The use of corridor development as a strategic and supporting instrument towards the development of national space economies

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Preface

This study would not have been possible without the grace of GOD, who guided me in strength and reminded me of HIS presence, and the fact, that HE created me with the ability to be great. Furthermore, I would also like to thank those closest to me, especially my beautiful wife Delveen and lovely son Johnathan. They stood by me, prayed for me, encouraged me, lifted me up, motivated me and kept on reminding me who I am. Their prayers, support and belief were the driving force enabling me to achieve this memorable milestone in my life.

In your hands lies a dissertation that is the product of a dream I have had since I obtained my first degree. The research was not easy, especially venturing down a path that requires dedication, patience and motivation. In this regard, I would like to thank my promoter, Professor Drewes, for his guidance and support during my research.

You might ask – and indeed many did – why, at this stage of my life, I decided to tread upon this path. In all honesty, I asked myself the same question more than once. However, at the end of the day, it comes down to personal expectations more than anything else, or maybe it is because a teacher commented that the best I would ever achieve in life was absolutely nothing. Does that still bother me? Not at all. By GOD's grace, I was able to prove to myself and especially to my son that one should never measure oneself according to someone else's perceptions, but rather according to one's own abilities and inner self. Furthermore, one should dream; when one dreams, one expands one's boundaries. Expanding one's boundaries makes one more inquisitive; being more inquisitive increases opportunities; more opportunities strengthen one's abilities; stronger abilities allow one to reach for something that might not have seemed possible.

On that note, what does the dissertation entail? The dissertation might not be a Dan Brown novel. However, it does venture towards the interpretation of spatial transformation and economic space development. The key question asked is how the concept of corridors can be utilised to guide economic space development, in other words, is it possible to model economic spaces to establish preferred locations for investment opportunities to promote inclusive economic growth? Evident from the findings are the possibilities being created when modelling and mapping economic spaces; they provide new insight into the interpretation and structuring of spatial transformation and economic space development. The details pertaining to development corridors as a mechanism to promote economic space development are within the dissertation. I hope you enjoy reading it.

I would also like to extend my thanks to the following people:

1) My mother, for her encouragement and support over so many years
2) Family and friends, for their support and encouragement

3) MacFaden Kotelo, for all the difficult GIS analyses and map work he performed

Mr. Andre De Wet Brand

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Voorwoord

Die produk van hierdie studie was slegs moontlik deur die begenadiging van GOD wat my in krag gelei en aan SY teenwoordigheid herinner het, en die feit dat HY my geskape het met die vermoë om uitnemend te wees. Verder wil ek ook dié naaste aan my bedank, veral my beeldskone vrou Delveen en pragtige seun Johnathan. Hulle het my bygestaan, vir my gebid, my ondersteun, my opgehef, my gemotiveer en my heeltyd herinner aan wie ek is. Hul gebede, ondersteuning en geloof is die stukrag wat my in staat gestel het om hierdie onvergeetlike mylpaal in my lewe te bereik.

In u hande lê 'n proefskrif wat die eindproduk is van 'n droom wat ek gehad het sedert ek my eerste graad verwerf het. Die navorsing was nie maklik nie, veral omdat dit 'n pad van toewyding, geduld en motivering was. In hierdie opsig wil ek graag my promotor, Professor Drewes, bedank vir sy leiding en ondersteuning tydens my navorsing.

U mag dalk vra – en vele het al – hoekom ek op hierdie stadium van my lewe besluit het om hierdie pad te betree. In alle eerlikheid, moet ek beken dat ek myself al verskeie kere dieselfde vraag afgevra het. Aan die einde van die dag kom dit egter neer op persoonlike verwagtinge meer as enige iets anders, of dalk is dit omdat 'n onderwyser 'n opmerking gemaak het dat die beste wat ek ooit in my lewe sou bereik absoluut niks is. Pla dit my nog steeds? Geensins nie. Deur GOD se genade kon ek aan myself en veral aan my seun bewys dat jy jouself nooit aan iemand anders se persepsie behoort te meet nie, maar eerder aan jou eie vermoëns en innerlike self. Bowendien, moet 'n mens droom; wanneer jy droom brei jy jou grense uit; om jou grense uit te brei maak jou meer nuuskierig; om meer nuuskierig te wees veroorsaak meer geleenthede; meer geleenthede versterk jou vermoëns; sterker vermoëns laat jou toe om na iets uit te reik wat nie moontlik gelyk het nie.

Op daardie noot, wat behels die proefskrif? Die proefskrif is dalk nie 'n Dan Brown roman nie, maar dit beweeg wel in die rigting van 'n interpretasie van ruimtelike transformasie en ekonomiese spasie-ontwikkeling. Die kernvraag was hoe die konsep van korridors gebruik kan word om ekonomiese spasie-ontwikkeling te lei, met ander woorde of dit moontlik is om ekonomiese spasies te modelleer om voorkeur liggings vir beleggingsgeleenthede vir bevordering van inklusiewe ekonomiese groei vas te stel. Dit is duidelik uit die bevindings dat moontlikhede geskep word wanneer ekonomiese spasies gemodelleer en uitgestippel word; dit bied nuwe insig in die interpretasie en strukturering van ruimtelike transformasie en ekonomiese spasie-ontwikkeling. Die besonderhede met betrekking tot ontwikkelingskorridors as 'n meganisme om ekonomiese spasie-ontwikkeling te bevorder is in die proefskrif. Ek hoop u geniet die lees.

Ek wil ook my dank betuig aan die volgende mense:

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2) Familie en vriende, vir hulle ondersteuning en aanmoediging
3) MacFaden Kotelo, vir al die moeilike GIS-analise en kartering wat nodig was

