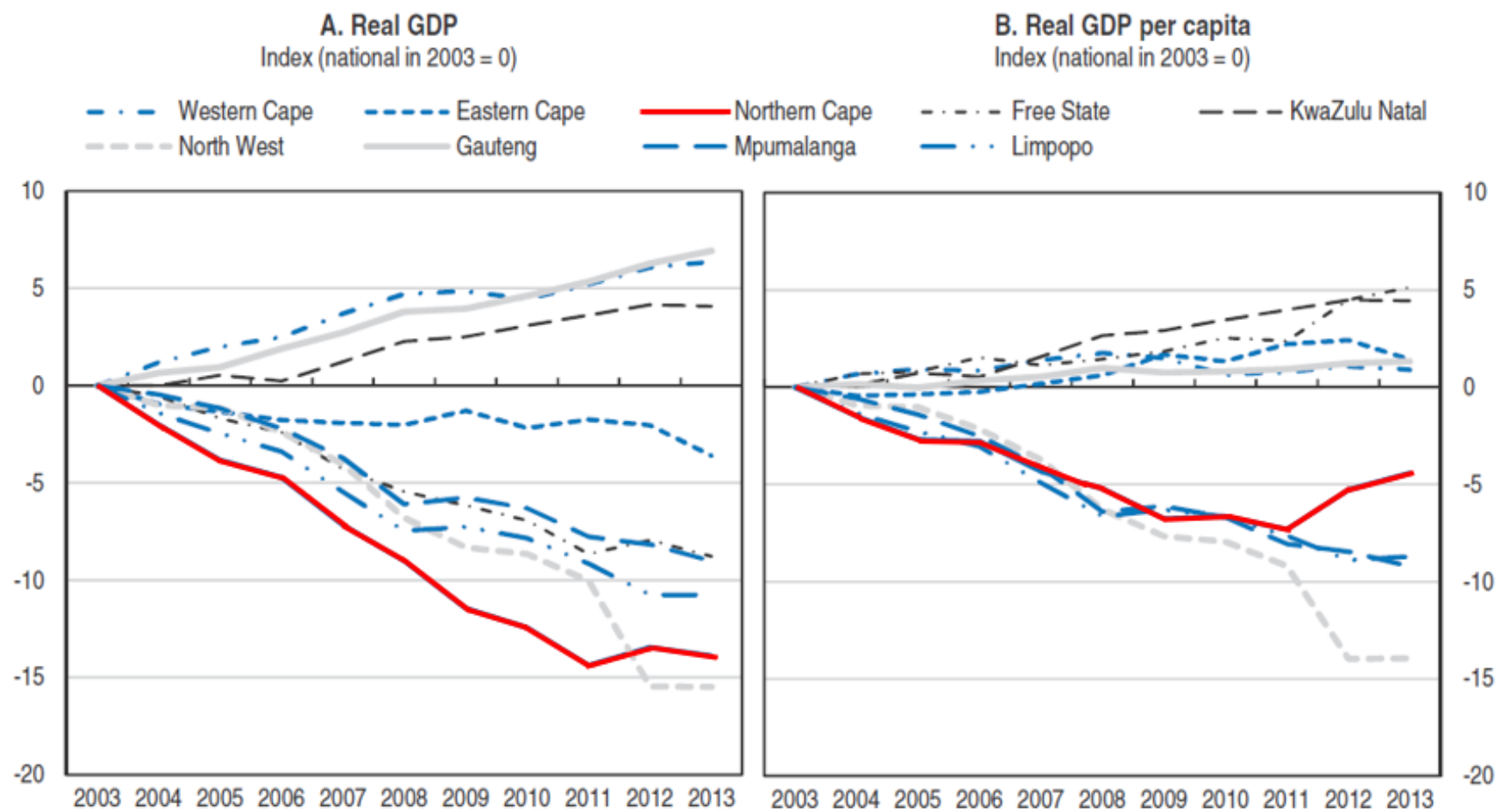
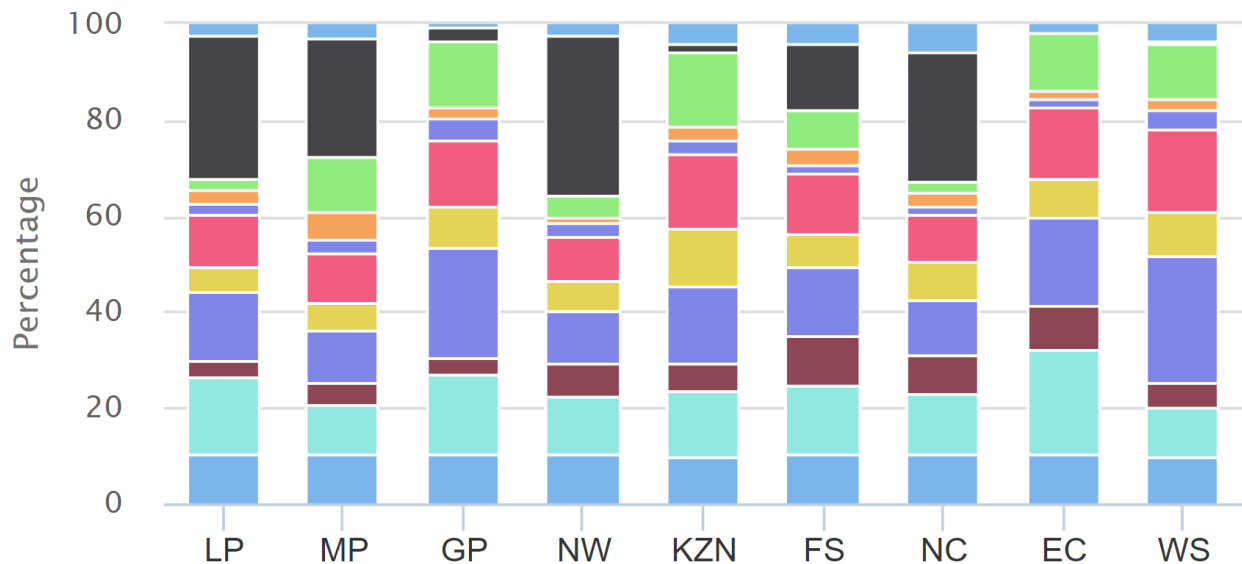


Figure 7-8: Economic growth of South Africa

Source: OECD (2015:31)

From the figure above, it is clear that the Northern Cape Province's overall contribution to the GDP is lower than the remaining provinces (refer to Section 2.4.1). In 2011, the GDP of the Northern Cape improved significantly up to 2013 and proves that the Northern Cape has economic development potential. The Northern Cape economy can then be subdivided into different key economic sectors which are as follows:



Key Economic Sectors	Northern Cape
Agriculture	6%
Mining	26.7%
Manufacturing	2.1%
Electric	3%
Construction	1.6%
Wholesale	9.9%
Transport	7.8%
Finance	11.6%
Personal Services	8.1%
Government Services	12.8%
Taxes	10.2%

Figure 7-9: Key economic sectors of the South African provinces

Source: Adapted from Statistics South Africa (2018)

Figure 7-9 illustrates the key economic sectors of all South African provinces. For the purpose of this study, a specific focus is placed on the Northern Cape. Mining is the dominant sector of the Northern Cape as it accounts for 26,7% of the Northern Cape's GDP. Mining can be described as a primary economic activity and due to the population distribution of the province, it can also be associated with an underdeveloped region as the region is sparsely populated and focusses on primary activities (refer to Section 2.2.3). Other key sectors are Government, Finance, Taxes and Wholesale Sectors.

7.2.3.2 Population distribution characteristics

The Northern Cape is characterised by numerous small and isolated settlements which are scattered across the vast area of the province. A large number of these settlements find it challenging to provide the residents with basic services and economic opportunities (van der Merwe & Zietsman, 2011:1). The Northern Cape province exists of approximately 115 urban settlements which vary in size and hierarchy (refer to Section 3.2 and 3.3). The following figure illustrates the population distribution in the Northern Cape province:

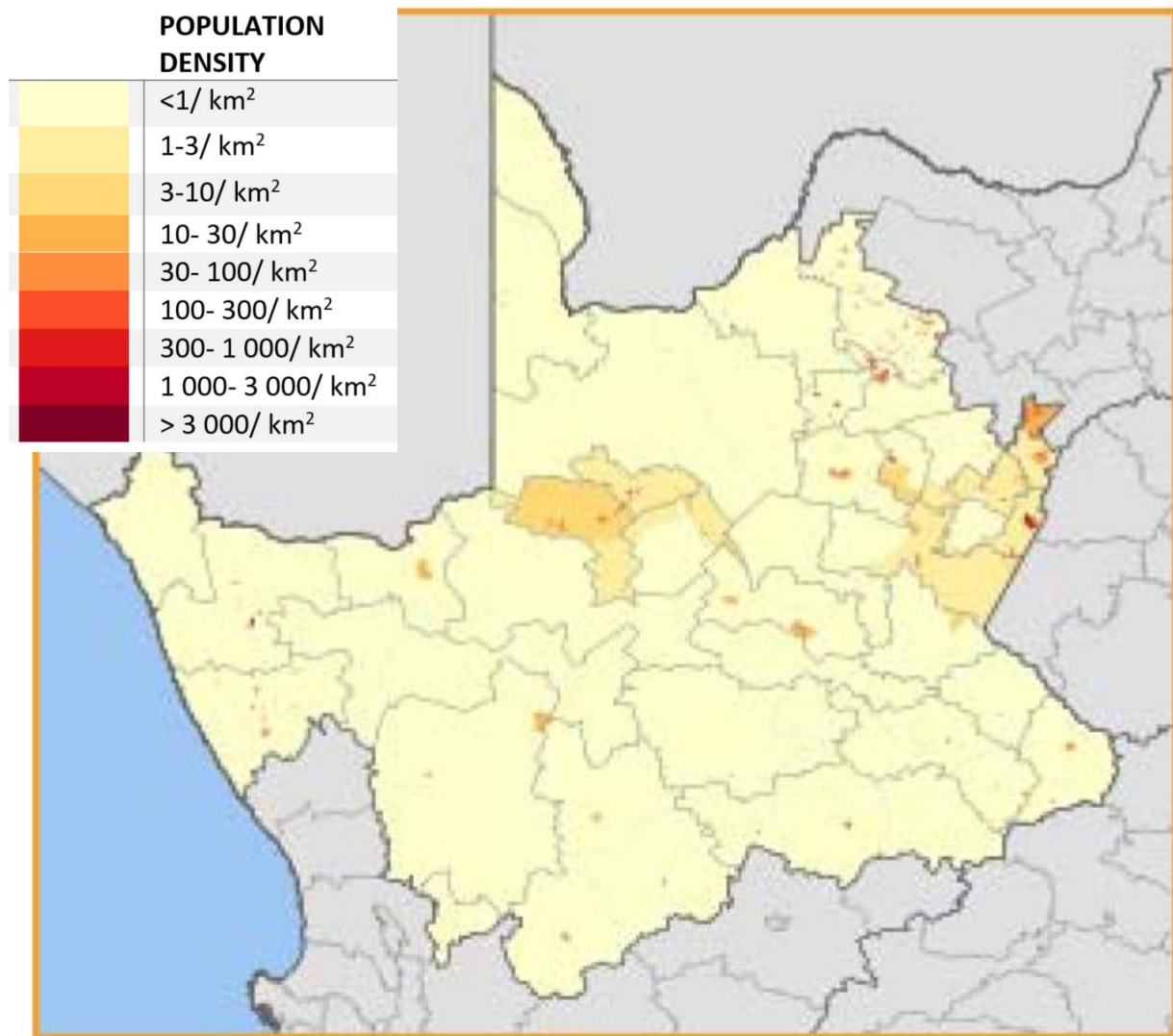


Figure 7-10: Population distribution of the Northern Cape province

Source: Adapted from the Department of Rural Development and Land Reform (2010:1)

It would, therefore, also be of significance to explore the population distribution characteristics in terms of population for the Northern Cape province as it is the identified study area. As mentioned in Sections 6.2.1.2, 6.2.3 and 7.2.2, the population statistics were used to determine the different hierarchical orders found in the urban system (or in this case the specified study area). The population distribution was used as it was the only way to clearly determine and indicate the different hierarchical orders (see Section 3.2.1 and 3.2.2). The figure below, therefore, illustrates the population distribution of the eight largest cities/towns located in the Northern Cape province:

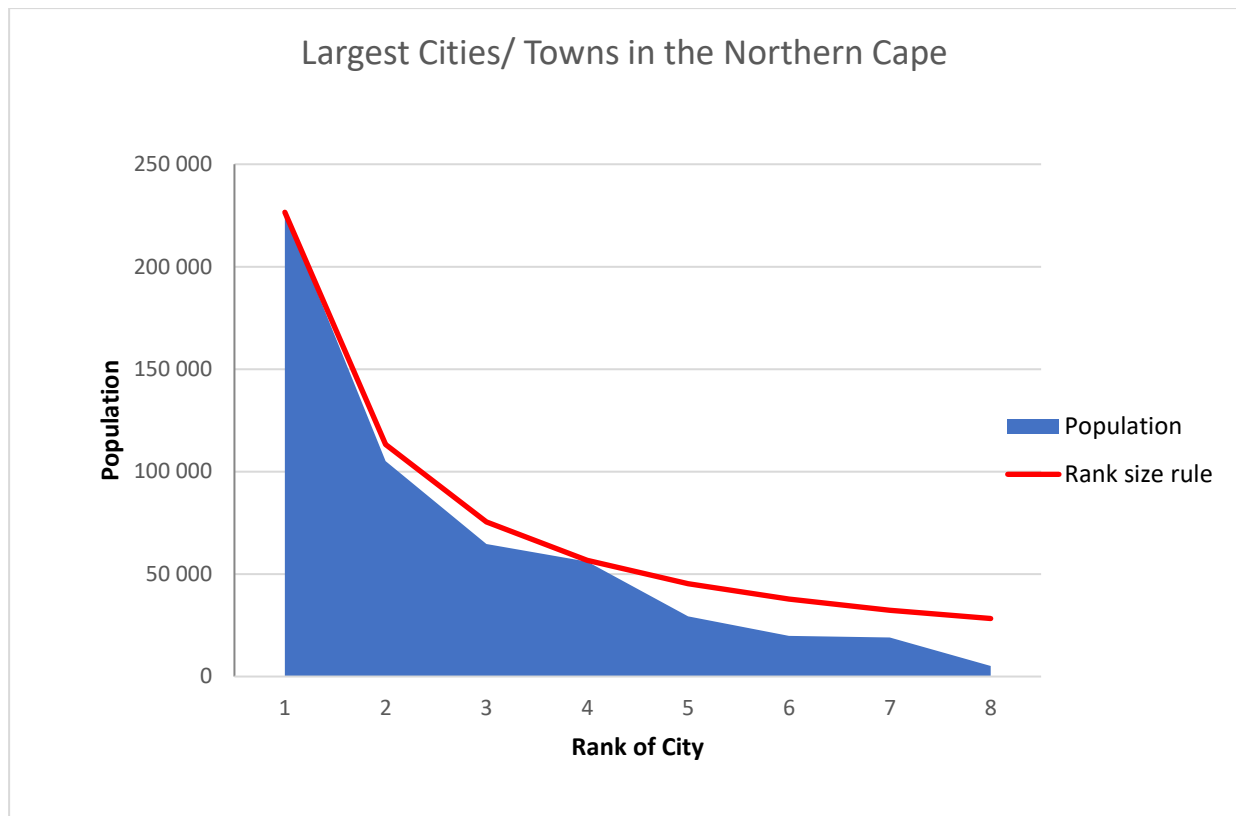


Figure 7-11: Largest cities/towns in the Northern Cape province

Source: Own compilation from Berry (1972) and Van Huyssten *et al.* (2016:8-11)

Figure 7-11 illustrates the population distribution of the Northern Cape for the cities and towns found in the area. Only eight cities and towns were identified for this study as the 8th largest town only has a population of approximately 5 000 residents (refer to Figure 7-12 as the sharp decline in the population is visible). When comparing the Northern Cape's population distribution against South Africa (refer to Figure 7-7), it is clear that the Northern Cape's spatial distribution on a provincial level follows the rank-size rule (which could be linked to structural optimisation which could be used to improve resilience in different urban systems). This again indicates that the cities and towns are more balanced when focussing on a regional level and have the potential for growth. However, it should be noted that the Northern Cape is sparsely populated, and thus numerous small towns or communities exist which influences the data. Furthermore, the log rank-size distribution was also calculated and is illustrated below:

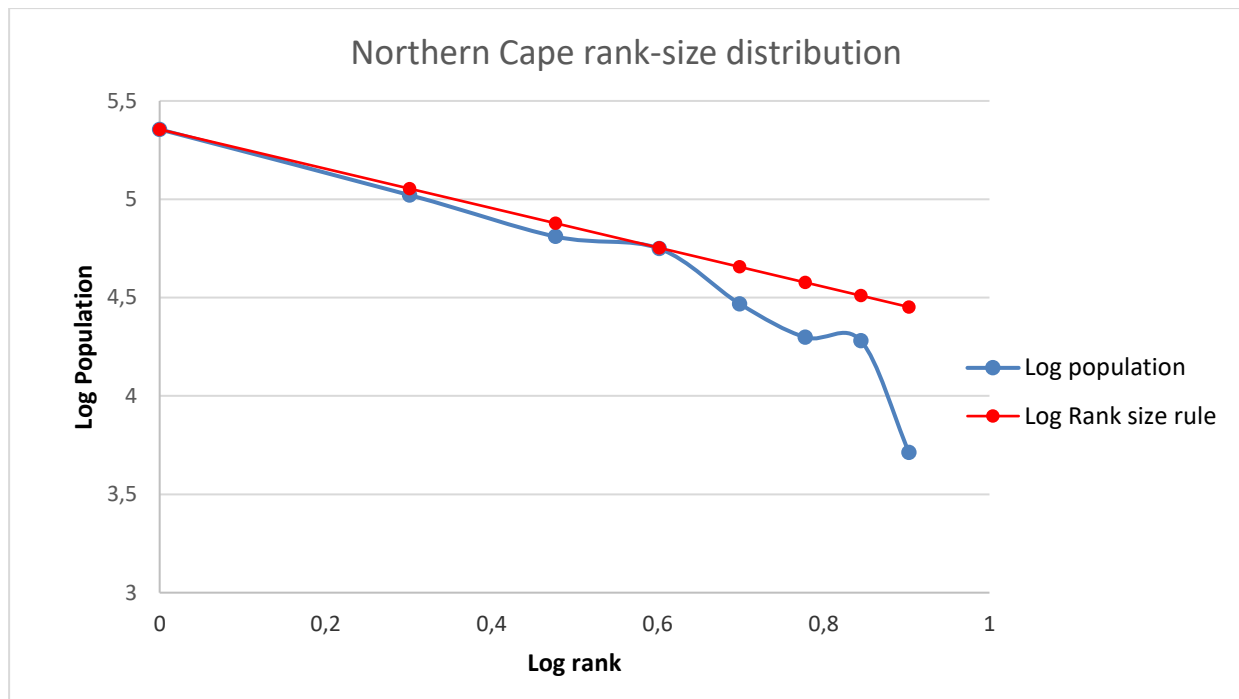


Figure 7-12: Northern Cape rank-size distribution

Source: Own compilation from Berry (1972) and Van Huyssten *et al.* (2016:8-11)

From Figure 7-12 it is evident that the spatial distribution pattern of the Northern Cape is close to a normal distribution (refer to Figure 3-2). This proves that the Northern Cape province does not encompass a similar distribution to South Africa (refer to Figure 7-7) and no dominant primate city exist for the Northern Cape (which from a spatial point of view can be used to describe a higher level of resilience in the specific urban system). The small towns are smaller than predicted and this creates an imbalance in the normal distribution of the Northern Cape. Chapter Eight will explore different scenarios to improve regional resilience in different urban systems. In addition, the Northern Cape also has several growth strategies and frameworks in place to improve their regional growth.