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Potchefstroom

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Abstract

Development corridors are the outcome of the flow of goods, services and information between nodes which leads to the manifestation of urban development and economic growth. This functional relationship leads to two key elements: 1) a link between nodes providing access to different levels of economies; and 2) the intensity of economic development at nodes which vary in size and dominance. The outcome is a regional or urban system comprised of a larger number of lower-order settlements and fewer higher-order settlements, each having a different impact and contribution regarding economic space development. Therefore, great, cumulative benefits may become apparent when potential corridors are modelled along economic spaces, thereby underpinning the notion that the corridor concept has been and still is regarded as an important development instrument in planning. However, it is evident that the notion that development corridors are integrated strategic and supporting networks to structure economic space development is lacking. What is specifically lacking is an integrated approach (Spatial Corridor Model [SCM]) to identify development corridors that will create areas or zones as potential investment opportunities to promote the structuring of economic spaces. In this regard, the research focused on constructing an SCM as a theoretical framework that will provide direction in the restructuring of economic spaces. The outcome of the model focused on three key functional output levels: 1) the spatial distribution of settlements, according to functional typologies which represent the economic dominance of each settlement, relative to one another; 2) the relative economic advantage (how gravity correlates with the size of the economy) of the settlements based on proximity relative to one another; and 3) integrated and supporting networks of development axes creating potential corridor development zones upon which a national spatial framework can be built to guide economic space development within the country. The research findings support the notion that the Spatial Corridor Model (SCM) provides a mechanism for interpreting spatial transformation and economic development. This is achieved based on the following elements: 1) providing a framework for the establishment of potential economic zones; 2) promoting explicit, focused areas guiding economic space development under the auspices of primary and secondary nodes supporting predominant, prominent and significant development axes; 3) highlighting primary and secondary nodes which lack potential development axes; 4) promoting economic advantages for nodes located in close proximity to the connecting predominant, prominent and significant links; and 5) creating economic conditions that stimulate intra-regional and cross-border trade opportunities. Furthermore, the research also highlighted the consideration that the factors to increase the appeal of preferred locations as destinations for investment, to promote inclusive growth lay with cities, by implication. Lastly, the research concluded that the national government should, through the Spatial Corridor Model (SCM), develop a realistic spatial perspective on long-term settlement patterns and investment opportunities which will transform economic space development, while provincial and local governments should identify opportunities that align with their circumstances, in other words, local authorities should respond proactively and innovatively to rapid change; and they should realise their

economic potential as consumers, producers, landowners or investors to develop and promote the economy.

Uittreksel

Ontwikkelingskorridors is die resultaat van die vloei van goedere, dienste en inligting tussen nodusse wat lei tot stedelike ontwikkeling en ekonomiese groei. Hierdie funksionele verhouding lei tot twee belangrike elemente, naamlik 1) 'n skakel tussen nodusse wat toegang bied tot verskillende vlakke van ekonomieë; en 2) die intensiteit van ekonomiese ontwikkeling by nodusse wat verskil in grootte en dominansie. Die resultaat is 'n streek- of stedelike stelsel wat bestaan uit 'n groter aantal nedersettings van 'n laer orde en minder nedersettings van 'n hoër orde, wat elkeen 'n verskillende impak en bydrae het met betrekking tot ekonomiese spasie-ontwikkeling. Dus kan groot kumulatiewe voordele na vore gebring word wanneer potensiële korridors gemodelleer word langs ekonomiese spasies, wat die idee ondersteun dat die korridorkonsep as 'n belangrike ontwikkelingsinstrument in beplanning beskou is en steeds so beskou word. Dit is egter duidelik dat ontwikkelingskorridors tekortskiet as geïntegreerde strategiese en ondersteunende netwerke om ekonomiese spasie-ontwikkeling te struktureer. Wat spesifiek ontbreek is 'n geïntegreerde benadering (Ruimtelike Korridor-model [RKM]) om ontwikkelingskorridors te identifiseer wat areas of sones kan skep as potensiële beleggingsgeleenthede om die strukturering van ekonomiese spasies te bevorder. In hierdie opsig het die navorsing gefokus op die bou van 'n RKM as 'n teoretiese raamwerk wat leiding sal verskaf in die herstrukturering van ekonomiese spasies. Die uitkoms van die model het gefokus op drie belangrike funksionele uitsetvlakke, naamlik: 1) die ruimtelike verspreiding van nedersettings volgens funksionele tipologieë wat die ekonomiese dominansie van een nedersetting relatief tot 'n ander verteenwoordig; 2) die relatiewe ekonomiese voordeel (hoe swaartekrag korreleer met die grootte van die ekonomie) van die nedersettings gebaseer op nabyheid relatief tot mekaar; en 3) geïntegreerde en ondersteunende netwerke van ontwikkelingsasse om sodoende potensiële korridorontwikkelingsones te skep waarop 'n nasionale ruimtelike raamwerk gebou kan word om ekonomiese spasie ontwikkeling in die land te kan lei. Die navorsingsbevindings ondersteun die idee dat die Ruimtelike Korridor-model (RKM) 'n meganisme verskaf waardeur ruimtelike transformasie en ekonomiese ontwikkeling geïnterpreteer kan word. Dit word bereik, gegrond op die volgende elemente, naamlik: 1) die verskaffing van 'n raamwerk waardeur potensiële ekonomiese sones geskep word; 2) die bevordering van duidelik gefokusde areas wat ekonomiese spasie-ontwikkeling begelei onder beskerming van primêre en sekondêre nodusse wat oorheersende, prominente en beduidende ontwikkelingsasse ondersteun; 3) die beklemtoning van primêre en sekondêre nodusse met 'n gebrek aan potensiële ontwikkelingsasse; 4) die bevordering van ekonomiese voordele vir nodusse wat naby die verbindende oorheersende, prominente en beduidende skakels geleë is; en 5) die daarstelling van ekonomiese toestande vir die stimulering van handelsgeleenthede binne streke/oor grense. Die navorsing het verder ook die oorweging beklemtoon dat die faktore om voorkeurgebiede se aantrekkingskrag as bestemmings vir belegging vir die bevordering van inklusiewe ontwikkeling te verhoog, by implikasie by stede lê. Laastens, het die navorsing tot die gevolgtrekking gekom dat die nasionale regering, deur die Ruimtelike Korridor-model (RKM), 'n realistiese ruimtelike perspektief op langtermyn nedersettingspatrone en

beleggingsgeleenthede moet ontwikkel wat ekonomiese spasie ontwikkeling sal transformeer, terwyl provinsiale en plaaslike regerings geleenthede moet identifiseer wat in ooreenstemming is met hulle omstandighede, met ander woorde, plaaslike owerhede moet pro-aktief en innoverend reageer op vinnige verandering; en hulle moet hulle ekonomiese potensiaal as verbruikers, vervaardigers, grondeienaars of beleggers realiseer om die ekonomie te ontwikkel en te bevorder.

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List of Abbreviations

ACSA	-	Airports Company South Africa
ADB	-	African Development Bank
AsgiSA	-	Accelerated and Shared Growth Initiative of South Africa
ATNS	-	Air Traffic and Navigation Services
AU	-	African Union
BRICS	-	Brazil, Russia, India, China and South Africa
CAF	-	Corporación Andina de Fomento
CBRTA	-	Cross-Border Road Transport Agency
CCIF	-	Cumulative Corridor Impact Factor
CDZ	-	Corridor Development Zone
CEC	-	Commission of the European Communities
COMESA	-	Common Market for Eastern and Southern Africa
CRUISE	-	Centre for Regional, Urban Innovation and Statistical Exploration
CSIR	-	Council for Scientific and Industrial Research
DCOG	-	Department of Cooperative Government
DPLG	-	Department of Provincial and Local Government
DRDLR	-	Department of Rural Development and Land Reform
DTI	-	Department of Trade and Industry
EAC	-	Eastern African Community
EC	-	European Commission
ESDA	-	Economic Space Development Axes

EIF	-	Economic Impact Factor
EU	-	European Union
Fonplata	-	River Plate Basin Financial Development Fund
GDP	-	Gross Domestic Product
GEAR	-	Growth Employment and Redistribution Programme
GIS	-	Geographical Information Systems
GVA	-	Gross Value Added
IATA	-	International Air Transport Association
IDB	-	Inter-American Development Bank
IDZ	-	Industrial Development Zones
IIRSA	-	Integration of the Regional Infrastructure of South America
IPAD	-	Industrial Policy Action Plan
IPP	-	Industrial Parks Programme
IUDF	-	Integrated Urban Development Framework
LDM	-	Land-Development Management
LDV	-	Link Demand Value
LUM	-	Land-Use Management
MmAIF	-	Multi-modal Air Impact Factor
MmIF	-	Multi-modal Impact Factor
MmPIF	-	Multi-modal Port Impact Factor
MLUP	-	Municipal Land-Use Plans
MSDF	-	Municipal Spatial Development Framework

NATMAP	-	National Transport Master Plan
NDP	-	National Development Plan
NDoT	-	National Department of Transport
NEG	-	New Economic Geography
NGP	-	National Growth Path
NIP	-	National Infrastructure Plan
NPC	-	National Planning Commision
NPR	-	National Ports Regulator
NRC	-	National Research Council
NSDF	-	National Spatial Development Framework
NSDP	-	National Spatial Development Perspective
NUDF	-	National Urban Development Framework
OECD	-	Organisation for Economic Co-operation and Development
PRASA	-	Passenger Rail Agency of South Africa
PSDF	-	Provincial Spatial Development Framework
RAF	-	Road Accident Fund
RDP	-	Reconstruction and Development Plan
RSDF	-	Regional Spatial Development Framework
RSR	-	Railway Safety Regulator
RTMC	-	Road Traffic Management Corporation
RTIA	-	Road Traffic Infringement Agency
SAA	-	South African Airways

SACAA	-	South African Civil Aviation Authority
SADC	-	Southern African Development Community
SACN	-	South African City Network
SAMSA	-	South African Maritime Safety Authority
SANRAL	-	South African National Roads Agency
SCM	-	Spatial Corridor Model
SDF	-	Spatial Development Framework
SEZ	-	Special Economic Zones
SP	-	Statutory Planning
SPLUMA	-	Spatial Planning and Land Use Management Act
Stats SA	-	Statistics South Africa
TCC	-	Technical Coordination Committee
TEN-T	-	Trans-European Transport Networks
TFR	-	Transnet Freight Rail
TNPA	-	Transnet National Port Authority
UFI	-	Urban Function Index
UN	-	United Nations
WB	-	World Bank

List of Key Words

Case studies

Cumulative Corridor Impact Factor (CCIF)

Corridors

Economic Impact Factors (EIF)

Economic spaces

Economic Space Development Axes (ESDA)

Equations

Key planning instrument

Link Demand Value (LDV)

Models

Spatial Corridor Model (SCM)

Theories

Chapter 1 Introduction and background

1.1 Introduction

The period since the establishment of the Union of South Africa has seen major changes in all spheres of the country. Although mining activities continue to be the backbone of the South African industry, intensive industrialisation has expanded rapidly since the 1930s and, as a result, the population of towns and cities increased sharply (Kwamena-Poh, 1986). This resulted in the creation of functional and locational connections between economic nodes where large amounts of economic resources are concentrated. Hohenberg *et al*. (1985) referred to functional and locational relationships, when linked, as networks within which trade occurred and, according to them, this played an important role in the creation of scope economies. They based their argument on the notion that various networks formed a unique exchange environment from which economic development benefitted. This was also supported by Batten (1994), who highlighted the fact that synergies of interactive growth could create scope economies. In the South African landscape, economic networks and synergies of interactive growth revolve around the metropolitan regions, which accommodate 65 per cent of the national economy (Council for Scientific and Industrial Research [CSIR], 2013; Van Huyssteen, 2013). The amalgamation or agglomeration of economies at interdependent locations can lead to the creation of competitive advantages i.e. such as creativity, learning and innovation. Agglomeration (see section 4.4) describes the benefits or advantages that industries obtain when locating in close proximity to one another. This relates to the notion of economies of scale and effects, which is based on the principles of the cause and effect of market forces structuring economic spaces.

A network linkage, also referred to in the contemporary idiom as corridors, is a concept that has played and is still playing a key role in the planning thinking in South Africa. The first use of development corridors as a planning instrument is traced back to the National Physical Development Plan of South Africa, published more than four decades ago. Since then, the development corridor as an important concept has remained a key planning instrument at various levels of spatial aggregation (South Africa, 1975, 1980, 1981, 1999, 2000, 2006, 2009, 2012 & 2013), evident in spatial legislation, such as the Reconstruction and Development Programme (RDP); the National Department of Transport (NDoT); the National Transport Master Plan (NATMAP); the National Infrastructure Plan (NIP); the National Spatial Development Perspective (NSDP); and the National Development Plan (NDP).

The publication of the NDP (South Africa, 2013), however, marked the beginning of a new focus on strategic spatial planning and thinking in South Africa, and places a strong emphasis on spatial targeting to create investment opportunities. The NDP contains six suggested national spatial themes with two relating directly to corridors as an instrument to create investment opportunities. They are:

1) National competiveness corridors – The theme relates directly to the development corridor initiative proposed by the Presidential Infrastructure Coordinating Commission's 20-year planning framework, in relation to spatial targeting
2) Transnational development corridors – Although not part of the Presidential Infrastructure Coordinating Commission's proposed 20-year planning framework, the theme is critical in creating an integrated southern African economy. The Common Market for Eastern and Southern Africa (COMESA), the Eastern African Community (EAC) and the Southern African Development Community (SADC) seek to deepen economic integration among its members through the free trade initiative that came into effect in 2008. Development corridors have an important bearing on economic development and integration because they are tools creating trade and investment opportunities. This is especially true of the regions represented by the members of COMESA, EAC and SADC, as various development corridors exist in these regions, including the Maputo corridor, arguably the biggest and most successful initiative, which makes it a model example. Other initiatives include the Northern corridor, Central corridor, Dar es Salaam corridor, Walvis Bay corridor, Abidjan-Lagos corridor, the North-South corridor and the Lobito corridor (see Figure 7.11).