7.2.3.3 Policies

National policies with reference to the South African content were described in Sections 5.3 and 5.4. The aim of this section is to focus on a regional/provincial level. As described in Sections 5.3.5 and 5.4.1, SPLUMA and the NDP envisioned that the different spheres of government should compile their own spatial policies to assist with the spatial planning principles and policies of South Africa overall. This section will, therefore, concentrate on policies formulated on a provincial level.

7.2.3.3.1 Policy design process

One of the frameworks implemented as required by SPLUMA (refer to Section 5.4.1) is the Northern Cape Provincial Spatial Development Framework (PSDF), which was designed to encourage sustainable urban and rural development in the long term (refer to Section 4.3.5). The PSDF also proposed different development “capitals” to facilitate economic growth. These five “capitals” (or growth centres) identified are vital for the development of the province as they are equally important to initiate growth and development and to improve the region’s resilience in different urban systems; they are illustrated in the figure below:

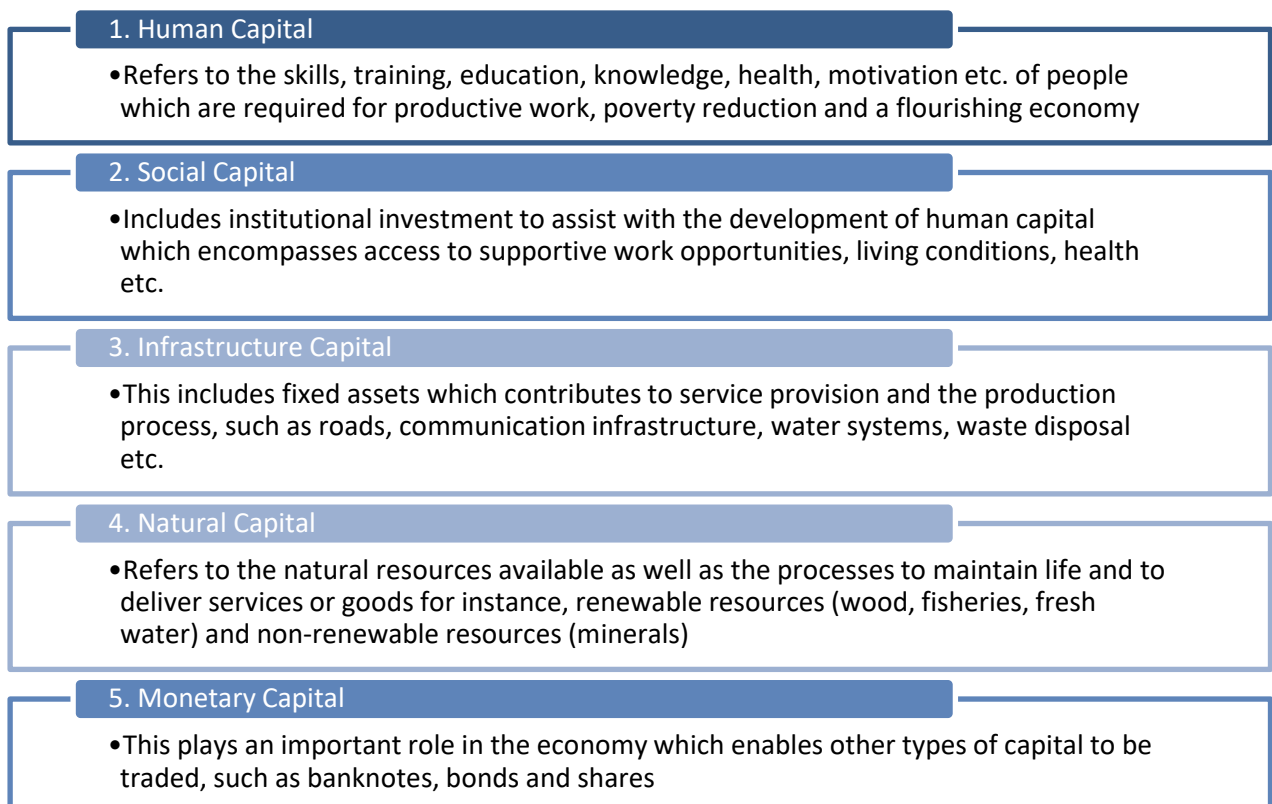


Figure 7-13: 5 Forms of development capitals

Source: Adapted from van der Merwe & Zietsman (2011:2)

If strong relationships and networks exist within these five forms of development capitals (refer to Figure 7-13:) it would improve the regional development of the Northern Cape. This, in turn, could also be linked to the different fields identified to improve resilience as described in Section 4.2.2. Unfortunately, the Northern Cape is experiencing trends of declining settlements for numerous years and therefore, the reformulation of policies was required to assist with the declining population and other challenges which followed (refer to problematic regions in Section 2.2.3).

The following policies and strategies were implemented to improve regional development/regional resilience on a provincial scale:

i. Northern Cape Provincial Growth and Development Strategy (PGDS)

The PGDS was developed in response to the social and economic development requirements of the province and aims to achieve the following main objectives:

PGDS Objectives	1. Promoting growth, diversification and transformation in the province
	2. Reducing poverty through social development
	3. Creating sufficient levels of human capital
	4. Improving the effectiveness and efficiency of development institutions and the government
	5. Improving infrastructure to ensure economic growth and social development

Figure 7-14: PGDS Main development objectives of the Northern Cape

Source: Adapted from van der Merwe & Zietsman (2011:18)

Figure 7-14 illustrates the five main objectives set out in the PGDS of the Northern Cape. These objectives are aimed to facilitate growth in the province. The PGDS is important as it assists different spheres of the government by providing a guideline for several economic opportunities in the province (refer to Section 2.4.2, 2.4.3 and 2.4.4).

The PGDS also raised the alarm that some of the mining industries are declining (especially in the diamond and copper mining industries) and that alternative economic sectors should be promoted to diversify the Northern Cape economy, especially in the towns that were dependent on the income of these minerals (van der Merwe & Zietsman, 2011:18). This again demonstrates the importance of diversifying economic sectors to improve resilience (refer to Section 4.3). The PGDS was developed from an economic growth perspective and should be read in accordance with the Provincial Spatial Development Framework, which is described below.

ii. Provincial Spatial Development Framework (PSDF)

The aim of the PSDF is to address the challenges the Northern Cape province faces as outlined in the PGDS. The PSDF was developed to guide strategic decisions as the following questions

should be addressed (i) What should be developed? (ii) Where the development should take place? (iii) How the development will be implemented? and (iv) When the development will take place? (refer to the fundamental questions of resilience in Table 4-3). The aim of the PSDF is to not only to give effect to the national policies (refer to Section 5.3) but should also outline the local, district and provincial development principles in the Northern Cape. The PSDF has the following purpose:

Purpose of PSDF	1. Indicate the spatial implications and development objectives set in the PGDS
	2. Serve as a spatial plan than supports local economic development
	3. Identify strategies, guidelines and proposals for sustainable development
	4. Facilitate co-operation between municipalities, provinces and countries
	5. Serve as a manual to standarise and integrate municipal planning frameworks

Figure 7-15: Purpose of the PSDF

Source: Adapted from the Department of Cooperative Governance (2012:2-4)

The figure above illustrates the purpose and the functions of the PSDF and the policy was formed to adhere to international, national and regional policies. Figure 7-15 illustrates the overarching purpose of the PSDF designed for the Northern Cape province. The PSDF aims to promote economic, social and environmental sustainability by providing a spatial land use directive and to assist the government with the prioritising of areas and economic sectors (refer to Section 4.2.2). In short, the PSDF aims to build on the PGDS vision to build a prosperous, sustainable growing provincial economy and to eradicate poverty while improving social sustainability (Department of Cooperative Governance, 2012:3). Due to the regional focus of this study, the purpose and formulation are of importance as they will be used as a guideline to evaluate if the current policy implementation would improve regional resilience in different urban systems. Thus, the PGDS will serve as a spatial development guideline as it aims to identify several spatial development initiatives while incorporating the role of the different levels of government spheres. To accomplish the vision of both the PGDS and the PSDF, the PSDF identified the following development objectives:

PSDF Objectives

1. Promote balanced, integrated and sustainable human settlements in the long-term
2. Indicate preferred locations for development to guide investors about where development is planned/not planned
3. Provide guidelines for both private and public decision-making
4. Indicate priority areas of targeted public investment which supports the spatial development vision

Figure 7-16: PSDF Objectives for the Northern Cape

Source: Adapted from the Department of Cooperative Governance (2012:1-2)

The objectives as illustrated in Figure 7-16 are the foundation on which the PSDF is built. These objectives were designed to provide a place-specific and coherent methodology for the management and planning of the different government spheres. The Northern Cape is unique and distinctive and therefore, it would be best to facilitate its management with global and local best-practice (Department of Cooperative Governance, 2012:4). This is of relevance to this study as the objectives identified above can be used to improve regional resilience, especially if strategic spatial priority areas are identified (refer to Section 8.3). Furthermore, it would also be beneficial if the roles of the different government spheres are classified and integration is promoted, as the current policies which are to be implemented in South Africa are challenged by low government integration (refer to Section 5.3.5). By increasing the integration between the government spheres, policies would be implemented more efficiently, and strategies would also be developed in a more coherent manner which, in turn, would improve the regional resilience of the Northern Cape province and ultimately affect the whole urban system of South Africa (refer to Section 4.4.3).

7.2.3.3.2 Implementation of Policies and Frameworks

As mentioned above, South Africa is currently challenged with the implementation of several strategic documents on the a local, regional and national level, as government spheres are not fully integrated (refer to Section 5.3). Therefore, the PSDF adopted a bioregional approach which includes the compliance of the following imperatives (Department of Cooperative Governance, 2012:4):

- i. *Institutional Integration:* Alliances between institutions should be forced to minimise overlap, close gaps and to improve the efficiency of both management and investment.
- ii. *Integrated Development Planning:* Planning should be a participatory approach to integrate social, economic, environmental, spatial, sectoral, institutional and fiscal

strategies to support the optimum allocation of scarce resources which would result in economic growth, equity and empowerment.

- iii. *Co-operative Governance*: The relationship between the governmental spheres (national, provincial and local) are interdependent, interrelated and distinctive. The three spheres should exist in unity and they should work together on decision-making, coordinating budgets as well as the development and implementation of policies.

It is important to integrate and standardise planning in all spheres of the government to develop a valuable Spatial Development Framework for the Northern Cape (refer to Section 4.5). As described above, the PSDF aims to develop a spatial vision in terms of the bioregional planning principles combined with the desired land uses throughout the province (refer to Section 4.5.4).

7.2.3.3.3 Development Objectives

The spatial vision for the Northern Cape as set out in the PSDF therefore, took several factors into account, such as competitive and comparative advantages (refer to Figure 4-6) which will be used to promote regional development as efficiently as possible (Department of Cooperative Governance, 2012:10). The following figures illustrate the six SPC's identified for the Northern Cape which were overlaid to form the Composite Spatial Plan. These figures were developed to incorporate the proposed interventions of the PGDS, the sectoral strategies as well as the input received from stakeholder participation.

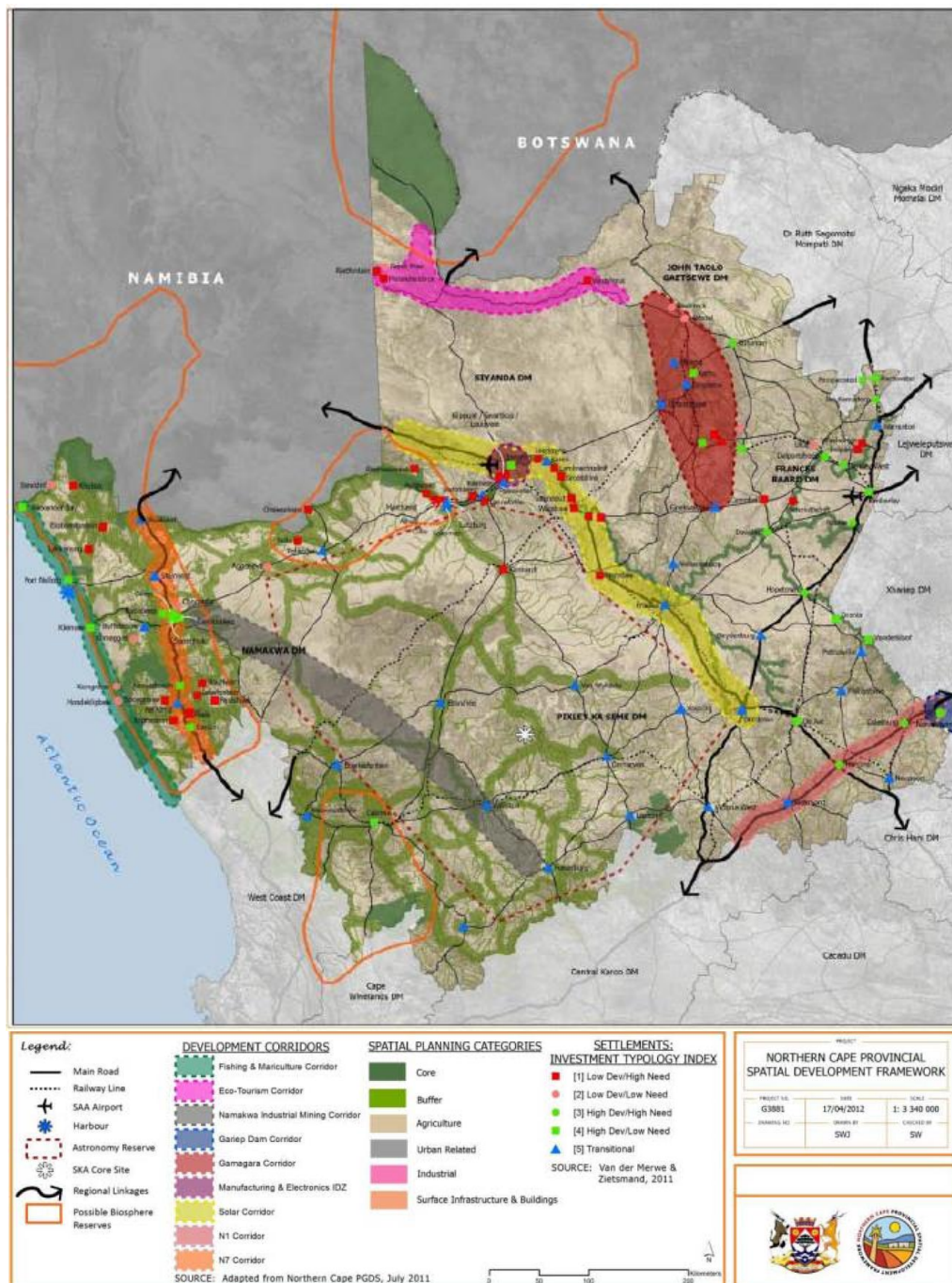


Figure 7-17: Northern Cape composite spatial plan

Source: Department of Cooperative Governance (2012:13)

Figure 7-19 illustrates the spatial vision for the Northern Cape province which is included in the PSDF. The PSDF categorised their development objectives into three different priority areas:

- High Priority:* Requires implementation within 1-3 years
- Medium Priority:* Requires implementation within 4-6 years
- Low Priority:* Requires implementation within 7-10 years.

The identified category of the priority will inform the annual allocations of budgets of the Northern Cape province which ensures a more systematic (refer to Figure 4-9) and strategic implementation (Department of Cooperative Governance, 2012:14). Furthermore, the PSDF divided the key economic sectors and other key economic drivers of the Northern Cape province and focussed on each sector's planning and development. The following figure illustrates the priority areas identified in the PSDF according to the settlement types:

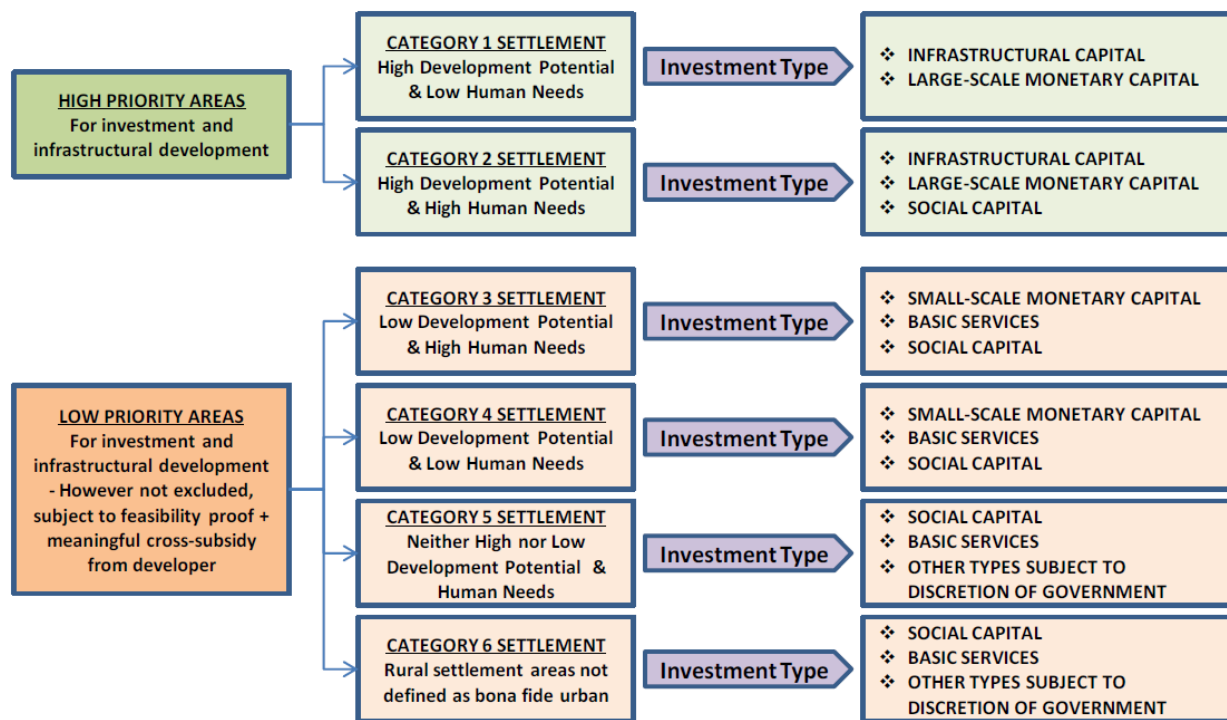


Figure 7-18: General approach to the appropriation of capital

Source: Department of Cooperative Governance (2012:50)