According to the CSIR (2013), also highlighted in the NDP (South Africa, 2013), South Africa's footprint of economic activities is distributed across the major metropolitan regions, as well as a network of settlements and cities, all linked by established networks of connecting infrastructure. These economic regions (CSIR, 2013; Van Huyssteen, 2013) are considered the core cylinders of South Africa's economic footprint, contributing more than 80 per cent towards the country's national economy (see Table 8.2). Furthermore, in the view of Van Huyssteen (2013), the international connectivity and extensive hinterlands of these regions also offer great opportunities for economic growth and development.

It is clear that corridors are considered an important planning instrument in the spatial transformation of the country. One of the key concepts underlying national spatial planning, also highlighted in the NDP (South Africa, 2013), includes the role of a national spatial framework to prioritise investment opportunities (South Africa, 2015). The key question is why space, or rather economic spaces, should be utilised as a key backdrop against which investment opportunities are considered. The answer lies in the degree to which economic activities are concentrated on a specific locality, which relates to the factors of the New Economic Geography (NEG) of Krugman (1991): 1) the current and emerging economic composition of regions; and 2) the flow of economies between and within regions, all supporting the idea of economic space development. According to Glasson (1978), regional development concerns the incidence of economic growth; it is, ultimately, the result of the location of economic activities, in response to differential regional attractions. Shifts in location patterns have direct repercussions on economic growth. Since spatial organisation is a function of activity and interaction patterns, regional development is simply an expression of these patterns. Howitt (2004) and McCann (2004) supported his

notion, emphasising that the processes which contribute to the development and economic growth of regions are found in the types of economies that are formed, their sources, and the supporting networks linking them.

However, in Brand's (2014) view, spatial development, in all spheres of government, especially in the South African context, does not provide any suitable evidence on which forces result in the creation of development corridors, or the state of development, vibrancy, or effectiveness of development corridors as spatial and economic development instruments. Although it is clear that strong evidence exists that corridors are regarded as important spatial development instruments which structure economic space development, arguments that emerged from the assessments of development corridors reflect the need for broader strategies at a national level, as well as a greater awareness of where economies amalgamate to allow for the integration of corridors as strategic and supporting networks (Cameron, 1998; Fensham, 1998; Oranje, 1995; Lamont, 1999). Drewes (2015) noted that there was no explicit, integrated spatial planning policy or framework to guide economic space development. According to him, government departments run their own policies and programmes that promote investments in explicit focused areas. It seems that numerous regional infrastructure development programmes are being implemented with no integration between these mentioned policies and programmes. This is evident when considering that many of these policies and programmes do not align with areas with sufficient agglomeration economies that can advance economic development effectively at a national level. Furthermore, Kleynhans (2007) was of the view that the influence of corridors to advance economic space development stretched beyond their boundaries. Therefore, corridors needed to be dealt with in an integrated manner and should never be considered in isolation. This was reiterated by Brunner (2013), who stated that corridors did not generate significant economic benefits in isolation, but rather had to be analysed as part of integrated global or regional economic networks.

In brief, what is found to be lacking is an integrated approach towards a spatial planning policy or framework, combined with an explicit spatial focus; in this case, development corridors as strategic and supporting networks which can structure the development of economic spaces.

1.2 Research

In Yin's (2009) findings, he concluded that research remained one of science's most challenging endeavours. Although the basic aim of research was to collect, present and analyse data fairly, it also required establishing a good method of design. A further goal was to bring the research to a closure by writing a compelling synthesis that ultimately contributed towards science. He elaborated on this, indicating that to avoid underestimating the depth of research, one should advocate a research design that favours and responds to the research questions being posed. In this regard, Chapter 1 not only explains the rationale and significance for the study, but also elaborates, in detail, on the aim, objectives and research questions. Furthermore, although Chapter 1 only briefly explains the methodological path

being followed, Chapter 2 deals in more specific detail with the research design which is central to the aim, objectives and questions posed.

1.2.1 Research aim

The aim of the research is to construct a spatial corridor model as a theoretical framework to provide direction in the restructuring of economic spaces, in order to ultimately predict explicitly, spatially focused investment opportunities.

1.2.2 Problem statement

Found to be lacking when considering the aim of the research was an integrated approach towards identifying development corridors as strategic and supporting networks which can structure the development of economic spaces. The creation of a Spatial Corridor Model (SCM) will allow for the establishment of development corridors which will ultimately identify explicit areas as investment opportunities that will promote the restructuring of economic spaces. Currently, there is no such model constituting a strategic development framework for structuring economic space development in the country.

1.2.3 Research questions

The outcome of the research will endeavour to answer the following key questions:

1) Do the underlying locational principles quantify the outcomes of development forces, displaying evolving economic spaces which demonstrate the notion of economic growth and development?
2) Are development corridors being identified and developed to their full economic development potential?
3) Do selected case studies provide the required evidence needed to support development corridors as a key planning instrument in the restructuring of economic spaces?
4) Will the Spatial Corridor Model (SCM) constructed be sufficient to create an integrated supporting network that can direct and guide the restructuring of economic spaces?

1.2.4 Research objectives

The research is subjected to the following objectives:

1) To provide a critical review around the underlying principles constituting development forces of economic spaces, with the focus on locality and cities
2) To explore the concept of development corridors as a key planning instrument to structure economic space development, with the focus on fundamental attributes, properties, functionality, accessibility and mobility

3) To review selected case studies as comparative lessons and real-life events, with the focus on economic integration, economic systems, corridors, networks and spatial planning
4) To construct a Spatial Corridor Model (SCM) to direct and guide the restructuring of economic spaces.

Each objective constitutes a chapter or chapters within the thesis. The objectives, and the designs and methods used to research each objective, are outlined in more detail in Chapter 2. However, the selected approaches, designs and methods are further discussed in more detail within the respective chapters.

Although the purpose of the study is to construct an Spatial Corridor Model (SCM) as a theoretical framework to guide the restructuring of space economies, it is important to understand what the terminologies 'corridor', 'key planning instrument' and 'economic spaces', as well as the methodological reflection of 'theories', 'models', 'case studies' and 'equations' mean in the context of the study.

1.3 Terminologies

Three key terms in the title of the thesis, namely 'corridor', 'key planning instrument' and 'economic spaces' are central to the study and are, therefore, briefly explained.

The concept of 'corridors' can by no means be considered simplistic. However, corridors do propose important alternatives around economic space development such as channelling economic growth or the mapping of economic spaces (Friedmann, 1972; Tuppen, 1977; Geyer, 1988; Andersen *et al*., 1998; Brunner, 2013).

Corridors, when measured against the works of Hurd (1924), Christaller (1933), Lösch (1954), Perroux (1955), Pottier (1963), Friedmann (1966 & 1972), Berry (1969), Doxiadis (1969), Papaioannou (1969), Bähr (1976), Koch (1976), Tuppen (1977) and Geyer (1988), are considered an important 'planning instrument'. However, the real importance of corridors as a planning instrument is best described by Brunner (2013), who concluded that large, cumulative economic benefits between nodes become more apparent when potential corridors are modelled along economic spaces.

In the beginning, various economists and geographers such as Hagget (1965), Woldenberg (1968), Berry (1969), Beckmann *et al*. (1970), Parr (1970), Beavon *et al*. (1975), Parr *et al*. (1975), Beavon (1977), Lloyd *et al*. (1977), Parr (1978a & 1978b), Parr (1981), Sonis (1986b & 2005) and King(1996), developed more quantitative theories around 'economic spaces'. However, as times changed, scholars such as Krugman (1991), Scotchmer *et al*. (1992), Mayer (1996), Samuelson *et al*. (2001), Fujita *et al*. (2004), Howitt (2004), McCann (2004), Brunner *et al*. (2005), Nafziger (2006), and Combes *et al*. (2008) started to introduce concepts such as trade, economic integration and agglomeration as the underlying

building blocks of the cause and effect of market forces, which ultimately resulted in the manner in which the development of economic spaces took place at a variety of scales.

The details pertaining to these concepts are further discussed in Chapter 2 and the subsequent chapters.

1.4 Methodological Reflection

The progression of any discipline (Du Toit, 2010) depends on the extent to which its theory and methodology are applied. Earlier, the researcher mentioned that central to the output of the study was the construct of a Spatial Corridor Model (SCM) as a theoretical framework to guide the restructuring of space economies. Therefore, the advancement of the construct of an Spatial Corridor Model (SCM) requires distinguishing between what constitutes 'theories', 'models', 'case studies' and 'equations'.

'Theories', according to Coetzee *et al*. (1985), provide points of departure and a systematic frame of reference for analysis, i.e. the idea is to use well-tried theories of relevant systems, in order to make conditional predictions of functional relationships that explain the shaping of certain conditions.

'Models' (Techopedia, 2017) refer to the imitation of real-world processes or systems, i.e. the development of a model represents the key characteristics, behaviours and functions of the selected system or process.

'Case studies', in the view of Yin (1984 & 2009), contextualise the relationships between events or certain conditions, i.e. they reflect experiences distilled from real-life events, which are actively taken into account for future consideration.

'Equations', according to Bivand (2002), determine the relationship that exists between spatial entities and are generally based on certain conditions such as location, topology or distance.

The details pertaining to these concepts are further discussed in Chapter 2 and the subsequent chapters.

1.5 Research Design and Methodology

Research is a logical and systematic search for new and useful information on a particular topic, where the words 'how' and 'what' essentially define what research is. However, according to Du Toit *et al*. (2013), researchers often have limited exposure to, or understanding of what constitutes a research design. According to them, it is not uncommon that researchers claim that a study has a quantitative or qualitative design, or that the design will be a set of interviews or questionnaires. Quantitative or qualitative research is not a design in itself, but merely an indication of the type of data to be collected.

Similarly, a set of interviews or questionnaires is also not a design, but merely a form of data collection. Du Toit (2010) asserted that the use of a research design referred to the extent to which different designs applicable to research were used. He elaborated, indicating that the choice of design and methods should maximise the validity of findings, thereby ensuring some degree of reliability. The aim of the research, which is to construct a Spatial Corridor Model (SCM), signifies that the relevance of the study is based on determining spatial relationships between various entities using numerical algorithms. Therefore, the research design is based on the modelling and prediction of spatially focused investment opportunities. However, Du Toit *et al*. (2013) also noted that research designs were strictly associated with context and flexibility, i.e. they are necessary for explicating the study's design by using other designs. In this regard, considering contextualisation and framework as key components of the study, it is clear that the study is also a discipline of research case studies and methodology, thereby constituting comparative and meta-methodological types. The details pertaining to these concepts as mentioned are further discussed in Chapter 2, as well as the subsequent chapters.

1.6 Research Chronology

The research chronology is subjected to the following chapters:

1) Chapter 1: Introduction and background focusing on the rationale for the study and its significance.
2) Chapter 2: Research design and methodology focusing on what core logic yields a more encompassing, yet concise range of designs and methods, useful when considering the breadth of the research.
3) Chapter 3: Nodal development focusing on the principles behind economic space development as a result of the cause and effect of market forces. Spatial theories were used as a point of departure to relate to the functional and locational principles that explain the shaping of economic space development.
4) Chapter 4: Economic space development focusing on the principles of comparative advantages resulting in spatially selective approaches. Spatial theories were used to relate to the functional and selective principles explaining why certain cities or regions are selected as preferred locations for investment opportunities, which ultimately shape economic space development.
5) Chapter 5: Development corridors focusing on the concept that development corridors are integral to the economic development of a region and country. In particular, emphasis is placed on what fundamental attributes and properties relate to the economic potential of development corridors. Focus is also placed on corridor systems, emphasising the imperative to integrate existing multimodal corridor systems to enable optimal economic functionality between economic nodes.
6) Chapter 6: International case studies focusing on fostering an understanding of what is known through current, real-life events. Emphasis is placed on contextualising the relationships and conditions of economic integration within European and South American countries.

7) Chapter 7: South Africa focusing on fostering an understanding of what is known through current, real-life events. Emphasis is placed on contextualising the relationships and conditions of economic space development within South Africa as real-life events.
8) Chapter 8: Spatial Corridor Model (SCM) focusing on the key functional output levels in the creation of the model as a theoretical framework upon which a national spatial framework guiding economic space development within the country can be structured.
9) Chapter 9: Conclusion focusing on deductive reasoning, basically to find a degree of reliability through validation of the findings.

Diagram 1.1 shows a graphical outline illustrating how the different chapters link with one another in relation to the objectives.