Figure 7-18 illustrates the different priority area identified together with the type of investment to take place (refer to Section 4.3.5). Even though the settlement types require intervention, the PSDF also acknowledges the pivotal functions of the Northern Cape province as it functions as a linkage between the remainder of South Africa, Botswana and Namibia (Department of Cooperative Governance, 2012:19). Therefore, transport linkages were identified as a high priority as they should be of high standard (Refer to Section 4.5.3). Figure 7-19 illustrates the identified transport links within the Northern Cape:

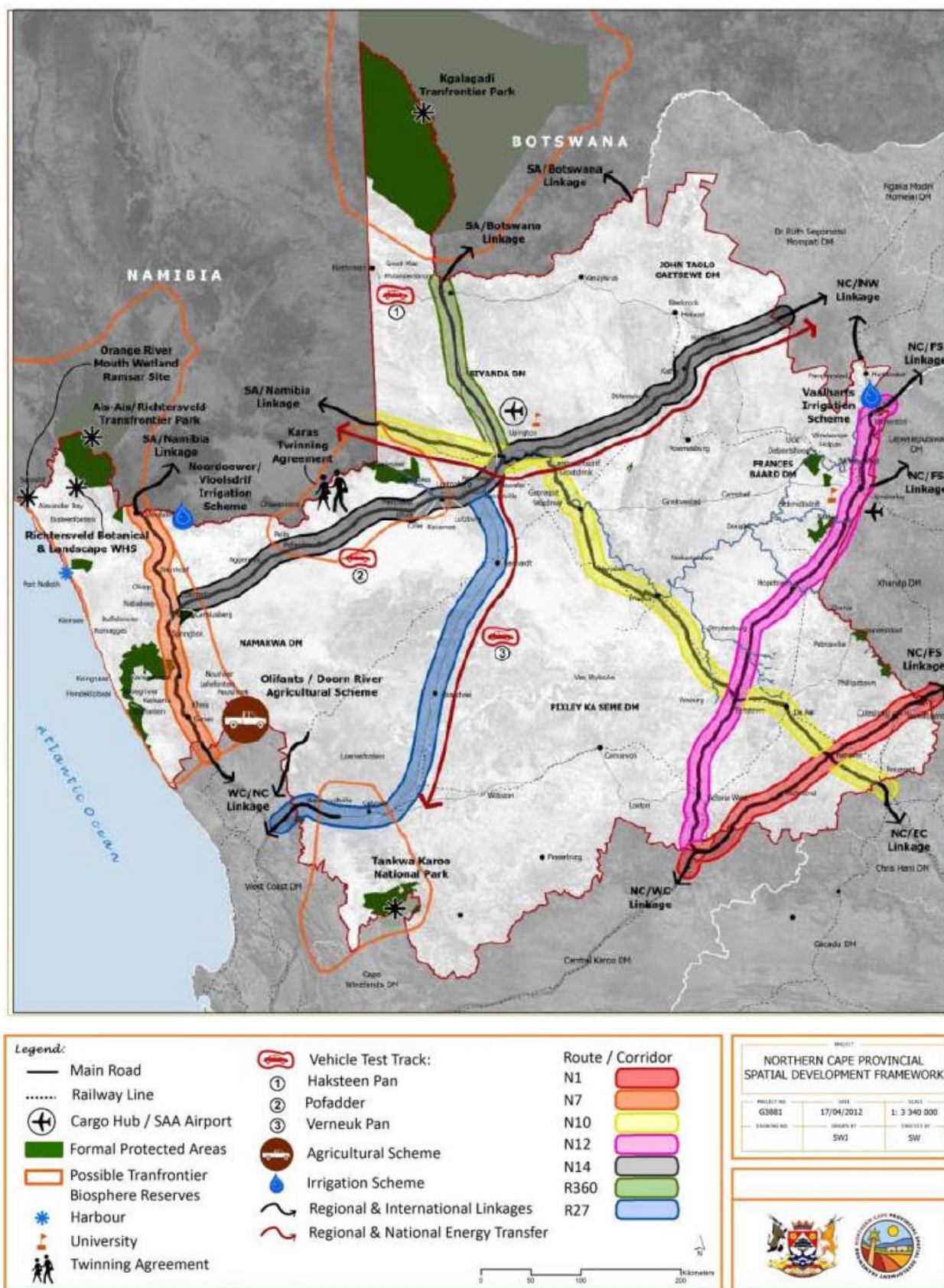


Figure 7-19: Spatial plan for the Northern Cape as a pivot to the surrounding provinces

Source: Department of Cooperative Governance (2012:20)

The figure above (Figure 7-19) illustrates the main corridors identified in the Northern Cape (refer to Section 2.4.3). The PSDF aims to ensure that these transport networks are of high quality to promote the use of these routes which, in turn, will promote economic growth in the Northern Cape as it would provide adequate linkages to other provinces in South Africa as well as international linkages to Botswana and Namibia (Refer to Section 2.4.4 and 3.4.2).

7.3 Conclusion

It is perceived that sustainable rural development is closely related to a functional urban system (refer to Section 3.3.3 and 3.4) where small towns are used as the starting point that drive regional development and economic growth (refer to Section 2.4.2). The Northern Cape's small settlements contribute to satisfying the needs of the surrounding communities (refer to Section 2.3.1, 2.3.2, 2.3.3 and 3.3). It is also perceived that these small towns affect sustainable regional development as they have an impact on the spatial economy and affect global links in terms of improving the connectivity in urban systems (refer to Section 4.5.3). It is, therefore, recommended that urban and rural settlements be evaluated as a functional system rather than to only evaluate urban settlements in isolation (refer to Section 4.5). This approach would also assist the decision-makers when strategic documents are to be designed and implemented (refer to Section 8.3.3). Furthermore, it was also discovered that the Northern Cape province can be identified as an underdeveloped region due to its economic and spatial characteristics, and the problematic region could be improved through government intervention by means of investment opportunities in the form of unbalanced growth (refer to Section 2.4.4). In addition, due to the Northern Cape's richness in minerals and the industries which are associated with mining activities, resilience could also be improved by strengthening forward and backward linkages, especially in the form of diversification (refer to Section 3.3.4).

The contribution which small towns could make to regional development overall is not recognised in rural development strategies, especially on the national government sphere. If a more dynamic approach is followed which recognises the existing and potential roles of rural towns, it would create a knock-on effect to larger towns and cities (refer to Section 8.3.1). It is also important to note that a strong interdependence exists between rural and urban areas (refer to Section 3.3.2) and if sufficient infrastructure exists between these areas, the productivity of the area could improve overall (refer to Section 4.5). The concepts as depicted in the empirical investigations will be used together with the relevant theories and concepts identified in the literature review to recommend policy interventions and implementation in the following chapter (Chapter Eight) on a South African level.

CHAPTER EIGHT: SYNTHESIS AND RECOMMENDATIONS

8.1 Introduction

The study identified three research objectives (refer to Section 1.3) which were approached by both literature studies and empirical studies (quantitative and qualitative data) with a pragmatic paradigm approach (refer Section 1.5.1). The following figure illustrates the chapters which addressed the research objectives identified for this study:

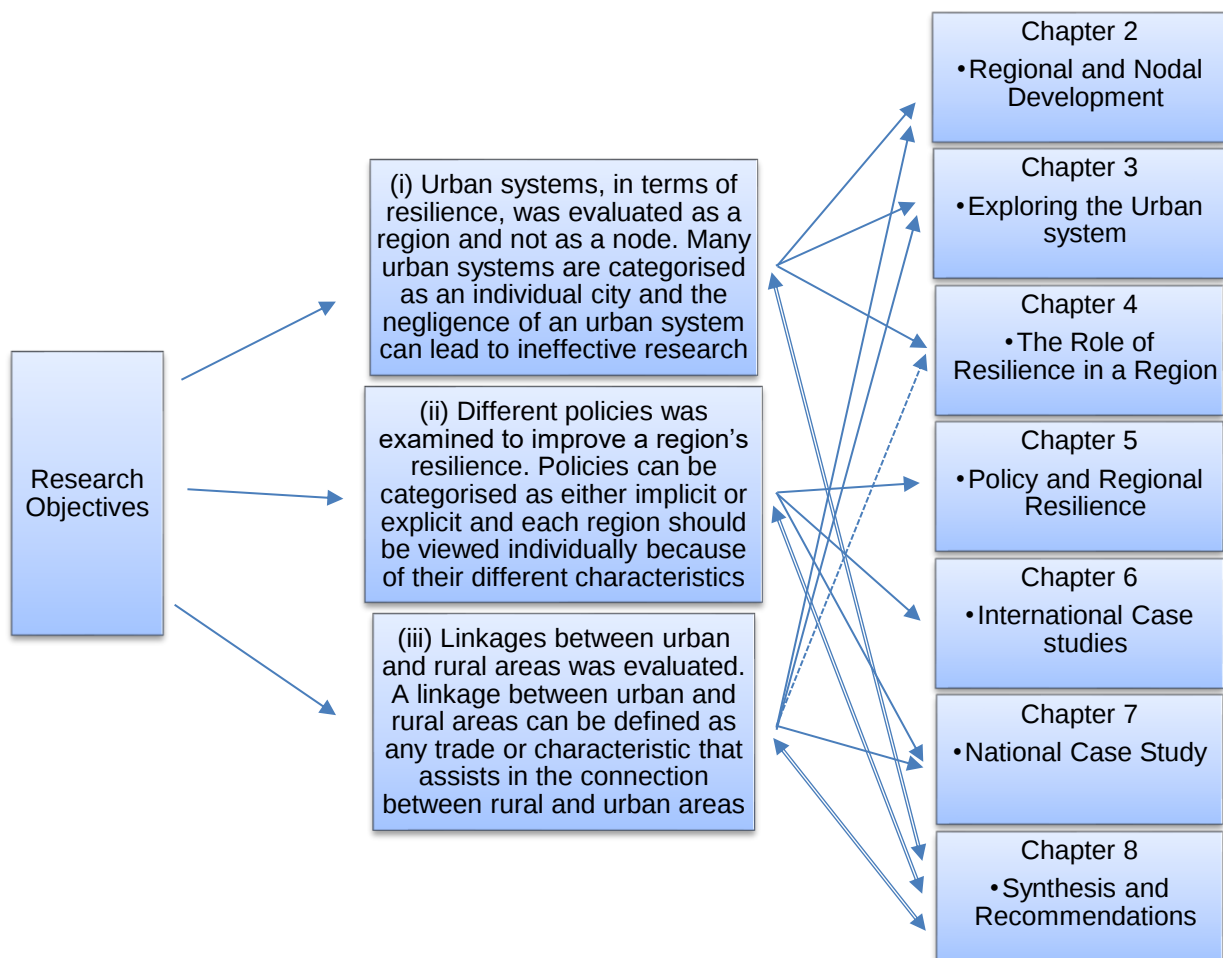


Figure 8-1: Research objectives addressed in the chapters of the study

Source: Own compilation

Figure 8-1 illustrates the different chapters in the study which addressed the objectives as set out in Section 1.3. The first part of the study (literature review i.e. Chapter Two, Three and Four) focussed on several theories which include regional development theories (refer to Sections 2.2.1, 2.2.2 and 2.2.3), different interactions which take place within regions (refer to Sections 2.4.1, 2.4.2, 2.4.3 and 2.4.4), different hierarchical orders and spatial distributions (refer to Section 3.2) of settlements within regions and lastly the concept of resilience (refer to Sections 4.3, 4.4 and 4.5). These theories and concepts were vital for the study as they be used in this chapter to conclude and recommend on how regional resilience can be improved in different urban systems.

The second part of the study (empirical investigation i.e. Chapter Five, Six and Seven) mainly focussed on different policies implemented on international (refer to Sections 5.2, 6.2.1.3 and 6.2.4), national (refer to Sections 5.3 and 5.4) and regional scale (refer to Section 7.2.3) to improve regional resilience. These policies were evaluated in terms of the design process (refer to Sections 6.2.1.3.1, 6.2.4.1.1 and 7.2.3.3.1) to equip the researcher with the necessary information to propose how policies can be used to improve regional resilience.

The aim of this final Chapter is to provide a summary of the findings in the study as well as propose several recommendations on how to improve regional resilience in different urban systems. This will be done with specific reference to the Northern Cape province as the local study area.

8.2 Synthesis

The theoretical foundation of this study will be assessed in this Section. The synthesis will summarise the theoretical findings of regional and nodal development (Chapter Two), exploring the urban system (Chapter Three) and the role of resilience in a region (Chapter Four) and describe the purpose of the different theoretical sections and the impact they had on the study and the objectives which were to be addressed. Furthermore, the empirical study will be assessed by incorporating both international and national policies (Chapter Five), investigating different international case studies (Chapter Six) and lastly investigating national and a regional case study (Chapter Seven) by using concepts identified to improve regional resilience.

8.2.1 Purpose

The study aimed to achieve the following objectives: (i) evaluate urban systems as a region and not only as a node; (ii) examine different policies to improve regional resilience and (iii) to evaluate different linkages between rural and urban areas in different urban systems. These objectives will

then be used to achieve the main goal, which is to propose a systematic approach to improve regional resilience in different urban systems.

Ultimately, the study aimed to propose a systematic approach to improve regional resilience in different urban systems.

8.2.2 Findings

Regions are unique, and they are usually demarcated according to the function the region provides (refer to Section 2.2.2). Regions encompass several components i.e. social, cultural, economic, political and the activities and interactions of these components can lead to economic growth which in turn will strengthen the spatial significance of the region (refer to Section 2.2.1). Interaction within and between regions can either be by means of growth poles (refer to Section 2.4.2) or corridor development (refer to Section 2.4.3) and policy intervention via unbalanced growth (as it was derived that balanced growth is unrealistic) could contribute to stronger interactions within and between regions (refer to Sections 3.3 and 3.4).

Growth poles usually act as attractive investment opportunities for industries and social opportunities for individuals who reside in rural areas as industries tend to create structural change through agglomeration (refer to Section 2.4.2). The policy proposals, which are to be formulated, should consider the stage of development of the area (or region) as it could either improve or hamper the economic growth of the area (refer to Section 2.4.1). By creating attractive investment opportunities through policy intervention, unbalanced growth can be achieved when investing in SOC (refer to Section 2.4.4). This, in turn, will lead to investment in DPA which would increase the economic activity of the area and can lead to a more developed state of economic development (refer to Section 2.2.4).

An increase in economic activity would lead to the growth of settlements which in turn would provide more diversified services and products to the community (refer to Section 2.3) and attract more individuals as more opportunities will be available (refer to Section 2.3.3). This will result in the growth of rural areas ascertaining that cities in the regional system can be classified as economic growth engines for the region (refer to Section 2.4.2). This, however, does not account for a primate population distribution (refer to Section 3.2.1), which is one of the numerous ways which resilience can be measured (refer to Section 4.2.1). Several shortcomings may exist by only examining the population distributions of countries and regions, however, it should be noted that it was not part of the scope of the study (refer to Section 6.2.1.2, 6.2.3, 7.2.2 and 7.2.3.2). It was thus derived through the study and the literature review that resilience is accompanied with a complete hierarchical system which is distributed according to a specific spatial manner (refer

to Sections 3.2, 3.4, 4.4, 6.2.1.2, 6.2.3, 7.2 and 7.2.3). The study also established that if the growth of a settlement spreads its effects on rural areas and small settlements (refer to Section 3.3), policy implementation should be focussed on the economic growth of these medium- to large-sized cities as it could increase the growth of the region overall (refer to Sections 2.3.3, 2.4.2, 3.3.1, 3.3.2, 3.3.3 and 3.3.4). If the large cities have a negative or parasitic effect on smaller settlements or rural areas (refer to Section 3.2.1), policy guidelines and implementation should shift focus to enhancing the development of small settlements and rural areas to decrease the disparities between urban and rural areas (refer to Section 3.2.1).

Furthermore, the study identified different levels of urban systems which interact with one another on a daily, regional or national scale (refer to Section 3.4). The interaction of these levels verify that an urban system should not only be evaluated by means of individual cities but rather as a network which interacts with one another through several activities (refer to Section 4.5.1, 4.5.2, 4.5.3 and 4.5.4). There is rationale which supports cities to be engines of growth for the neighbouring region (refer to Sections 3.3.1, 3.3.2, 3.3.3, 3.3.4 and 3.4) as it (i) often produces numerous job opportunities for individuals who reside in rural areas; (ii) creates opportunities for businesses and industries to relocate to smaller cities and rural areas and still serve urban areas and (iii) congestion in large urban areas may cause businesses and industries to relocate to smaller urban areas or even rural communities (refer to Section 2.4.4). However, it should be noted that all of these functions represent some kind of interaction (refer to Sections 3.4.1, 3.4.2 and 3.4.3) which takes place on different scales. The market potential of areas should be evaluated in terms of their hierarchical level to develop strategic and effective policies within a region (refer to Sections 2.3 and 3.2.2). Medium-sized cities appear to produce “spread” effects where large-sized cities generally produce backwash effects, which increase urban and rural disparities (refer to Section 3.2.1).

The study also concluded that resilience can be described as the capacity of a system to absorb disturbances and to re-organise itself to operate as a functional system (refer to Sections 4.3 and 4.4). Furthermore, it proposes that a system has adaptive capabilities to function normally or even improve its functions after a disturbance took place (refer to Section 4.4.3). Resilience can, therefore, be linked to the regional concepts as mentioned above by means of the following four broad categories:

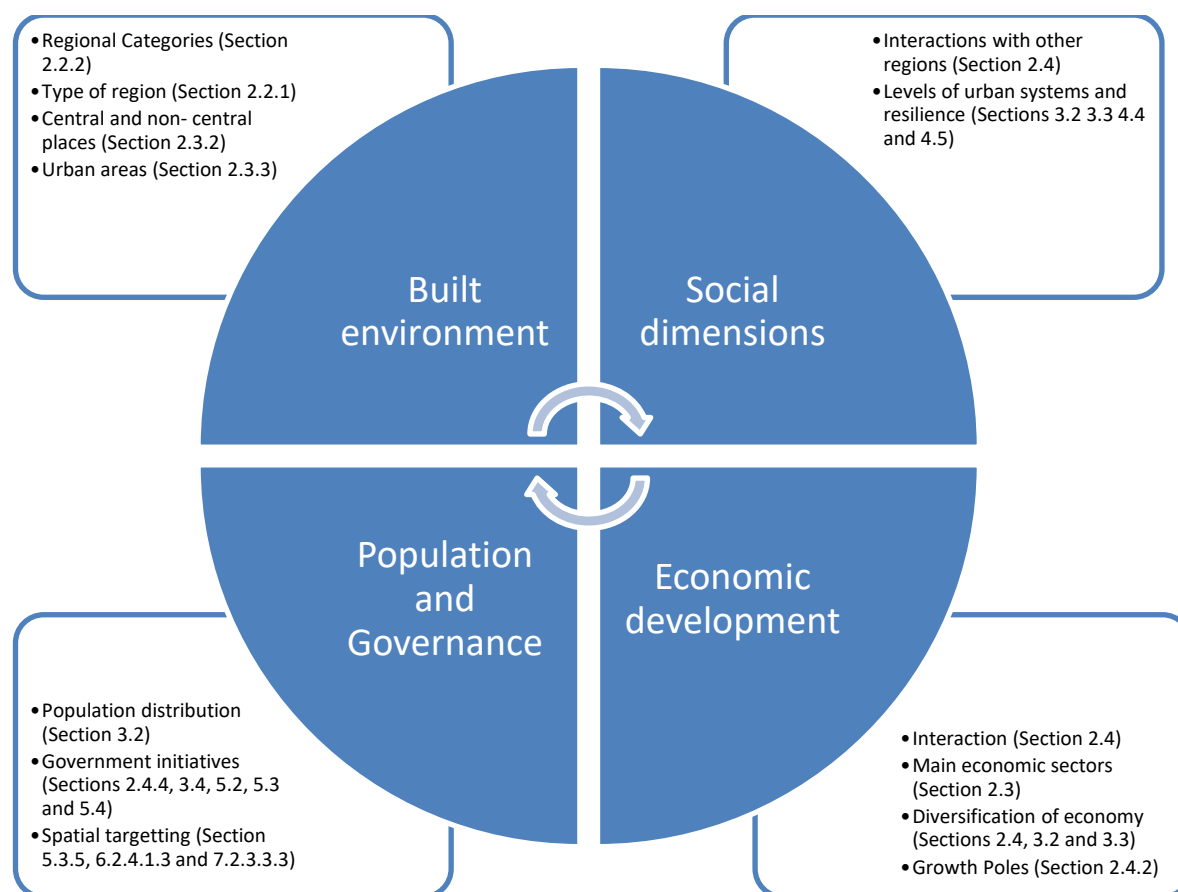


Figure 8-2: Resilience linked with regional development

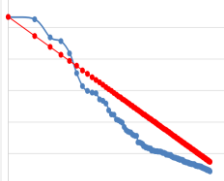
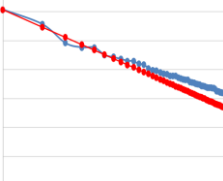
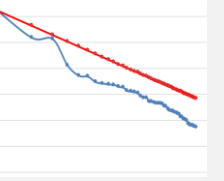
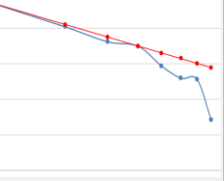
Source: Own compilation

The figure above illustrates the concept of resilience integrated into the concepts of this study. This provides the reader with a clear indication of the integration and dependence of each of these concepts on resilience. Furthermore, governance was identified as an important component to increase resilience as the government has the ability to design and implement several frameworks and policies (refer to Sections 5.2, 5.3, 6.2.1.3, 6.2.4 and 7.2.3) which could potentially improve resilience.

As mentioned previously, the case studies used for this study included both a developed and developing country to achieve a better understanding between the policy design process and policy implementation of different countries, where certain concepts can be used to recommend guidelines for South Africa policies to improve regional resilience. From the case studies, it was evident that the developed country had a diverse economic sector and focussed on mainly tertiary economic activities as well as trade (refer to Section 6.2.1.1). They also make use of a strong public participation process (co-design) when policies are to be formulated. Furthermore, the developed country focussed on the provision of infrastructure as they require the infrastructure for trade (refer to Section 6.2.1). The developed country also focusses largely on social

challenges and the primate population distribution according to the rank-size rule was as expected for a developed country (refer to Section 3.2.1). The developing country, on the other hand, uses a strong top-down approach (refer to Section 6.2.2) as they focussed on spatially targeted investment opportunities to rectify their spatial distribution (refer to Section 6.2.4.1.3). The strong top-down approach led to several social challenges as communities and other stakeholders challenge the frameworks (refer to Section 6.2.2.1). The top-down approach did, however, assist with the spatial distribution of the population as the government enforced capital incentives, such as Free Trade Zones in specific areas (refer to Section 6.2.4.1.3). In addition, the developing country's policies are focused on the diversification of the economy and they mainly focus on secondary and tertiary economic activities (refer to Section 6.2.2.1 and 6.2.4). South Africa, on the other hand, is largely focussed on primary and secondary activities and also follows a top-down approach when referring to the design and implementation process (refer to Sections 7.2.1 and 7.2.3) of policies and frameworks. The following table illustrates the similarities and differences between the countries identified in the study with a specific focus on economic sectors, policy design & implementation:

Table 8-1: Comparisons between case studies

	Developed Country (Australia)	Developing Country (Brazil)	Developing Country (South Africa)	Northern Cape province
Main economic sector	Services (Tertiary Economic Activities)	Services & Industries (Secondary and Tertiary Activities)	Mining and Industries (Primary Economic Activities)	Primarily Mining (Primary Activities)
Spatial Distribution				
Policy Design Process	Mainly bottom-up Approach (Co-Design Process)	Top-down & Bottom-up Approach	Top-down Approach	Top-down Approach

Policy Implementation	Integration of global, national, city-region and local government spheres (through enabling and strategic activities)	Mainly implementation from National Policies	Mainly implementation from National policies - recent frameworks suggest more authority to local and provincial spheres (Low integration between government spheres)	Combination of National and Provincial spheres (Low integration between spheres)
Development objectives	• Building resilience • Infrastructure • Education and Health • Trade Facilitation • International competitiveness	• Promoting converge level of development within regions • Ensuring regional competitiveness • Promoting value addition industries and economic diversification • Consolidating polycentric network of cities • Strengthening centralities in different geographical scales	• Infrastructure Investment • Job opportunities • Human wellbeing and sustainable development • Diversify and increase rural skills	• Promoting growth, diversification and transformation • Reducing poverty through social development • Improving effectiveness and efficiency of institutions and the government • Improving infrastructure to ensure economic growth and social development

Source: Own compilation

The table above illustrates the differences and similarities between the countries investigated. It can be derived that the developed country follows a bottom-up approach with a large focus on social and infrastructure development. In the developing country (Brazil), the spatial distribution is surprisingly close to the rank-size rule and the policy objectives most likely contribute to the

distribution. Brazil mainly focusses on the diversification of the economy together with the cooperation between different government spheres and institutions. Furthermore, Brazil tends to promote spatial connectedness and competitiveness (these components were identified to increase regional resilience in Section 4.4 and 4.5). South Africa, on the other hand, focusses largely on social development while seeking to improve the efficiency of government spheres (refer to Section 5.4). This again confirms that South Africa faces a challenge when integrating different spheres of the government. Lastly, the Northern Cape also focusses on similar development objectives as the South African legislation. These findings will be used in the recommendation Section (Section 8.3) together with the concepts of the figure below, on ways to improve regional resilience in different urban systems:

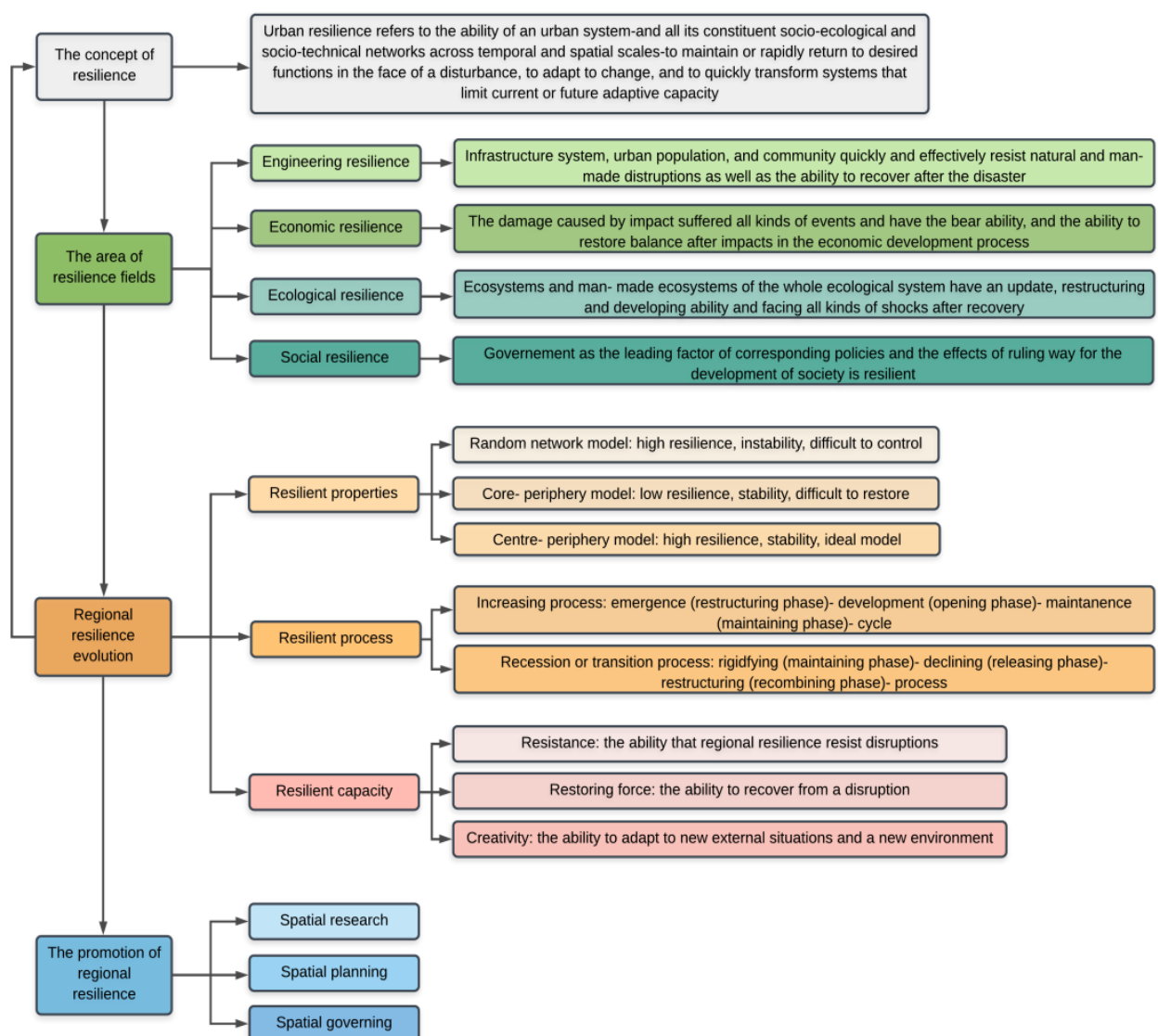


Figure 8-3: Improving regional resilience

Source: Derived from Meerow *et al.* (2016) and Peng *et al.* (2017)

The figure above illustrates a systematic method to be followed in order to improve regional resilience. The figure above illustrates the different fields of resilience, together with the properties and process and lastly how resilience can be improved. Regional resilience can, therefore, be improved by using three components i.e. (i) spatial research (ii) strategic spatial planning and (iii) spatial governing. Therefore, these components will form the foundation of the recommendations on how to improve regional resilience in different urban systems.

8.3 Recommendations

Promotion of regional resilience can be accomplished through a systematic approach by firstly investigating the spatial characteristics and components, secondly, through strategic spatial planning, objectives identified and policies to be implemented and lastly spatial governing to ensure that the spatial policies are to be implemented. These will be discussed below.

8.3.1 *Spatial research*

Spatial research is important to understand the spatial distribution and characteristics of regions. Each region is unique and depends on different resources (refer to Sections 2.2, 2.3 and 2.4). Therefore, a region should be investigated in terms of its status quo to determine the strengths and weaknesses of the region. This is regarded as a form of pre-planning for the subsequent stage of strategic spatial planning. When incorporating the concept of resilience into regions, dynamic and comprehensive resilience approaches are required which should measure the following (refer to Section 4.4.3; Figure 4-10):

- i. The resilience capacity together with the initial vulnerability.
- ii. A disturbance component, such as economic shocks, political conflicts etc.
- iii. Measuring the well-being and vulnerability level after the shock.

The challenge of measuring the resilience of a region, therefore, emerges when realising the interdependence of both systems and sub-systems (refer to Section 3.4) as a disturbance in the system does not only affect one element (one city or settlement). Therefore, resilience should rather be measured via integrated approaches that leave room for interrelated and multiple risks.

Most institutions tend to focus on resilience on a city level, rather than larger urban systems (refer to Sections 4.2 and 4.3) and when reporting and projecting cycles, it should be done over a timely basis to determine if activities deliver real resilience. Measuring resilience should be based on indicators which are both quantitative (population trends, economic growth etc.) and qualitative (government and social capital etc.) in nature (refer to Sections 4.3, 4.4 and 4.5). The role of processes which could improve regional resilience should be recognised, such as skills training,

education, organisation skills etc. By using both qualitative and quantitative assessments could also assist stakeholder engagement and other interventions which could improve resilience. The following figure represents the different components to consider when developing policies to improve regional resilience.

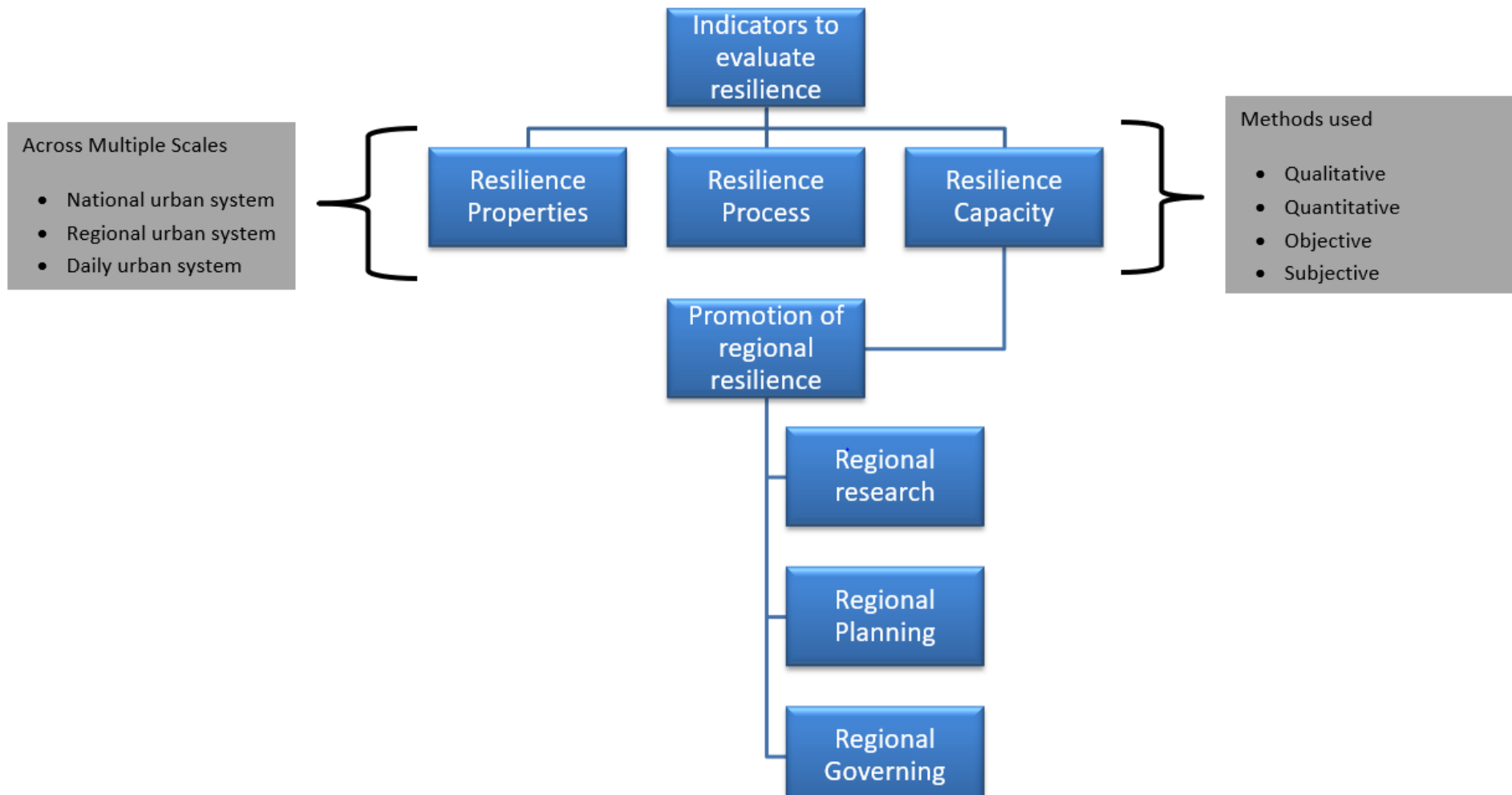


Figure 8-4: Proposed approach to improve regional resilience

Source: Own compilation

The figure above illustrates that there are several components which should be considered when developing and implementing policies to improve regional resilience. Firstly, different scales of the urban system should be identified as resilience does not only affect one settlement (refer to Sections 3.4, 4.4 and 4.5). After the properties of resilience have been identified between different urban systems, the process and capacity of resilience should be investigated. The process and capacity should include (refer to Sections 4.4.2 and 4.4.3) the (i) built environment; (ii) social dimensions; (iii) economic development and lastly (iv) population and governance (refer to Figure 8-2). These concepts can be evaluated and be used to promote regional resilience.

As mentioned in Section 7.2, South Africa is classified as a developing country and encompasses a primate distribution which leads to several spatial and economic challenges. This study is aimed to improve regional resilience in different urban systems and therefore, several scenarios were created to illustrate the spatial distribution of South Africa when policy interventions are used to focus on spatial targeting, which is focussed on medium- to smaller-sized cities in the Northern Cape (refer to Section 7.2.3.3). This formulation was done to estimate the impact that spatial targeting could have on the spatial distribution of South Africa. It is only for illustrative purposes and the researcher is aware that the likelihood of the population migrating from only the Gauteng CR is unlikely, but it does, however, give the researcher an idea on the impact such interventions would have on the spatial distribution of South Africa as a whole.