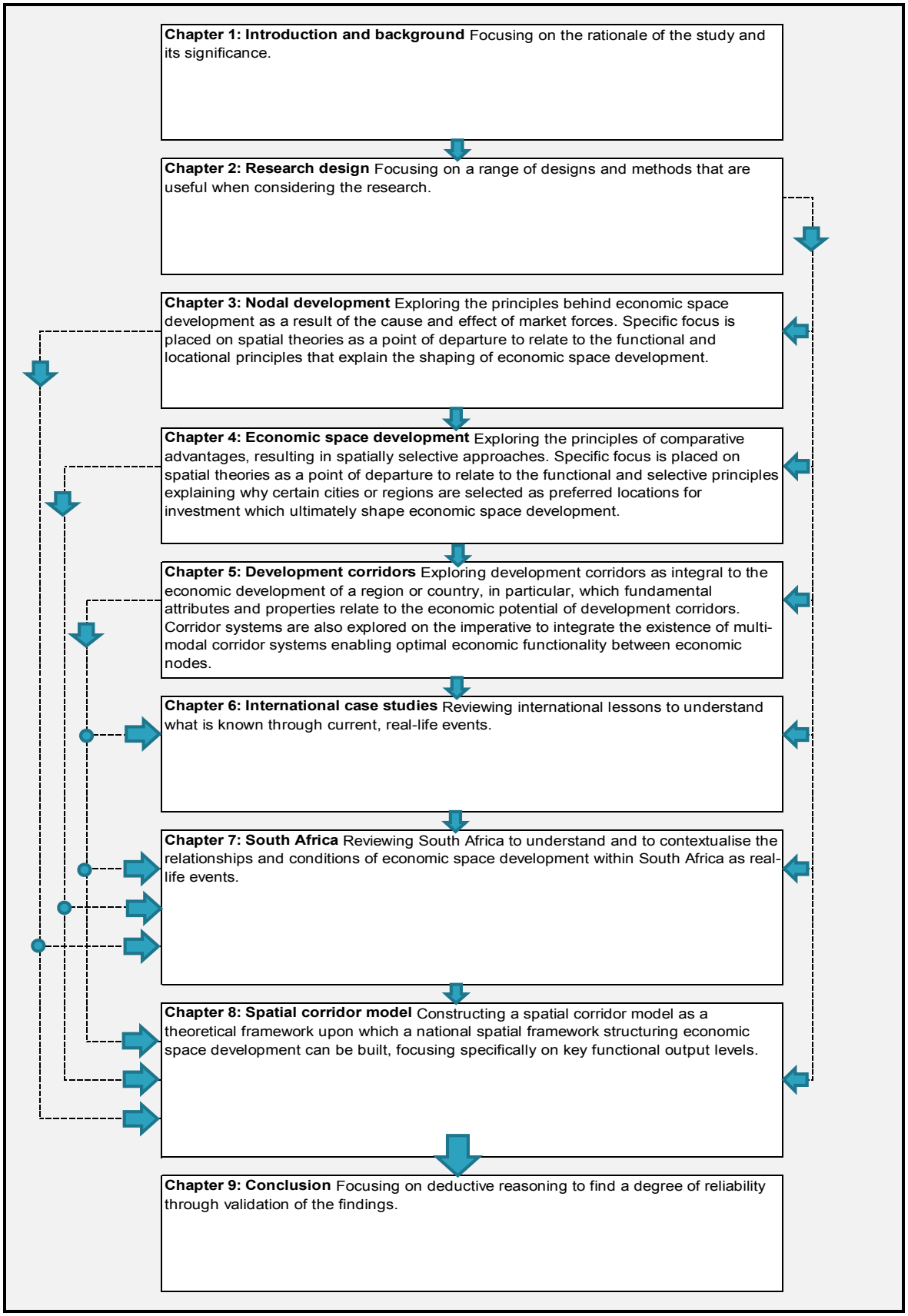


Diagram 1-1 Chapter outline Source: Own compilation

1.7 Limitations to the Study

Limitations are influences that the researcher cannot control i.e. the shortcomings or conditions that place restrictions on the methodology and conclusions of this research. In this regard the research is subjected to the following limitations:

1) The 2011 Census data was used for the study even though the results from the Community Survey conducted and released in 2016 were available. Active economic population considered central to the study was however not released. To ensure consistency, continuity and certainty, the 2011 Census data was used as the baseline.
2) Regarding shipping vessel movements, limited data was available. The same applies to air cargo where only data for the main international gateways was available (see Tables 8.4 and 8.6). To ensure objectivity and the alignment to the 2011 Census as the baseline, the measure of central tendency was applied.
3) Due to the lack of methodology, the results of the international case studies referred to in chapter 6 were interpreted to determine the general approach for each scenario. The interpreted outcomes from each scenario were used to determine the basis to explore real-life events pertaining to South Africa.
4) The Gross Value Added (GVA) at basic prices rather than the accepted Gross Domestic Product (GDP) were used to compare regions with different sizes of economies. GVA data is available at a Municipal level supporting nodality which is a key consideration within the study. GDP is only available at a National level.

Each of the mentioned limitations and the manner in which they were resolved is discussed in more detail in the subsequent chapters.

1.8 Areas of Future Research

Research tends to unearth further questions or considerations that can be used as ideas for further research.

Although the Spatial Corridor Model (SCM) stands on theoretical and empirical grounds, the various spatial planning instruments, especially at a National level, responsible for policy formulation have yet to review it. Further research is therefore needed into how the model can influence Planning, Monitoring and Evaluation especially at a National level. The research may include how to use the model as a planning instrument to inform decision-making as well as to evaluate policy action plans intended to create investment opportunities to promote economic growth.

Furthermore, considering that the United Nations (UN) and the African Development Bank (ADB) have embarked on promoting various action plans in the hope of stimulating intra-regional and global trade, various regional development corridors have been established to provide important connections between economic nodes or hubs. Research is therefore needed to use the model across all the southern African countries to establish which of the economic nodes will promote better intra-regional and global trade.

Chapter 2 Research Design

2.1 Introduction

Rajasekar *et al*. (2013) found that research was a search for knowledge where knowledge meant information about matters. According to them, research determines the economic and social development of a nation leading to new contributions to the existing knowledge. Their findings align with those of prominent methodologists such as De Vaus (2001), Robson (2002), Bryman *et al*. (2005), Creswell (2009), Yin (2009) and Leedy *et al*. (2010), defining research design as a logical plan, with the aim of maximising the validity of findings. The notion of a logical plan, sometimes referred to as a research strategy, involves a particular way of engaging empirical reality that will allow the answering of a research question as unambiguously as possible. Although in agreement with the mentioned methodologists, Fouché *et al*. (2005) and Du Toit (2010) also recommended that research design be chosen based on its core logic. The reason was that core logic yielded a more encompassing yet concise range of designs, which was useful when considering the breadth of a research study.

2.2 Terminologies

As mentioned in Chapter 1 (see section 1.2), the purpose of the study is to construct a Spatial Corridor Model (SCM) as a theoretical framework to structure economic space development. Yet, it is important to understand what the terminologies ‘corridor’, ‘key planning instrument’ and ‘economic spaces’ mean in the context of the study.

The three key terminologies in the title of the thesis are central to the study and are, therefore, briefly explained. The details pertaining to these concepts are further discussed in the subsequent chapters (see chapters 3 and 4, in relation to economic spaces, and Chapter 5, in relation to corridors and key planning instrument).