- **Scenario One**

Scenario One was formulated by proposing that if government focussed on spatial targeting in the largest city of the Northern Cape province i.e. Upington RSC, and 1 000 000 of the Gauteng CR population migrates to the Northern Cape as a result of the policy intervention, economic opportunities etc. The researcher is aware that this scenario is highly unlikely but is was used as an example to illustrate the long-term impact that population distribution could potentially have on the larger system. The spatial distribution for South Africa will rearrange itself as follows:

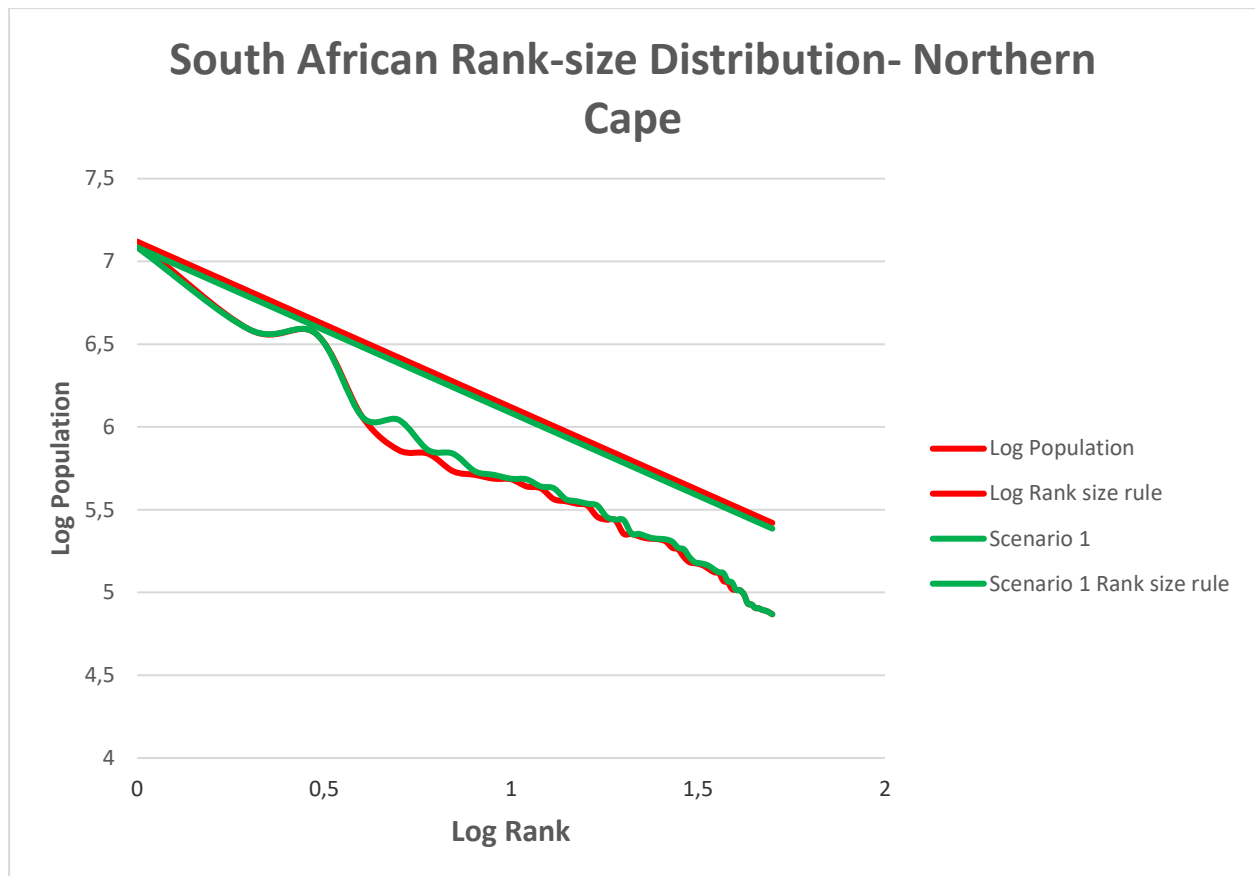


Figure 8-5: South African spatial distribution - Scenario One

Source: Own compilation

From the figure above, it is evident that if government focuses on investment opportunities through spatial targeting, it will have a knock-on effect on the whole urban system of South Africa. This proves that the government can only focus on one settlement with market potential to improve the spatial distribution of the whole urban system and subsequently resilience within the Northern Cape province will also improve.

From the case study, it was evident that the Northern Cape province focusses largely on mining activities and it is the main source of their GDP (refer to Section 7.2.3). This tendency when referring to resilience is seen as unsustainable and the government should focus on providing other economic opportunities to diversify the Northern Cape's economy (refer to Sections 2.4.1, 2.4.2, 4.3, 4.5 and 7.2.3). This could be achieved through an unbalanced growth approach (refer to Section 2.4.4). By investing in other businesses and industries or by using initiatives, such as Free Trade Zones (refer to Section 6.2.2.3), the economic activities would transform and ultimately focus on more secondary activities which could also lead to stronger backward and forward linkages (refer to Section 3.3.4). Upington will then act as a "growth engine" for the rest of the Northern Cape as its economy could potentially become more active and diversified (refer to Section 2.4.2). This, in turn, will improve the regional resilience in the Northern Cape as the

focus from primary activities is transformed to more secondary activities (refer to Section 4.3.1, 4.3.3 and 4.3.4).

- **Scenario Two**

Scenario Two was formulated by proposing the effect it would have on the population distribution if the government focussed on targeting the secondary cities as proposed by the report compiled by the South African Cities Network (2014:5); by following a polycentric spatial approach (refer to Sections 4.4, 5.3.5, 6.2.4.1.3 and 7.2.3). Scenario two was, therefore, compiled by adding a population of 166 666 for each secondary city identified and 1 000 000 of the Gauteng City Region residents migrate to the following towns:

- Kwa-Zulu Natal-Richards Bay: 166 000 new residents
- Gauteng: 166 000 new residents
- Limpopo-Polokwane: 166 000 new residents
- North West-Klerksdorp/ Stilfontein: 166 000 new residents
- Mpumalanga-Witbank: 166 000 new residents
- Western Cape-George: 166 000 new residents

The following figure illustrates the scenario of the population distribution as described above:

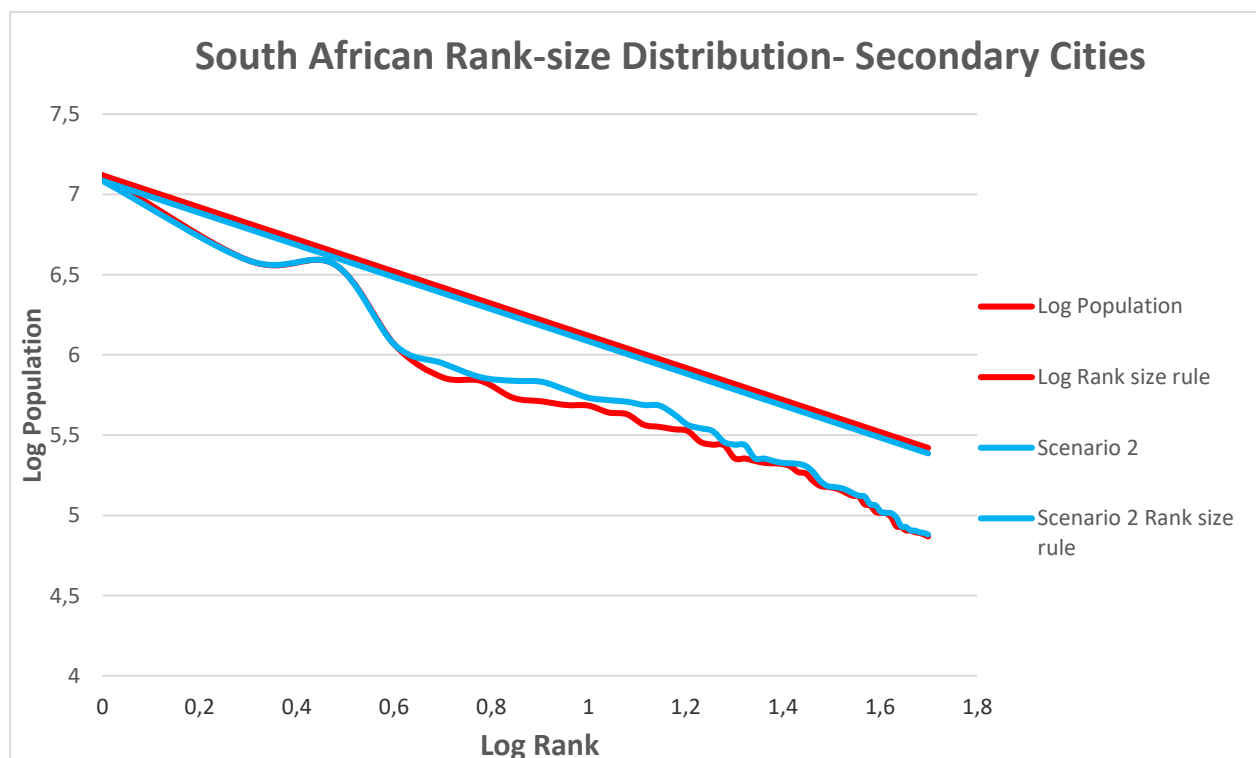


Figure 8-6: South African spatial distribution - Scenario Two

Source: Own compilation

Figure 8-6 illustrates the transformation of the spatial distribution of South Africa when government initiatives focus on the second largest cities in each of the provinces. The figure illustrates that targeted investment (refer to Sections 6.2.4.1.2 and 6.2.4.1.3) in smaller- to medium-sized cities will lead to a better spatial distribution which in turn would improve the whole urban system of South Africa (refer to Section 4.5.2 and 4.5.4). The investments and initiatives to be implemented in the medium-small sized cities should be suitable and complementary to the economic activities found in the area. It is also important to keep in mind that the more diversified an economy becomes, the higher the resilience would be as there would be different economic sectors which can each contribute to the economy if a shock occurs (refer to Sections 4.3.4, 4.4.1, 4.4.2 and 4.4.3).

- **Scenario Three**

Scenario Three was formulated by proposing that if the government focussed on targeting the third largest city/town in the eight remaining provinces of South Africa (Gauteng was excluded as it was identified as a primate city) and 1 000 000 of the Gauteng residents migrate to the following towns:

- i. Kwa-Zulu Natal-Richards Bay: 125 000 new residents
- ii. Eastern Cape-Mthatha: 125 000 new residents
- iii. Limpopo-Thohoyandou: 125 000 new residents
- iv. North West-Mmabatho: 125 000 new residents
- v. Mpumalanga-Dennilton/ Siyabuswa: 125 000 new residents
- vi. Free State-Phuthaditjhaba: 125 000 new residents
- vii. Western Cape-George: 125 000 new residents
- viii. Northern Cape-Upington: 125 000 new residents

The following figure illustrates the scenario of the population distribution as described above:

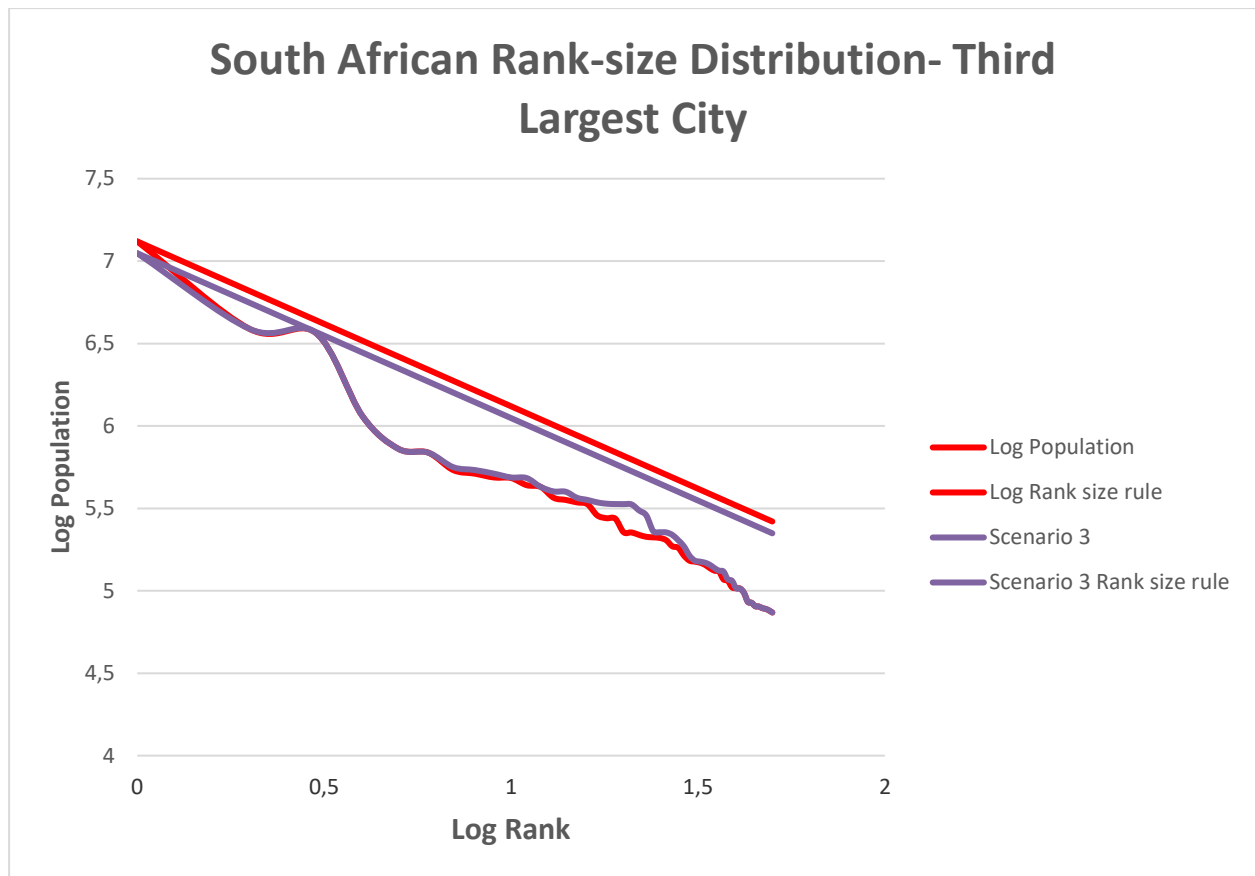


Figure 8-7: South African spatial distribution - Scenario Three

Source: Own compilation

From this figure, it is evident that the spatial distribution is moving away from the primate city area and contributes to a larger gap between large- and medium-sized cities (which could lead to lower connectivity and stability in urban systems as described in Section 4.5.1 and 4.5.3). This approach would, therefore, not be preferable as South Africa is currently facing numerous challenges with its primate distribution and by targeting these smaller cities/towns it could lead to a larger primate distribution and it would become more difficult to obtain a normal spatial distribution, which South Africa desires (refer to Section 3.2.1, 7.2.2 and 7.2.3.2). The following figure illustrates all the scenarios on one figure which provides the reader with the ability to compare all the scenarios carefully:

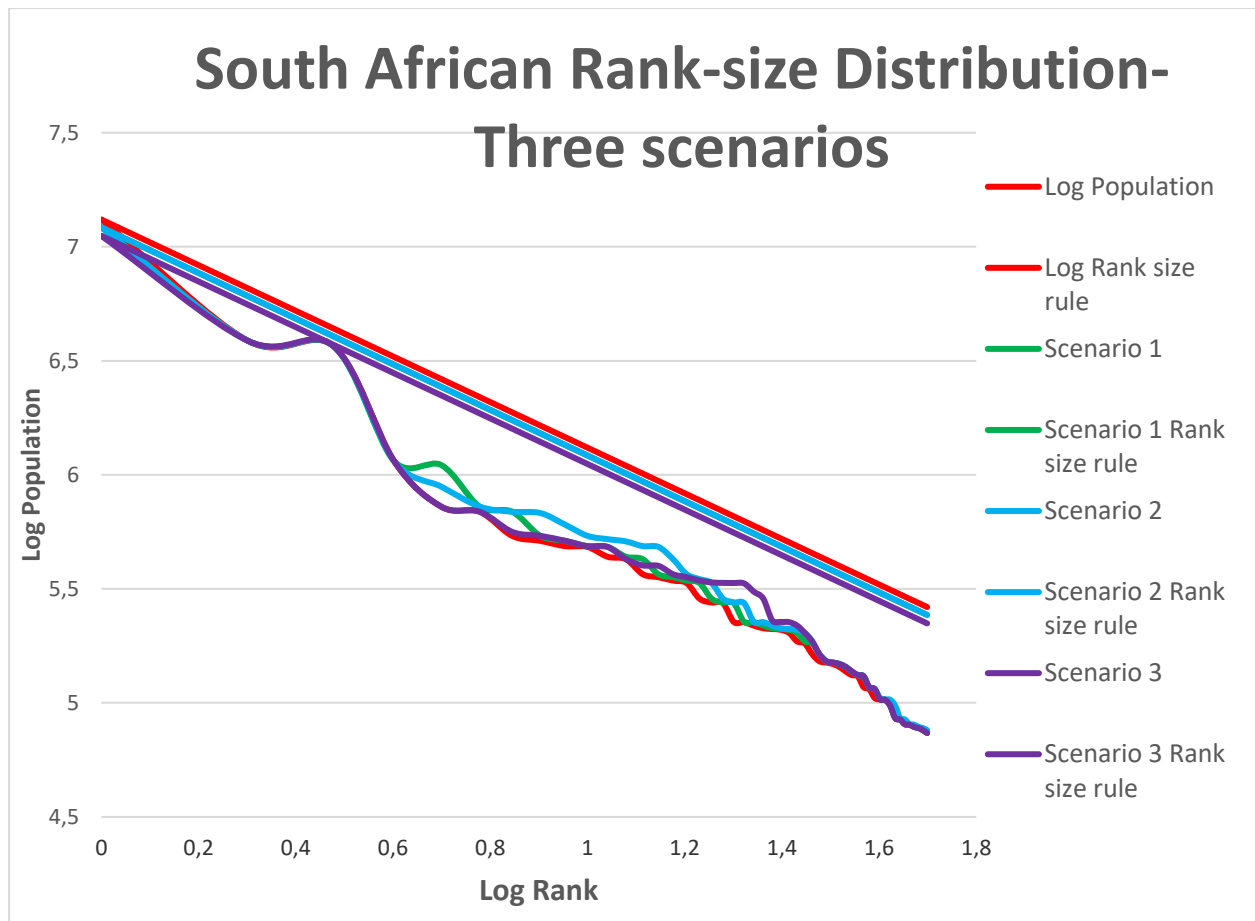


Figure 8-8: South African spatial distribution - All scenarios

Source: Own compilation

The figure above illustrates the scenarios combined into one figure. Scenario One (by only focussing on investment in Upington in the Northern Cape province) is proven to be most effective as it would decrease the gap found between the four large metropolitan areas of South Africa and the medium-sized cities (refer to Section 4.5). Scenario Two, where secondary cities were identified, also resulted in a seemingly more effective approach as it would be easier to achieve and it also reduces the gap between the primate and secondary cities significantly. It is, therefore, important to conduct spatial research on the region which is identified for policy intervention or investment opportunities as the strengths, weaknesses and opportunities will play an important role in the structuring and goals of the policy to be implemented. The following section aims to identify and describe the spatial planning component identified to improve regional resilience in different urban systems.

8.3.2 Strategic spatial planning

Strategic spatial planning typically includes approaches which are process-based and focused over the medium- to long-term to increase regional resilience. There are several approaches to

be followed to improve regional resilience and with specific reference to the South African typology, the following recommendations are made with reference to the four identified categories to improve regional resilience in South Africa (refer to Sections 6.2.1.3, 6.2.4 and 8.3.1):

Table 8-2: Policy recommendations for South Africa's development policies

Sector	Recommendations
Built Environment	• Allocation of resources should be allocated more efficiently towards infrastructure as it is seen as a vital component to increase connectivity, which in turn increases regional resilience (refer to Section 2.4.3 and 4.5.3). • Connectivity of different hierarchical settlements are important, and infrastructure should be planned accordingly as it could potentially contribute to structural optimisation in urban systems (refer to Section 2.3.1, 2.3.3, 3.2 and 4.5.4). • Investment in SOC's (this could improve the efficiency of industries and increase profit margins, which in turn will lead to larger private investments- refer to Section 2.4.4).
Social Dimensions	• Currently, a large amount of investments from the government are allocated to the education sector (investment should be focussed on primary and secondary education as South Africa is currently a developing country with low education figures- refer to Section 2.4.1, 3.2.1 and 7.2). • Integration of communities via public transportation facilities will increase social integration and cohesion (refer to Section 3.3.1, 3.3.3, 3.3.4, 3.4.3, 4.2.2 and 7.2.3.3).
Economic Development	• Economic sectors should be diversified by focussing on the promotion of secondary and tertiary economic sectors such as finance, manufacturing and trade (refer to Section 2.4.1, 6.2.1.1 and 6.2.2.1). • Spatial targeting should be implemented in settlements with a large market potential which are located centrally, along major transportation routes or areas which has room for development as they are mainly focussed on primary activities such as underdeveloped regions, i.e. Upington in the Northern Cape province (refer to Section 2.2.3, 2.3.1, 2.4.2, 3.3, 3.4, 4.5.2 and 7.2.3.3.3).

	• Investment initiatives should be implemented to promote the development in targeted areas such as tax incentives, attractive returns on investment etc. (refer to Section 2.4.4, 4.4, 6.2.1.3.3 and 6.2.4.1.3). • Free Trade Zones could be advantageous as it would promote investment in these zones from industries and businesses, especially in areas in the Northern Cape where agglomeration activities could develop by developing several ancillary industries to support mining activities, which in turn will create numerous job opportunities (refer to Section 2.4.2, 6.2.4.1.3 and 7.2.3.3.3). • Promote infrastructure investment and develop stronger economic linkages by focussing on important transportation routes, which would increase the connectivity in urban systems (refer to Section 2.4.3, 3.3.4, 3.4.1, 3.4.2, 4.4.3, 4.5, 6.2.1.3.3 and 7.2.3.3.3). • Create regional funds for infrastructure and increase the participation of the private sector in infrastructure projects (transportation routes, manufacturing industries etc.) which could stimulate growth by means of unbalanced development (refer to Section 2.4.4, 4.3.1, 6.2.1.3.3 and 6.2.4.1.3).
Population and Governance	• South Africa encompasses a primate population distribution which should be countered by shifting large investments from the four metropolitan nodes to medium- and smaller-sized cities (refer to Section 3.2.1, 4.5.2, 7.2.2 and 7.2.3.2). • This will result in an increase of the population in medium- and smaller-sized cities as the cities' economic activity increases (refer to Section 2.4.2, 6.2.4 and 8.3.1).

Source: Own compilation

The table above encompasses several recommendations on how to improve resilience on a National Scale. As mentioned in Section 1.3, the study aimed to improve regional resilience in different urban systems and therefore, the recommendations were also formulated to improve the Northern Cape's regional resilience.

Table 8-3: Policy recommendations for the Northern Cape Development policies

Sector	Recommendations
Built Environment	• Focus on improving the infrastructure which connects Upington to large metropolitan areas, which are also identified in the PSDF such as the R27, N10 and N14, (refer to Section 4.2.2, 7.2.3.3.3). • Improve road infrastructure which is used internationally such as the R360, N7 and N10 (refer to Figure 7-19). • Strengthen local networks and gateways (especially when referring to infrastructure which connects areas as accessibility could improve productivity and regional resilience (refer to Section 3.3, 3.4.3, 4.4.3 and 4.5.3). • Promote secondary sector investments (i.e. agri-processing plants, processing plants for minerals etc. in Upington and the surrounding areas).
Social Dimensions	• Improving/investment in educational facilities (primary and secondary educational facilities). • Development of labour skills as the Northern Cape focuses primarily on the primary sector such as mining and agriculture (refer to Section 5.3 and 7.2.3.3). • Promote public participation initiatives which could result in a higher community resilience (refer to Section 4.3.2, 4.3.3, 4.3.4 and 6.2.4.1.1).
Economic Development	• Promote the diversification of economic activities, especially by focussing on ancillary secondary and tertiary activities (refer to Section 2.4.1 and 7.2.3.3). • Strengthen the competitiveness of businesses and industries by using agglomeration advantages of areas identified (refer to Section 2.4.2 and 3.3). • Initiate investment incentives for secondary and tertiary activities which will promote and support the mining activities in the area. • Strengthen current agricultural activities through supporting structures and attractive investment/tax incentives (refer to Section 3.3.1 and 3.3.2). • Promote private investment through Direct Productive Activities (DPA's) as described in Section 2.4.4.

Population and Governance

- Improve spatial distribution of the region by investing in medium and small towns with large market potential such as Upington (refer to Section 8.3.1).
- Integration of regional and national government spheres (refer to Section 5.4.1, 7.2.3.3.1, 7.2.3.3.2 and 7.2.3.3.3).
- Integration of various government departments/entities within the regional and national government spheres.

Source: Own compilation

As mentioned above, when referring to economic knowledge, smaller cities are more prone to shocks which could have detrimental impacts on the viability and growth of small cities (refer to Section 2.3.3, 3.2.2, 3.4, 4.3, 4.4 and 4.5). Therefore, a mechanism should be set into place in order to prevent a city suffering when an economic shock occurs.

By implementing spatial targeting in regions/urban areas with a large market potential, it would not only improve the individual targeted city but will eventually create more opportunities for the region the city is located in and would also contribute to an overall increase in economic activities. The figure below illustrates the effect spatially targeted investment could have on South Africa (with specific focus on the Northern Cape province):

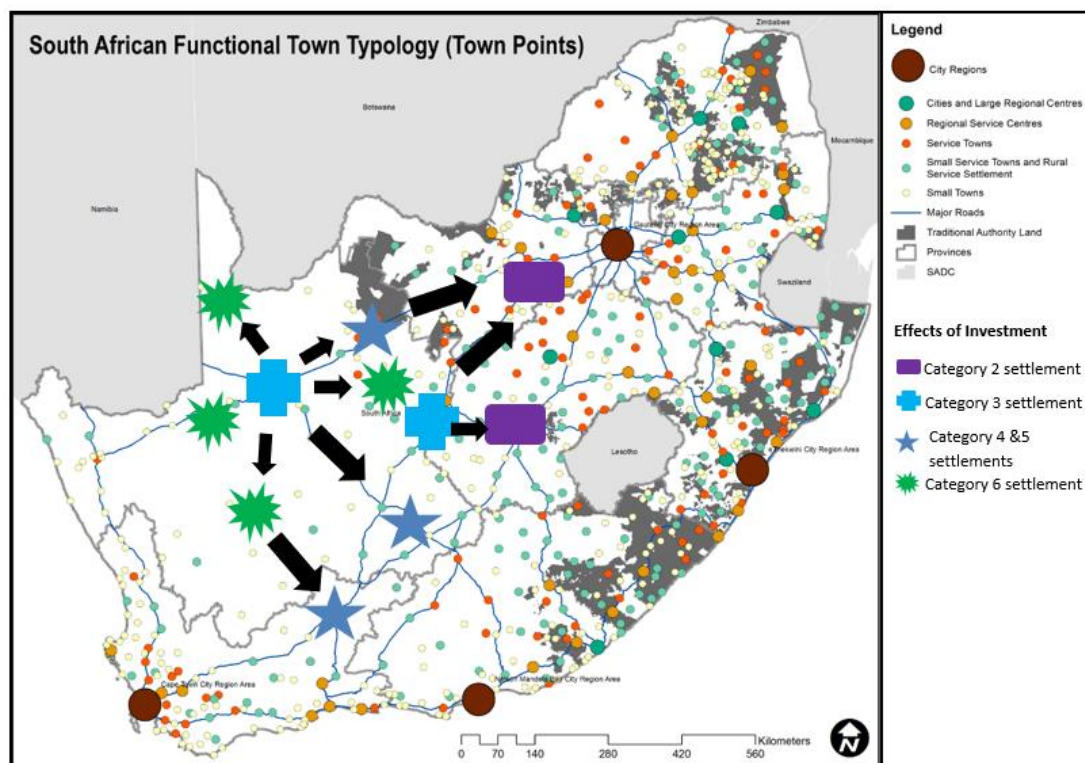


Figure 8-9: Theoretical impact of investment in medium- to small-sized settlements

Source: Own compilation

The figure above illustrates the impact investment in Upington could have on the urban system of South Africa. The spatial distribution of the whole urban system (refer to Sections 3.4.1, 3.4.2 and 3.4.3) will be affected in different term strategies. For instance, if the spatially targeted investment is implemented in Upington, it could potentially lead to spillover effects to the small settlements which will be inclined towards economic growth and economic activities as their connectivity is generally weak (refer to Section 3.3, 3.4 and 4.5). When investment is continued over a medium-term, Upington will start acting as a regional centre which will stimulate local and regional growth and ultimately national growth (refer to Section 8.3.1). In addition, the growth of the regional centre will decrease its dependency on national centres, making it more resilient and susceptible to shocks (refer to Section 2.3, 2.4, 4.3.2 and 4.3.4). The increase in the Upington population will redistribute the spatial distribution of South Africa (refer to Figure 8-5 and Figure 8-8) as the urban system functions in different hierarchical levels i.e. daily, regional and national urban system (refer to Section 3.4).

8.3.3 Spatial governance

Governance is closely related to the processes of interaction and the decision-makers who create and implement policies (refer to Sections 2.4.4, 5.3, 6.2.1.3.2, 6.2.4.1.2 and 7.2.3). The government has the ability to allocate resources and services and thus it is important to recognise and examine the roles of the government to support resilience in their policy planning (refer to Section 5.4.1). Therefore, several concepts were used as identified in both the international and national case studies (refer to Sections 6.2 and 7.2). Furthermore, the government can be classified into different spheres i.e. national, provincial and local spheres. All of these spheres play an important role in the formulation and implementation of strategic policies, which are focussed on spatial development (refer to Sections 5.3, 6.2.1.3.1, 6.2.1.3.2, 6.2.4.1.1, 6.2.4.1.2 and 7.2.3).

As described in Sections 4.2 and 4.4, economic resilience can be increased by the number of resources available, the diversity of the economic sectors and the distribution of the resources available. Therefore, if a community is only dependent on a narrow range of resources, the resilience of the community or urban system use also lowers as it poses a higher risk for disaster-related damage. Governance, management and policy design processes are required to understand the connection between resilience planning and policy outcomes (refer to Sections 5.3, 5.4 and 8.3.1).

A holistic planning approach is required in the policy design process across all levels of government spheres (national, provincial and local level). Policies and strategies to be implemented should be focussed on an issue-based strategy rather than a position-based

strategy (refer to Sections 5.2, 5.3, 6.2.1.3 and 6.2.4). It would also be vital from a governmental level to improve and promote community involvement for the community to enhance the policies to be implemented. Policies should also encourage interagency coordination, which will promote interdepartmental cooperation of several disciplinary teams (refer to Sections 5.4.1, 6.2.1.3.1, 6.2.1.3.2, 6.2.1.3.3, 6.2.4.1.1, 6.2.4.1.2 and 6.2.4.1.3). Therefore, top-level strategy policy intervention is required to establish initiatives. The collaboration across all government spheres and departments as well as between different stakeholder groups and regions is the key to a successful long-term strategic framework, which would improve regional resilience. The design and implementation of the resilience policies should be a top-down approach (the government should be responsible) as it is categorised as a government function. The successful implementation of these frameworks and initiatives is dependent upon government spheres who recognise the needs of the region and identify the windows of opportunity (and when to push for the implementation thereof).

Regional spheres of the government are, however, faced with challenging conditions as government spheres are prone to low integration (refer to Sections 5.4.1 and 7.2.3). In addition to the poorly integrated spheres of government, the different entities found in each government sphere also face integration problems. SPLUMA (refer to Section 4.5.1) was, therefore, implemented to achieve a higher integration of the different governmental spheres, however, the implementation thereof is still found as challenging. Therefore, it is recommended that the government spheres encompass the following functions and responsibilities:

- **National government sphere**

The national sphere implemented several policies which can be used to improve regional resilience, such as the NDP, UDF, RDF, NSDF and SPLUMA (refer to Sections 5.3 and 5.4).

The NDP provides several guidelines for spatial development in South Africa, for instance, emphasis was placed on economic resilience by increasing exports and to develop sustainable regions by means of industries and businesses, however, little emphasis was placed on guidelines of how to improve regional resilience (refer to Section 5.3.1). Furthermore, the NDP also included the upgrading and investment in the infrastructure sector but focussed largely on electrical supply instead of connectivity in terms of freight (roads and railways). The NDP did, however, make provision for an inclusive rural economy and several concepts were identified to improve the agricultural sector as well as promote investment in the agri-processing sector. This would, in turn, assist in the transformation of the settlement distribution of South Africa and human settlements as it also links with concepts within the IUDF to establish strong and efficient planning systems (refer to Sections 5.3.1 and 5.3.3), which are integrated with national, regional and local

governmental spheres. It is proposed that the NDP includes a Chapter which focusses on spatial resilience (refer to Section 4.5) where initiatives can be proposed to increase regional resilience by focussing on the main economic sectors of South Africa and the region applicable (refer to Sections 7.2.1 and 7.2.3.1).

The UDF focusses on sustainable urban development and the IUDF was implemented to counter the rapid urbanisation trends of South Africa. This also connects with the concept of resilience to make cities sustainable with specific reference to human settlements and the national space economy as it steers development into a more compact, coordinated and connected model (this could also be associated with Section 4.2.2; Table 4-2, which proposes different resilient property models). On the other hand, the RDF focussed on the sustainability of the rural areas instead of nodes and was implemented to improve the availability of infrastructure in rural areas (increase the connectivity of urban and rural areas which can be associated with the daily and regional urban systems. The RDF encompasses medium-term strategies as it realises that a proactive planning approach is required to encourage the involvement of the community. The RDF, therefore, focusses on community involvement and social cohesion and partnering with both private and public sectors.

The NSDF is in the draft phase as SPLUMA and the NDP proposed that this policy be formulated where it will allocate different responsibilities to the national, regional and local spheres of government. SPLUMA was implemented to counter several spatial challenges (refer to Section 5.4.1) associated with apartheid and therefore, the development of the NSDF is of the utmost importance. Different roles and responsibilities of the government are to be classified and it also provides several guidelines when referring to the compilation of SDF's; it will provide spatial guidelines on a national scale. The interpretation of the principles set out in this document will influence the spatial economy as it will also encompass several spatial targeting areas in South Africa.

All of the national policies and frameworks as described above encompass some components and concepts of regional resilience, however, clearer guidelines and concepts should be explored and incorporated into these documents as the regional spheres make use of these documents when formulating regional frameworks and policies. The enforcement of these policies and frameworks should also be described in a more detailed manner, especially when referring to SPLUMA as it hopes to improve the integration of government spheres. Long-term investment opportunities should also be identified within these documents as it would attract more investment, especially when referring to the private sector. In addition, more provision should also be made in terms of spatial targeting, investment opportunities, tax benefits and economic zones. With clearer guidelines on a national scale, the regional resilience would also be improved via

short-, medium- and long-term investment opportunities. Integration of different urban systems in terms of resilience is also a shortcoming in all the above-mentioned policies.

- **Regional government sphere**

The study aimed to improve regional resilience in different urban systems and therefore, the focus is placed on regional policies. The Regional Spatial Development Framework (RSDF) was also proposed as a planning instrument which does not necessarily conform to a spatial boundary (refer to Section 5.3.5) and may be compiled at the Minister's discretion (refer to Figure 5-16). The RSDF was proposed to give effect to the national land use policies or priorities in specific geographic areas.

Therefore, RSDF's are usually compiled under unique circumstances than manifest across administrative boundaries. The RSDF therefore, incorporates the dynamics of the surrounding areas and it is classified as a planning instrument that extends beyond jurisdictional boundaries and encompasses functional intra- and inter-provincial spatial regions with specific spatial expression (such as the Northern Cape urban system) to the vision of the province and or municipality's development strategy (refer to Section 5.3.5). This again proves the low integration between the different government spheres and entities as the RSDF is only used and implemented if challenges arise from different municipal boundaries.

- **Provincial government sphere**

For the purpose of this study, the focus was placed on the Northern Cape province and therefore, policies implemented on a regional scale were evaluated (refer to Section 7.2.3). Policies and frameworks implemented on a regional scale include the PGDS and PSDF, which are summarised below.

The PSDF of the Northern Cape was designed to encourage both rural and urban development over the long-term by proposing that strong relationships and networks should exist. The Northern Cape experienced a decline in population and economic activities and therefore, the reformulation of policies was required together with strong policy interventions to assist with these challenges (refer to Section 7.2.3). The objectives as set out in the PGDS were established to facilitate growth in the province by proposing that alternative economic sectors should be promoted as the Northern Cape province is highly dependent on mining activities.

The PSDF was developed to guide strategic decisions to create a more attractive investment environment, as it gives effect to national, provincial, district and local municipalities (refer to Section 7.2.3). The PSDF also intends to provide spatial land use directions to assist other

government spheres with spatial targeting by identifying priority areas and priority economic sectors. The PSDF includes both short-, medium- and long-term development objectives together with clear spatial development initiatives and priority areas. Furthermore, the PSDF also identifies several strengths, weaknesses and opportunities which can be used by the national government to develop efficient and effective policies through spatial targeting in the Northern Cape (refer to Sections 5.3.5 and 7.2.3). In short, the PSDF provides a place-specific and coherent methodology for the management and planning of the different government spheres which should be used by the national spheres of the government. Unfortunately, South Africa is currently challenged with the implementation of several strategic documents on the local, regional and national level as government spheres are not fully integrated.

It is, therefore, proposed that a bioregional approach (refer to Section 7.2.3.3) is to be followed, which includes institutional integration, integrated development planning and co-operative governance. The integration of these spheres is important to develop valuable spatial development frameworks across South Africa.

8.4 Limitations

The study had numerous limitations, such as obtaining statistical information for both the international and national case studies. The data obtained from sources were challenging, especially when attempting to retrieve data from 2018. Furthermore, it would have been of great significance if functional classifications of regions (refer to Sections 2.2.2 and 2.2.3) could have been used as it would have provided another perspective on different hierarchies, however, it was difficult to compare the regions across national scales. In addition, it was also challenging to determine the exact market area of urban areas (as it depends on the type of services the area provides and the distance a consumer is willing to travel), which in turn could have been used to determine the hierarchical order of different urban systems.

- Population data was used to propose a specific form the population should adhere to improve regional resilience where other data, such as the economic functions can also be used in future to determine different hierarchical orders.

8.5 Areas of future research

The researcher identified the following areas for future research with regards to this study:

- Research could be intensified by including the functional index of the towns.
- The study area could be increased to include the rest of South Africa's urban system.

- The research could be tested in other countries to evaluate the impact these theories will have.

8.6 Conclusion

This research proposed a top-down approach with bottom-up components, together with spatially targeted interventions to improve regional resilience. It also proposes a systematic approach to improve regional resilience through (i) spatial research; (ii) strategic spatial planning and (iii) spatial governance. The study established that different government spheres (national and regional spheres) should implement spatial strategies coherently as it could have a significant impact on the spatial distribution characteristics of South Africa, which will improve the resilience of the national settlement distribution. Medium- to small-sized settlements are categorised by migration and low economic activities and growth, ageing population etc., and investing in these settlements could lead to sustainable economic growth in the daily, regional and national urban system in a cumulative manner. Spatial targeting is, therefore, of utmost importance to ensure that medium- to smaller-sized cities are targeted and this will increase the attractiveness of investors in regions and medium-sized cities overall. Both national and regional government support would be required to ensure effective and efficient investments and to create a “safe to fail” function for smaller settlements.