2.2.1 ‘Corridor’

Although the concept of what a development corridor is can by no means be considered simplistic, corridors as earlier mentioned, do propose important alternatives around economic space development. Reviewing the interpretations of various scholars such as Friedmann (1972), Tuppen (1977), Geyer (1988), Andersen *et al*. (1998) and Brunner (2013) on what constitutes a corridor, it is clear that two key commonalities stand out: 1) it provides a link between nodes by means of which different levels or scales of economic opportunities are accessed; and 2) the intensity of economic development at nodes varies in size and dominance. The first commonality of providing a linkage is defined using three concepts, namely infrastructure, networks of functional economic interaction and the degree or extent of the relationship (size of economies) that exists between two nodes; and the second commonality of intensity of economies is defined using the concept of cause and effect of market forces, resulting in various

scales of economic development at a specific location. These concepts in combination constitute development corridors which are considered to be a key planning instrument in the structuring of economic spaces.

2.2.2 'Key planning instrument'

The corridor concept was for many decades considered an important planning instrument and, although Hurd (1924), Christaller (1933), Lösch (1954) and Perroux (1955) were the first pioneers to study development corridors as a concept, Pottier (1963) was the first to pioneer the concept of development corridors as an important phenomenon in economic space development. Subsequently, scholars such as Friedmann (1966 & 1972), Berry (1969), Doxiadis (1969), Papaioannou (1969), Bähr (1976), Koch (1976), Tuppen (1977) and Geyer (1988), who expanded on the pioneering work, also reiterated the importance of corridors in the planning process. Corridors as a key planning instrument are probably best understood when considering the view of Brunner (2013), who concluded that large, cumulative economic benefits between nodes become more apparent when potential corridors are modelled along economic spaces.

2.2.3 'Economic spaces'

Economists and geographers such as Hagget (1965), Woldenberg (1968), Berry (1969), Beckmann *et al*. (1970), Parr (1970), Beavon *et al*. (1975), Parr *et al*. (1975), Beavon (1977), Lloyd *et al*. (1977), Parr (1978a, 1978b & 1981), Sonis (1986b & 2005) and King (1996), developed more quantitative theories around economic space development in their quest to understand how, where and why the development of economic activities was occurring. Subsequent to these scholars, Christaller (1933), Lösch (1954) and Perroux (1955) introduced locational principles as the basic building blocks of economic spaces. Although static and simplistic in nature – only focusing on the geometry of market areas – locational principles still provided the basic elements in the progression of development forces that create economic spaces. However, as times changed, geographers and economists such as Krugman (1991), Scotchmer *et al*. (1992), Mayer (1996), Samuelson *et al*. (2001), Fujita *et al*. (2004), Howitt (2004), McCann (2004), Brunner *et al*. (2005), Nafziger (2006), Combes *et al*. (2008), just to name a few, started to introduce other concepts such as trade, economic integration and agglomeration, in their analysis of economic space development. Today, these concepts are considered the underlying building blocks of the cause and effect of market forces, which ultimately resulted in the classification of regional and urban centres comprised of lower and higher-order settlements, with each having a different impact on economic space development, not only at regional level, but also at national level. This highlights the fact that economic space development takes place at a variety of scales and is the result of the cause and effect of market forces.

2.3 Methodological Reflection

As mentioned in Chapter 1 (see section 1.3), advancing the construct of a Spatial Corridor Model (SCM) as a theoretical framework to guide the restructuring of space economies requires making a distinction between 'theories', 'models', 'case studies' and 'equations'. These elements are central to the outcome of the study and, therefore, explained. The details pertaining to these concepts are further discussed in the subsequent chapters. However, considering that the relevance of the study is based on the construct of a Spatial Corridor Model (SCM), more emphasis will be placed on what the concept 'model' entails to advance the relevance of the study. The concepts 'theories', 'case studies' and 'equations' will be briefly explained.

2.3.1 'Theories'

Theories, in the views of Carter (1972), Needham (1977) and Herbert *et al*. (1978), are more accessible and comprehensible when providing a holistic perspective on the processes. According to Coetzee *et al*. (1985), theories provide points of departure and a systematic frame of reference for analysis, i.e. the idea is to use well-tried theories of relevant systems, in order to make conditional predictions of functional relationships which explain the shaping of certain conditions. Hawking (2001) probably best described the usefulness of a theory, stating that a good theory described a large range of phenomena on the basis of a few simple postulates, thereby making definite predictions that can be tested. It should be noted that, although the explanatory powers of theories might be limited, the use of theories remains a useful pedagogic approach for illustrating the development of certain conditions, such as forces shaping economic space development.

2.3.2 'Case studies'

Case studies bring an understanding of what is known through previous research or real-life events. In the view of Yin (1984 & 2009), case studies contextualise the relationships between events or certain conditions, i.e. they reflect experiences distilled from real-life events, which are actively taken into account for future consideration. Therefore, case studies are knowledge or understanding gained by experience, whether positive or negative. However, case studies must be significant in that they have a real or assumed impact; valid in that they are factually and technically correct; and applicable in that they identify a specific design, process or outcome. In essence, case studies are based on evaluating experiences abstracted from specific circumstances prepared for broader situations or solutions.

2.3.3 'Equations'

Equation is a statement containing one or more variables. Solving an equation involves determining which values of the variables make the equality true. The fact that the research focused on the construct of a spatial model may be compared to utilising equations, which are mainly concerned with solutions

based on a set of functions. Therefore, equations are solvable through explicit formulas being developed to determine a solution with a given degree of accuracy. This relates to the conclusion by Wang *et al*. (2012) that the relationships that exist among variables are directly translated into corresponding equations. Hawking (2001) took it a step further when he suggested that equations describe what has been found and say what predictions have been made, i.e. establish the extent (how strong) of the relationship which represents the solution between two or more entities. In this regard, the relevance of the study, the construct of the Spatial Corridor Model (SCM), is dependent on finding solutions through corresponding algorithms to determine the spatial relationship that exists between different entities. These spatial relationships, in the view of Bivand (2002), are generally based on locations; however, the most common spatial relationships are based on topology and distance, which refer to the set of functions concerned with the solution.

2.3.4 'Models'

As far back as the 1930s, Wright (1934) made the statement that there are different approaches to specifying a model of interest. Bollen *et al*. (1993) provided five steps that characterise most model applications:

1) Model formulation which refers to the model the researcher wants to apply and is normally formulated on the basis of theory and/or empirical findings.
2) Model identification determines whether there is a unique solution for all the parameters in the specified model. Critical with model identifications is that the next step, model estimation cannot converge or reach a solution if the model is not specified correctly.
3) Model estimation estimates the model parameters with fitting functions and solutions.
4) Model evaluation assesses whether the model fits the data. If the model fits the data and results are interpretable, then the modelling process does not need to continue to the step of model modification.
5) Model modification is only applicable if the model does not fit the data which will require the re-specification or modification of the model.