In conclusion, the contribution which small towns could make to regional development overall is not recognised in rural development strategies, especially on the national government sphere in South Africa. The study is of relevance as the Deputy Minister of Cooperative Governance and Traditional Affairs, Andries Nel, confirmed that small towns across South Africa will contribute to regional and rural development by becoming centres of markets for the agricultural sector for local consumers and they will also act as links for both national and export markets (Cooperative Governance and Traditional Affairs, 2018). A small-town regeneration programme will be implemented on a national level (to be incorporated in the NDP and NSDF) and through the implementation of the Integrated Urban Development Framework (Cooperative Governance and Traditional Affairs, 2018). It is also envisioned that smaller settlements can reduce costs and improve access to services and products, which include primary, secondary and tertiary economic sectors. In short, smaller towns can be used to improve the overall connectivity and economic activity of South Africa.

CHAPTER 9 BIBLIOGRAPHY

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ANNEXURE A

POPULATION DATA FOR AUSTRALIA

i\th	Name	Polulation (Pi)	Population Pi	P1	Rank-size Rule	Log rank	Log Pi real	Log rank Rule
1	Sydney	4627,35	4627345	4627345	4627345	0	6,66533188	6,66533188
2	Melbourne	4246,38	4246375	4627345	2313672,5	0,301029996	6,628018344	6,364301885
3	Brisbane	2189,88	2189878	4627345	1542448,333	0,477121255	6,340419921	6,188210626
4	Perth	1896,55	1896548	4627345	1156836,25	0,602059991	6,277963839	6,063271889
5	Adelaide	1225,24	1225235	4627345	925469	0,698970004	6,088219394	5,966361876
6	Gold Coast	591,47	591473	4627345	771224,1667	0,778151254	5,771934924	5,88718063
7	Canberra	367,75	367752	4627345	661049,2857	0,84509804	5,565555043	5,82023384
8	Newcastle	308,31	308308	4627345	578418,125	0,903089987	5,488984794	5,762241893
9	Wollongong	292,19	292190	4627345	514149,4444	0,954242509	5,465665348	5,711089371
10	Logan City	282,67	282673	4627345	462734,5	1	5,451284328	5,66533188
11	Geelong	226,03	226034	4627345	420667,7273	1,041392685	5,354173771	5,623939195
12	Hobart	216,66	216656	4627345	385612,0833	1,079181246	5,335770721	5,586150634
13	Townsville	196,22	196219	4627345	355949,6154	1,113943352	5,292741058	5,551388528
14	Cairns	153,08	153075	4627345	330524,6429	1,146128036	5,184904268	5,519203845
15	Toowoomba	131,26	131258	4627345	308489,6667	1,176091259	5,118125783	5,489240621
16	Darwin	129,06	129062	4627345	289209,0625	1,204119983	5,110798391	5,461211898
17	Rockingham	108,02	108022	4627345	272196,7647	1,230448921	5,033512214	5,434882959
18	Launceston	106,15	106153	4627345	257074,7222	1,255272505	5,025932272	5,410059375
19	Bendigo	100,62	100617	4627345	243544,4737	1,278753601	5,002671364	5,386578279
20	Ballarat	97,94	97937	4627345	231367,25	1,301029996	4,990946797	5,364301885
21	Mandurah	83,29	83294	4627345	220349,7619	1,322219295	4,920613719	5,343112586
22	Mackay	74,22	74219	4627345	210333,8636	1,342422681	4,870515099	5,322909199
23	Bundaberg	70,83	70826	4627345	201188,913	1,361727836	4,850192715	5,303604044
24	Bunbury	68,25	68248	4627345	192806,0417	1,380211242	4,834089929	5,285120639
25	Maitland	67,13	67132	4627345	185093,8	1,397940009	4,826929586	5,267391872
26	Armadale	62,30	62296	4627345	177974,8077	1,414973348	4,794460162	5,250358532
27	Rockhampton	61,72	61724	4627345	171383,1481	1,431363764	4,790454063	5,233968116
28	Adelaide Hills	60,39	60394	4627345	165262,3214	1,447158031	4,780993795	5,218173849
29	South Brisbane	60,00	60000	4627345	159563,6207	1,462397998	4,77815125	5,202933882
30	Reservoir	47,64	47637	4627345	154244,8333	1,477121255	4,677944403	5,188210626
31	Tamworth	47,60	47597	4627345	149269,1935	1,491361694	4,67757958	5,173970186
32	Wagga Wagga	46,91	46913	4627345	144604,5313	1,505149978	4,671293206	5,160181902
33	Albury	45,63	45627	4627345	140222,5758	1,51851394	4,659221915	5,14681794
34	Berwick	44,78	44779	4627345	136098,3824	1,531478917	4,651074391	5,133852963
35	Port Macquarie	41,49	41491	4627345	132209,8571	1,544068044	4,617953902	5,121263836

i\th	Name	Polulation (Pi)	Population Pi	P1	Rank-size Rule	Log rank	Log Pi real	Log rank Rule
36	Queanbeyan	40,66	40661	4627345	128537,3611	1,556302501	4,609178055	5,10902938
37	Orange	39,33	39329	4627345	125063,3784	1,568201724	4,594712904	5,097130156
38	Blacktown	39,00	39000	4627345	121772,2368	1,579783597	4,591064607	5,085548284
39	Shepparton	38,77	38773	4627345	118649,8718	1,591064607	4,588529405	5,074267273
40	Caloundra	38,71	38706	4627345	115683,625	1,602059991	4,587778292	5,063271889
41	Hoppers Crossing	38,11	38108	4627345	112862,0732	1,612783857	4,581016157	5,052548024
42	Werribee	37,74	37737	4627345	110174,881	1,62324929	4,576767372	5,04208259
43	Melton	35,49	35490	4627345	107612,6744	1,633468456	4,550105999	5,031863425
44	Castle Hill	35,39	35389	4627345	105166,9318	1,643452676	4,548868291	5,021879204
45	Saint Albans	35,09	35091	4627345	102829,8889	1,653212514	4,545195745	5,012119367
46	Nowra	34,48	34479	4627345	100594,4565	1,662757832	4,537554661	5,002574049
47	Frankston	34,46	34457	4627345	98454,14894	1,672097858	4,537277463	4,993234022
48	Frankston East	34,46	34457	4627345	96403,02083	1,681241237	4,537277463	4,984090643
49	Rowville	34,15	34145	4627345	94435,61224	1,69019608	4,533327117	4,9751358
50	Warrnambool	33,98	33982	4627345	92546,9	1,698970004	4,531248936	4,966361876

ANNEXURE B

POPULATION DATA FOR BRAZIL

i th	Name	Current Pop	Rank-size rule	Log Rank	Log Pi	Log Rank rule
1	São Paulo *	10 886 518	10886518,00	0,00	7,04	7,036888995
2	Rio de Janeiro *	6 093 472	5443259,00	0,30	6,78	6,735858999
3	Salvador *	2 892 625	3628839,33	0,48	6,46	6,55976774
4	Fortaleza *	2 431 415	2721629,50	0,60	6,39	6,434829004
5	Belo Horizonte *	2 412 937	2177303,60	0,70	6,38	6,337918991
6	Curitiba *	1 797 408	1814419,67	0,78	6,25	6,258737745
7	Manaus	1 646 602	1555216,86	0,85	6,22	6,191790955
8	Recife *	1 533 580	1360814,75	0,90	6,19	6,133799008
9	Porto Alegre *	1 420 667	1209613,11	0,95	6,15	6,082646486
10	Belém *	1 408 847	1088651,80	1,00	6,15	6,036888995
11	Goiânia *	1 244 645	989683,45	1,04	6,10	5,99549631
12	Guarulhos *	1 236 192	907209,83	1,08	6,09	5,957707749
13	Campinas *	1 039 297	837424,46	1,11	6,02	5,922945643
14	São Gonçalo *	960 631	777608,43	1,15	5,98	5,890760959
15	São Luís	957 515	725767,87	1,18	5,98	5,860797736
16	Maceió	896 965	680407,38	1,20	5,95	5,832769012
17	Duque de Caxias *	842 686	640383,41	1,23	5,93	5,806440074
18	Nova Iguaçu *	830 672	604806,56	1,26	5,92	5,78161649
19	São Bernardo do Campo *	781 390	572974,63	1,28	5,89	5,758135394
20	Teresina	779 939	544325,90	1,30	5,89	5,735858999
21	Natal	774 230	518405,62	1,32	5,89	5,7146697
22	Campo Grande	724 524	494841,73	1,34	5,86	5,694466314
23	Osasco *	701 012	473326,87	1,36	5,85	5,675161159
24	João Pessoa	674 762	453604,92	1,38	5,83	5,656677753
25	Santo André *	667 891	435460,72	1,40	5,82	5,638948986
26	Jaboatão dos Guararapes *	665 387	418712,23	1,41	5,82	5,621915647
27	Contagem *	608 650	403204,37	1,43	5,78	5,605525231
28	Uberlândia *	608 369	388804,21	1,45	5,78	5,589730964
29	São José dos Campos *	594 948	375397,17	1,46	5,77	5,574490997
30	Feira de Santana *	571 997	362883,93	1,48	5,76	5,55976774
31	Sorocaba *	559 157	351178,00	1,49	5,75	5,545527301
32	Ribeirão Preto *	547 417	340203,69	1,51	5,74	5,531739017
33	Cuiabá	526 831	329894,48	1,52	5,72	5,518375055
34	Aracaju	520 303	320191,71	1,53	5,72	5,505410078
35	Juiz de Fora *	513 348	311043,37	1,54	5,71	5,492820951

i th	Name	Current Pop	Rank-size rule	Log Rank	Log Pi	Log Rank rule
36	Londrina *	497 833	302403,28	1,56	5,70	5,480586494
37	Joinville *	487 003	294230,22	1,57	5,69	5,468687271
38	Ananindeua *	484 278	286487,32	1,58	5,69	5,457105398
39	Belford Roxo *	480 555	279141,49	1,59	5,68	5,445824388
40	Aparecida de Goiânia *	475 303	272162,95	1,60	5,68	5,434829004
41	Niterói *	474 002	265524,83	1,61	5,68	5,424105138
42	São João de Meriti *	464 282	259202,81	1,62	5,67	5,413639705
43	Campos dos Goytacazes *	426 154	253174,84	1,63	5,63	5,403420539
44	Santos *	418 288	247420,86	1,64	5,62	5,393436318
45	Betim *	415 098	241922,62	1,65	5,62	5,383676481
46	São José do Rio Preto *	402 770	236663,43	1,66	5,61	5,374131163
47	Mauá *	402 643	231628,04	1,67	5,60	5,364791137
48	Caxias do Sul *	399 038	226802,46	1,68	5,60	5,355647758
49	Vila Velha *	398 068	222173,84	1,69	5,60	5,346692915
50	Florianópolis *	396 723	217730,36	1,70	5,60	5,337918991

ANNEXURE C

POPULATION DATA FOR SOUTH AFRICA

i th	Name	Current Pop	Rank-size rule	Log Rank	Log Pi	Log Rank rule
1	Gauteng CR	13 159 963	13159963	0	7,119254668	7,119254668
2	Cape Town CR	3 872 895	6579981,5	0,301029996	6,588035723	6,818224673
3	eThekweni CR	3 673 345	4386654,333	0,477121255	6,565061719	6,642133414
4	Port Elizabeth CR	1 149 989	3289990,75	0,602059991	6,060693686	6,517194677
5	Bloemfontein/Botshabelo CA	725 770	2631992,6	0,698970004	5,860799012	6,420284664
6	Pietermaritzburg C	689 239	2193327,167	0,77815125	5,838369844	6,341103418
7	East London C	540 098	1879994,714	0,84509804	5,732472569	6,274156628
8	Polokwane C	513 530	1644995,375	0,903089987	5,71056582	6,216164681
9	Rustenburg C	486 875	1462218,111	0,954242509	5,687417475	6,165012159
10	Nelspruit C	483 113	1315996,3	1	5,684048724	6,119254668
11	Richards Bay C	437 439	1196360,273	1,041392685	5,6409175	6,077861983
12	New Castle RSC	426 831	1096663,583	1,079181246	5,630255954	6,040073422
13	Tzaneen RSC	366 659	1012304,846	1,113943352	5,56426235	6,005311316
14	Klerksdorp/Stilfontein RSC	355 834	939997,3571	1,146128036	5,551247443	5,973126633
15	Witbank RSC	343 835	877330,8667	1,176091259	5,536350083	5,943163409
16	Welkom RSC	335 519	822497,6875	1,204119983	5,525717119	5,915134686
17	Ladysmith RSC	286 793	774115,4706	1,230448921	5,457568547	5,888805747
18	Thohoyandou RSC	275 617	731109,0556	1,255272505	5,440306001	5,863982163
19	Phuthaditjhaba RSC	273 983	692629,6316	1,278753601	5,437723617	5,840501067
20	Kimberley RSC	226 554	657998,15	1,301029996	5,355171734	5,818224673
21	Paarl/Wellington RSC	225 985	626664,9048	1,322219295	5,354079613	5,797035374
22	Port Shepstone/Margate RSC	218 302	598180,1364	1,342422681	5,339057715	5,776831987
23	Mmabatho RSC	212 553	572172,3043	1,361727836	5,327467239	5,757526832
24	Mthatha RSC	210 920	548331,7917	1,380211242	5,324117763	5,739043427
25	Dennilton/Siyabuswa RSC	209 257	526398,52	1,397940009	5,320679995	5,72131466
26	Stanger RSC	202 715	506152,4231	1,414973348	5,306885886	5,70428132
27	Secunda RSC	186 190	487406,037	1,431363764	5,269956352	5,687890904
28	George RSC	182 369	469998,6786	1,447158031	5,260951017	5,672096637
29	Middelburg RSC	163 631	453791,8276	1,462397998	5,213865585	5,65685667
30	Bushbuckridge RSC	152 452	438665,4333	1,477121255	5,183133126	5,642133414
31	Estcourt RSC	150 296	424514,9355	1,491361694	5,176947422	5,627892974
32	Potchefstroom RSC	148 097	411248,8438	1,505149978	5,170546261	5,61410469
33	King Williams Town RSC	143 823	398786,7576	1,51851394	5,157828343	5,600740728
34	Vryheid RSC	137 357	387057,7353	1,531478917	5,137850797	5,587775751
35	Phalaborwa/Namakgale RSC	132 418	375998,9429	1,544068044	5,121947024	5,575186624

i th	Name	Current Pop	Rank-size rule	Log Rank	Log Pi	Log Rank rule
36	Hazyview RSC	130 932	365554,5278	1,556302501	5,117045802	5,562952167
37	Worcester RSC	117 292	355674,6757	1,568201724	5,069268392	5,551052944
38	Makopane RSC	115 075	346314,8158	1,579783597	5,060980984	5,539471072
39	Upington RSC	105 063	337434,9487	1,591064607	5,021449798	5,528190061
40	Queenstown RSC	103 658	328999,075	1,602059991	5,015602825	5,517194677
41	Makhado RSC	103 111	320974,7073	1,612783857	5,013304999	5,506470812
42	Kroonstad RSC	97 025	313332,4524	1,62324929	4,986883651	5,496005378
43	Standerton RSC	85 644	306045,6512	1,633468456	4,932696943	5,485786213
44	Ermelo RSC	84 615	299090,0682	1,643452676	4,927447359	5,475801992
45	Mossel Bay RSC	80 613	292443,6222	1,653212514	4,906405084	5,466042154
46	Oudtshoorn RSC	80 286	286086,1522	1,662757832	4,904639821	5,456496837
47	Dennilton/Siyabuswa RSC	78 476	279999,2128	1,672097858	4,894736859	5,44715681
48	Bethlehem RSC	77 607	274165,8958	1,681241237	4,889900896	5,438013431
49	Vredenburg RSC	75 981	268570,6735	1,69019608	4,880705005	5,429058588
50	Butterworth RSC	73 807	263199,26	1,698970004	4,868097553	5,420284664

ANNEXURE D

POPULATION DATA FOR THE NORTHERN CAPE

i th	Name	Current Pop	Rank-size rule	Log Rank	Log Pi	Log Rank rule
1	Kimberley RSC	226 554	226554	0	5,355171734	5,355171734
2	Upington RSC	105 063	113277	0,301029996	5,021449798	5,054141739
3	Kuruman ST	64 639	75518	0,477121255	4,810494629	4,87805048
4	Hartswater ST	56 092	56638,5	0,602059991	4,748900925	4,753111743
5	De Aar ST	29 410	45310,8	0,698970004	4,468495025	4,65620173
6	Kathu ST	19 864	37759	0,77815125	4,298066707	4,577020484
7	Springbok ST	19 049	32364,85714	0,84509804	4,279872182	4,510073694
8	Richmond ST NC	5 155	28319,25	0,903089987	3,71222867	4,452081747

ANNEXURE E

POPULATION DATA FOR SCENARIO 1

i th	Name	Current Pop	Rank-size rule	Log Rank	Log Pi	Log Rank rule
1	Gauteng CR	12 159 963	12159963	0	7,084932253	7,084932253
2	Cape Town CR	3 872 895	6079981,5	0,301029996	6,588035723	6,783902258
3	eThekweni CR	3 673 345	4053321	0,477121255	6,565061719	6,607810999
4	Port Elizabeth CR	1 149 989	3039990,75	0,602059991	6,060693686	6,482872262
5	Upington RSC	1 105 063	2431992,6	0,698970004	6,043387038	6,385962249
6	Bloemfontein/Botshabelo CA	725 770	2026660,5	0,77815125	5,860799012	6,306781003
7	Pietermaritzburg C	689 239	1737137,571	0,84509804	5,838369844	6,239834213
8	East London C	540 098	1519995,375	0,903089987	5,732472569	6,181842266
9	Polokwane C	513 530	1351107	0,954242509	5,71056582	6,130689744
10	Rustenburg C	486 875	1215996,3	1	5,687417475	6,084932253
11	Nelspruit C	483 113	1105451,182	1,041392685	5,684048724	6,043539568
12	Richards Bay C	437 439	1013330,25	1,079181246	5,6409175	6,005751007
13	New Castle RSC	426 831	935381,7692	1,113943352	5,630255954	5,970988901
14	Tzaneen RSC	366 659	868568,7857	1,146128036	5,56426235	5,938804218
15	Klerksdorp/Stilfontein RSC	355 834	810664,2	1,176091259	5,551247443	5,908840994
16	Witbank RSC	343 835	759997,6875	1,204119983	5,536350083	5,880812271
17	Welkom RSC	335 519	715291,9412	1,230448921	5,525717119	5,854483332
18	Ladysmith RSC	286 793	675553,5	1,255272505	5,457568547	5,829659748
19	Thohoyandou RSC	275 617	639998,0526	1,278753601	5,440306001	5,806178653
20	Phuthaditjhaba RSC	273 983	607998,15	1,301029996	5,437723617	5,783902258
21	Kimberley RSC	226 554	579045,8571	1,322219295	5,355171734	5,762712959
22	Paarl/Wellington RSC	225 985	552725,5909	1,342422681	5,354079613	5,742509573
23	Port Shepstone/Margate RSC	218 302	528694,0435	1,361727836	5,339057715	5,723204417
24	Mmabatho RSC	212 553	506665,125	1,380211242	5,327467239	5,704721012
25	Mthatha RSC	210 920	486398,52	1,397940009	5,324117763	5,686992245

i th	Name	Current Pop	Rank-size rule	Log Rank	Log Pi	Log Rank rule
26	Dennilton/Siyabuswa RSC	209 257	467690,8846	1,414973348	5,320679995	5,669958906
27	Stanger RSC	202 715	450369	1,431363764	5,306885886	5,653568489
28	Secunda RSC	186 190	434284,3929	1,447158031	5,269956352	5,637774222
29	George RSC	182 369	419309,069	1,462397998	5,260951017	5,622534256
30	Middelburg RSC	163 631	405332,1	1,477121255	5,213865585	5,607810999
31	Bushbuckridge RSC	152 452	392256,871	1,491361694	5,183133126	5,59357056
32	Estcourt RSC	150 296	379998,8438	1,505149978	5,176947422	5,579782275
33	Potchefstroom RSC	148 097	368483,7273	1,51851394	5,170546261	5,566418314
34	King Williams Town RSC	143 823	357645,9706	1,531478917	5,157828343	5,553453336
35	Vryheid RSC	137 357	347427,5143	1,544068044	5,137850797	5,540864209
36	Phalaborwa/Namakgale RSC	132 418	337776,75	1,556302501	5,121947024	5,528629753
37	Hazyview RSC	130 932	328647,6486	1,568201724	5,117045802	5,516730529
38	Worcester RSC	117 292	319999,0263	1,579783597	5,069268392	5,505148657
39	Makopane RSC	115 075	311793,9231	1,591064607	5,060980984	5,493867646
40	Queenstown RSC	103 658	303999,075	1,602059991	5,015602825	5,482872262
41	Makhado RSC	103 111	296584,4634	1,612783857	5,013304999	5,472148397
42	Kroonstad RSC	97 025	289522,9286	1,62324929	4,986883651	5,461682963
43	Standerton RSC	85 644	282789,8372	1,633468456	4,932696943	5,451463798
44	Ermelo RSC	84 615	276362,7955	1,643452676	4,927447359	5,441479577
45	Mossel Bay RSC	80 613	270221,4	1,653212514	4,906405084	5,43171974
46	Oudtshoorn RSC	80 286	264347,0217	1,662757832	4,904639821	5,422174422
47	Dennilton/Siyabuswa RSC	78 476	258722,617	1,672097858	4,894736859	5,412834396
48	Bethlehem RSC	77 607	253332,5625	1,681241237	4,889900896	5,403691016
49	Vredenburg RSC	75 981	248162,5102	1,69019608	4,880705005	5,394736173
50	Butterworth RSC	73 807	243199,26	1,698970004	4,868097553	5,385962249

ANNEXURE F

POPULATION DATA FOR SCENARIO 2

i th	Name	Current Pop	Rank-size rule	Log Rank	Log Pi	Log Rank rule
1	Gauteng CR	12 159 963	12159963	0	7,084932253	7,084932253
2	Cape Town CR	3 872 895	6079981,5	0,301029996	6,588035723	6,783902258
3	eThekweni CR	3 673 345	4053321	0,477121255	6,565061719	6,607810999
4	Port Elizabeth CR	1 149 989	3039990,75	0,602059991	6,060693686	6,482872262
5	Emfuleni	888 233	2431992,6	0,698970004	5,948526904	6,385962249
6	Bloemfontein/Botshabelo CA	725 770	2026660,5	0,77815125	5,860799012	6,306781003
7	Pietermaritzburg C	689 239	1737137,571	0,84509804	5,838369844	6,239834213
8	Polokwane C	680 196	1519995,375	0,903089987	5,832634074	6,181842266
9	Richards Bay C	604 105	1351107	0,954242509	5,78111243	6,130689744
10	East London C	540 098	1215996,3	1	5,732472569	6,084932253
11	Klerksdorp/Stilfontein RSC	522 500	1105451,182	1,041392685	5,718086295	6,043539568
12	Witbank RSC	510 501	1013330,25	1,079181246	5,707996597	6,005751007
13	Rustenburg C	486 875	935381,7692	1,113943352	5,687417475	5,970988901
14	Nelspruit C	483 113	868568,7857	1,146128036	5,684048724	5,938804218
15	New Castle RSC	426 831	810664,2	1,176091259	5,630255954	5,908840994
16	Tzaneen RSC	366 659	759997,6875	1,204119983	5,56426235	5,880812271
17	George RSC	349 035	715291,9412	1,230448921	5,542868979	5,854483332
18	Welkom RSC	335 519	675553,5	1,255272505	5,525717119	5,829659748
19	Ladysmith RSC	286 793	639998,0526	1,278753601	5,457568547	5,806178653
20	Thohoyandou RSC	275 617	607998,15	1,301029996	5,440306001	5,783902258
21	Phuthaditjhaba RSC	273 983	579045,8571	1,322219295	5,437723617	5,762712959
22	Kimberley RSC	226 554	552725,5909	1,342422681	5,355171734	5,742509573
23	Paarl/Wellington RSC	225 985	528694,0435	1,361727836	5,354079613	5,723204417
24	Port Shepstone/Margate RSC	218 302	506665,125	1,380211242	5,339057715	5,704721012

Rank	Name	Current Pop	Rank-size rule	Log Rank	Log Pi	Log Rank rule
25	Mmabatho RSC	212 553	486398,52	1,397940009	5,327467239	5,686992245
26	Mthatha RSC	210 920	467690,8846	1,414973348	5,324117763	5,669958906
27	Dennilton/Siyabuswa RSC	209 257	450369	1,431363764	5,320679995	5,653568489
28	Stanger RSC	202 715	434284,3929	1,447158031	5,306885886	5,637774222
29	Secunda RSC	186 190	419309,069	1,462397998	5,269956352	5,622534256
30	Middelburg RSC	163 631	405332,1	1,477121255	5,213865585	5,607810999
31	Bushbuckridge RSC	152 452	392256,871	1,491361694	5,183133126	5,59357056
32	Estcourt RSC	150 296	379998,8438	1,505149978	5,176947422	5,579782275
33	Potchefstroom RSC	148 097	368483,7273	1,51851394	5,170546261	5,566418314
34	King Williams Town RSC	143 823	357645,9706	1,531478917	5,157828343	5,553453336
35	Vryheid RSC	137 357	347427,5143	1,544068044	5,137850797	5,540864209
36	Phalaborwa/Namakgale RSC	132 418	337776,75	1,556302501	5,121947024	5,528629753
37	Hazyview RSC	130 932	328647,6486	1,568201724	5,117045802	5,516730529
38	Worcester RSC	117 292	319999,0263	1,579783597	5,069268392	5,505148657
39	Makopane RSC	115 075	311793,9231	1,591064607	5,060980984	5,493867646
40	Upington RSC	105 063	303999,075	1,602059991	5,021449798	5,482872262
41	Queenstown RSC	103 658	296584,4634	1,612783857	5,015602825	5,472148397
42	Makhado RSC	103 111	289522,9286	1,62324929	5,013304999	5,461682963
43	Kroonstad RSC	97 025	282789,8372	1,633468456	4,986883651	5,451463798
44	Standerton RSC	85 644	276362,7955	1,643452676	4,932696943	5,441479577
45	Ermelo RSC	84 615	270221,4	1,653212514	4,927447359	5,43171974
46	Mossel Bay RSC	80 613	264347,0217	1,662757832	4,906405084	5,422174422
47	Oudtshoorn RSC	80 286	258722,617	1,672097858	4,904639821	5,412834396
48	Dennilton/Siyabuswa RSC	78 476	253332,5625	1,681241237	4,894736859	5,403691016

i th	Name	Current Pop	Rank-size rule	Log Rank	Log Pi	Log Rank rule
49	Bethlehem RSC	77 607	248162,5102	1,69019608	4,889900896	5,394736173
50	Vredenburg RSC	75 981	243199,26	1,698970004	4,880705005	5,385962249

ANNEXURE G

POPULATION DATA FOR SCENARIO 3

i th	Name	Current Pop	Rank-size rule	Log Rank	Log Pi	Log Rank rule
1	Gauteng CR	11 159 963	11159963	0	7,047662755	7,047662755
2	Cape Town CR	3 872 895	5579981,5	0,301029996	6,588035723	6,746632759
3	eThekweni CR	3 673 345	3719987,667	0,477121255	6,565061719	6,5705415
4	Port Elizabeth CR	1 149 989	2789990,75	0,602059991	6,060693686	6,445602763
5	Bloemfontein/Botshabelo CA	725 770	2231992,6	0,698970004	5,860799012	6,34869275
6	Pietermaritzburg C	689 239	1859993,833	0,77815125	5,838369844	6,269511504
7	Richards Bay C	562 439	1594280,429	0,84509804	5,750075427	6,202564715
8	East London C	540 098	1394995,375	0,903089987	5,732472569	6,144572768
9	Polokwane C	513 530	1239995,889	0,954242509	5,71056582	6,093420245
10	Rustenburg C	486 875	1115996,3	1	5,687417475	6,047662755
11	Nelspruit C	483 113	1014542,091	1,041392685	5,684048724	6,00627007
12	New Castle RSC	426 831	929996,9167	1,079181246	5,630255954	5,968481509
13	Thohoyandou RSC	400 617	858458,6923	1,113943352	5,602729374	5,933719402
14	Phuthaditjhaba RSC	398 983	797140,2143	1,146128036	5,600954392	5,901534719
15	Tzaneen RSC	366 659	743997,5333	1,176091259	5,56426235	5,871571496
16	Klerksdorp/Stilfontein RSC	355 834	697497,6875	1,204119983	5,551247443	5,843542772
17	Witbank RSC	343 835	656468,4118	1,230448921	5,536350083	5,817213833
18	Mmabatho RSC	337 553	619997,9444	1,255272505	5,528341972	5,79239025
19	Mthatha RSC	335 920	587366,4737	1,278753601	5,526235862	5,768909154
20	Welkom RSC	335 519	557998,15	1,301029996	5,525717119	5,746632759
21	Dennilton/Siyabuswa RSC	334 257	531426,8095	1,322219295	5,524080511	5,72544346
22	George RSC	307 369	507271,0455	1,342422681	5,487660064	5,705240074
23	Ladysmith RSC	286 793	485215,7826	1,361727836	5,457568547	5,685934919
24	Upington RSC	230 063	464998,4583	1,380211242	5,361846779	5,667451513
25	Kimberley RSC	226 554	446398,52	1,397940009	5,355171734	5,649722746

i th	Name	Current Pop	Rank-size rule	Log Rank	Log Pi	Log Rank rule
1	Gauteng CR	11 159 963	11159963	0	7,047662755	7,047662755
26	Paarl/Wellington RSC	225 985	429229,3462	1,414973348	5,354079613	5,632689407
27	Port Shepstone/Margate RSC	218 302	413331,963	1,431363764	5,339057715	5,616298991
28	Stanger RSC	202 715	398570,1071	1,447158031	5,306885886	5,600504723
29	Secunda RSC	186 190	384826,3103	1,462397998	5,269956352	5,585264757
30	Middelburg RSC	163 631	371998,7667	1,477121255	5,213865585	5,5705415
31	Bushbuckridge RSC	152 452	359998,8065	1,491361694	5,183133126	5,556301061
32	Estcourt RSC	150 296	348748,8438	1,505149978	5,176947422	5,542512776
33	Potchefstroom RSC	148 097	338180,697	1,51851394	5,170546261	5,529148815
34	King Williams Town RSC	143 823	328234,2059	1,531478917	5,157828343	5,516183838
35	Vryheid RSC	137 357	318856,0857	1,544068044	5,137850797	5,50359471
36	Phalaborwa/Namakgale RSC	132 418	309998,9722	1,556302501	5,121947024	5,491360254
37	Hazyview RSC	130 932	301620,6216	1,568201724	5,117045802	5,479461031
38	Worcester RSC	117 292	293683,2368	1,579783597	5,069268392	5,467879158
39	Makopane RSC	115 075	286152,8974	1,591064607	5,060980984	5,456598148
40	Queenstown RSC	103 658	278999,075	1,602059991	5,015602825	5,445602763
41	Makhado RSC	103 111	272194,2195	1,612783857	5,013304999	5,434878898
42	Kroonstad RSC	97 025	265713,4048	1,62324929	4,986883651	5,424413464
43	Standerton RSC	85 644	259534,0233	1,633468456	4,932696943	5,414194299
44	Ermelo RSC	84 615	253635,5227	1,643452676	4,927447359	5,404210078
45	Mossel Bay RSC	80 613	247999,1778	1,653212514	4,906405084	5,394450241
46	Oudtshoorn RSC	80 286	242607,8913	1,662757832	4,904639821	5,384904923
47	Dennilton/Siyabuswa RSC	78 476	237446,0213	1,672097858	4,894736859	5,375564897
48	Bethlehem RSC	77 607	232499,2292	1,681241237	4,889900896	5,366421517
49	Vredenburg RSC	75 981	227754,3469	1,69019608	4,880705005	5,357466675

i th	Name	Current Pop	Rank-size rule	Log Rank	Log Pi	Log Rank rule
1	Gauteng CR	11 159 963	11159963	0	7,047662755	7,047662755
50	Butterworth RSC	73 807	223199,26	1,698970004	4,868097553	5,34869275
1	Gauteng CR	11 159 963	11159963	0	7,047662755	7,047662755

ANNEXURE H

POPULATION DATA FOR SCENARIO 4

i\th		Name	Current Pop	Rank-size rule	Log Rank	Log Pi	Log Rank rule
1	ga u	Gauteng CR	11 159 963	11159963	0	7,047662755	7,047662755
2	wc	Cape Town CR	3 872 895	5579981,5	0,301029996	6,588035723	6,746632759
3	kzn	eThekweni CR	3 673 345	3719987,667	0,477121255	6,565061719	6,5705415
4	ec	Port Elizabeth CR	1 149 989	2789990,75	0,602059991	6,060693686	6,445602763
5	fs	Bloemfontein/Botshabelo CA	725 770	2231992,6	0,698970004	5,860799012	6,34869275
6	kzn	Pietermaritzburg C	689 239	1859993,833	0,77815125	5,838369844	6,269511504
7	kzn	Richards Bay C	687 439	1594280,429	0,84509804	5,837234167	6,202564715
8	ec	East London C	540 098	1394995,375	0,903089987	5,732472569	6,144572768
9	lim	Thohoyandou RSC	525 617	1239995,889	0,954242509	5,720669403	6,093420245
10	fs	Phuthaditjhaba RSC	523 983	1115996,3	1	5,719317197	6,047662755
11	lim	Polokwane C	513 530	1014542,091	1,041392685	5,71056582	6,00627007
12	nw	Rustenburg C	486 875	929996,9167	1,079181246	5,687417475	5,968481509
13	mp	Nelspruit C	483 113	858458,6923	1,113943352	5,684048724	5,933719402
14	nw	Mmabatho RSC	462 553	797140,2143	1,146128036	5,665161502	5,901534719
15	ec	Mthatha RSC	460 920	743997,5333	1,176091259	5,663625553	5,871571496
16	mp	Dennilton/Siyabuswa RSC	459 257	697497,6875	1,204119983	5,662055785	5,843542772
17	wc	George RSC	432 369	656468,4118	1,230448921	5,635854548	5,817213833
18	kzn	New Castle RSC	426 831	619997,9444	1,255272505	5,630255954	5,79239025
19	lim	Tzaneen RSC	366 659	587366,4737	1,278753601	5,56426235	5,768909154
20	nw	Klerksdorp/Stilfontein RSC	355 834	557998,15	1,301029996	5,551247443	5,746632759
21	nc	Upington RSC	355 063	531426,8095	1,322219295	5,550305418	5,72544346
22	mp	Witbank RSC	343 835	507271,0455	1,342422681	5,536350083	5,705240074
23	fs	Welkom RSC	335 519	485215,7826	1,361727836	5,525717119	5,685934919
24	kzn	Ladysmith RSC	286 793	464998,4583	1,380211242	5,457568547	5,667451513

i\th		Name	Current Pop	Rank-size rule	Log Rank	Log Pi	Log Rank rule
25	nc	Kimberley RSC	226 554	446398,52	1,397940009	5,355171734	5,649722746
26	wc	Paarl/Wellington RSC	225 985	429229,3462	1,414973348	5,354079613	5,632689407
27	kzn	Port Shepstone/Margate RSC	218 302	413331,963	1,431363764	5,339057715	5,616298991
28	kzn	Stanger RSC	202 715	398570,1071	1,447158031	5,306885886	5,600504723
29	mp	Secunda RSC	186 190	384826,3103	1,462397998	5,269956352	5,585264757
30	mp	Middelburg RSC	163 631	371998,7667	1,477121255	5,213865585	5,5705415
31	mp	Bushbuckridge RSC	152 452	359998,8065	1,491361694	5,183133126	5,556301061
32	kzn	Estcourt RSC	150 296	348748,8438	1,505149978	5,176947422	5,542512776
33	nw	Potchefstroom RSC	148 097	338180,697	1,51851394	5,170546261	5,529148815
34	ec	King Williams Town RSC	143 823	328234,2059	1,531478917	5,157828343	5,516183838
35	kzn	Vryheid RSC	137 357	318856,0857	1,544068044	5,137850797	5,50359471
36	lim	Phalaborwa/Namakgale RSC	132 418	309998,9722	1,556302501	5,121947024	5,491360254
37	mp	Hazyview RSC	130 932	301620,6216	1,568201724	5,117045802	5,479461031
38	wc	Worcester RSC	117 292	293683,2368	1,579783597	5,069268392	5,467879158
39	lim	Makopane RSC	115 075	286152,8974	1,591064607	5,060980984	5,456598148
40	ec	Queenstown RSC	103 658	278999,075	1,602059991	5,015602825	5,445602763
41	lim	Makhado RSC	103 111	272194,2195	1,612783857	5,013304999	5,434878898
42	fs	Kroonstad RSC	97 025	265713,4048	1,62324929	4,986883651	5,424413464
43	mp	Standerton RSC	85 644	259534,0233	1,633468456	4,932696943	5,414194299
44	mp	Ermelo RSC	84 615	253635,5227	1,643452676	4,927447359	5,404210078
45	wc	Mossel Bay RSC	80 613	247999,1778	1,653212514	4,906405084	5,394450241
46	wc	Oudtshoorn RSC	80 286	242607,8913	1,662757832	4,904639821	5,384904923
47	lim	Dennilton/Siyabuswa RSC	78 476	237446,0213	1,672097858	4,894736859	5,375564897
48	fs	Bethlehem RSC	77 607	232499,2292	1,681241237	4,889900896	5,366421517

i^t h		Name	Current Pop	Rank-size rule	Log Rank	Log Pi	Log Rank rule
49	wc	Vredenburg RSC	75 981	227754,3469	1,69019608	4,880705005	5,357466675
50	ec	Butterworth RSC	73 807	223199,26	1,698970004	4,868097553	5,34869275