Wright (1934) was the first to suggest that the most intuitive way to specify a model is to describe one's model by means of a path diagram. In this regard, a detailed illustration of what the Spatial Corridor Model (SCM) entails is shown in Diagram 8.1, which forms part of the introduction of Chapter 8. A diagram provides a useful guide to clarifying ideas about the relationships that exist among variables, which could be directly translated into corresponding equations for modelling (Wang *et al*., 2012). Models refer to the imitation of real-world processes or systems and are generally used to illustrate the eventual real effects of specific conditions, as well as required courses of action, i.e. the creation of a model represents the key characteristics, behaviours and functions of the selected system or process (Techopedia, 2017). Furthermore, models require a process of analysis, where special rules and

procedures are applied to properly visualise data for better understanding. The visual nature helps to simplify understanding of the data for better deductive reasoning, which is sometimes difficult to formulate with simple numerical and textual data such as the outcome of economic forces.

2.4 Research Methodology

Mouton *et al*. (1996) considered research which, in essence, aligned with the notions of De Vaus (2001), Robson (2002), Yin (2003), Bryman *et al*. (2005), Creswell (2009) and Leedy *et al*. (2005), as a collaborative enquiry into which reality is studied with the aim of gaining a good understanding of it. From this consideration, they identified various dimensions applicable to research, of which one is the methodological dimension. In their view, also confirmed by Babbie *et al*. (2001), Robson (2002), Bryman *et al*. (2005) and Creswell (2009), the methodological dimension refers to the 'how' of the research process. Based on their findings, various considerations along which approaches may be classified were discerned. Research approaches are generally classified into three major categories, namely quantitative, qualitative and mixed methods, which outline the 'how' of the research process (Babbie *et al*., 2001; Robson, 2002; Bryman *et al*., 2005; Creswell, 2009). The research is associated with the collection and conversion of data into numerical form to determine to what extent a relationship between two or more variables by means of statistical analysis exists, which refers to a positivist paradigm. Quantitative research is generally associated with the positivist paradigm. Therefore, the study considers predictions about possible relationships that exist between two or more variables. Hawking (2001) remarked that positivist was used to describe what had been found and to say what predictions are being made.

Table 2.1 below outlines the research methodology and is further explained in more detail pertaining to the objectives, designs and methods.

Table 2-1 Outline of research methodology

Research objectives	Research designs	Research methods
To review principles constituting development forces of economic spaces	Literature review (theoretical)	Reviewing prominent locational theories and principles outlining the cause and effect of market forces in the creation of economic spaces
To explore the concept of development corridors	Literature review (theoretical)	Reviewing fundamental attributes and properties constituting development corridors as a key element in structuring economic space development
To review selected case studies as comparative lessons and real-life events	Case studies	Exploring international and South African case studies which are relevant in providing comparative lessons and real-life events relating to economic systems, corridors, networks and spatial planning
To construct a spatial corridor model	Modelling and visualisation	Creating a theoretical framework considering three key output levels: 1) establishing the economic dominance of urban centres relative to one another; 2) establishing how the size of economies based on proximity, correlate with one another; and 3) establishing development corridors restructuring economic spaces

Source: Own compilation

2.4.1 Research objectives

The problem statement highlights the lack of development corridors as a strategic element in identifying investment opportunities promoting the restructuring of economic spaces. In dealing with the problem statement, specific objectives relating to each research question were presented. Constructing a Spatial Corridor Model (SCM), which is the aim of the research, relates to selecting different designs and approaches. In this regard, each objective constitutes a separate chapter in the thesis.

1) Chapters 3 and 4 deal with objective 1, which is to review various theories postulating the creation of economic spaces

2) Chapter 5 deals with objective 2, which is to review development corridors as a key planning instrument in the restructuring of economic spaces
3) Chapters 6 and 7 deal with objective 3, which is to explore case studies to provide comparative lessons and real-life events relating to economic spaces
4) Chapter 8 deals with objective 4, which is to construct a Spatial Corridor Model (SCM) providing direction to the restructuring of economic spaces.

2.4.2 Research design

Knight *et al*. (2008) synthesised that, in a good research design, all the components work together in a coherent way. This means that the theoretical and conceptual framework of a research study aligns with the core logic of the research. The same applies to the data-gathering method, which also fits the method of analysis. In essence, a good research design is the blueprint or general plan of how to go about the research.

In his assessment of improvements in methodological rigour of theses completed between 1963 and 2007 in the built and planning environment, Du Toit (2010) came up with an index of designs constituting 25 subtypes and 10 prototypes, each with their own unique core logic (see Table 2.2).

Table 2-2 An index of designs applicable to social research in the built and planning environment

No.	Research design subtypes	No.	Research designs	Core logic
1	Cross-sectional surveys	1	Surveys	Generalisation
2	Longitudinal surveys			
3	True experiments	2	Experiments	Causal attribution
4	Quasi-experiments			
5	Modelling; Simulation	3	Modelling, simulation, mapping and visualisation	Perdiction/illustration
6	Mapping; Visualisation			
7	Content/textual analysis	4	Textual and narrative studies	Interpretation (hermeneutical)
8	Discourse/conversational analysis			
9	Historiography; Biography			
10	Ethnography	5	Field studies	Interpretation (ethnographical/phenomenological)
11	Phenomenology			
12	Single/multiple case studies	6	Case studies	Contextualisation
13	Comparative case studies			
14	Site/settlement analysis and assessment	7	Intervention research	Intervention
15	Plan/policy analysis and assessment			
16	Diagnostic/clarificatory evaluation	8	Evaluation research	Evaluation
17	Implementation evaluation; Programme monitoring			
18	Outcome/impact evaluation			
19	Technical/scientific/collaborative PAR	9	Participatory action research	Participation/action
20	Practical/mutual and/or collaborative/deliberate PAR			
21	Emancipating/enhancing/critical PAR			
22	Literature reviews; Research synthesis	10	Metaresearch	Various logics depending on the objectives of the research
23	Conceptual analysis			
24	Typology/model/theory construction			
25	Philosophical/logical/normative arguments			

Source: Du Toit *et al*. (2013)

The aim of the research, which is to construct a Spatial Corridor Model (SCM) as a theoretical framework to provide direction to the restructuring of economic spaces, defines, in essence, the core logic of the research, namely establishing the strength of economic advantages (size of economies) between urban centres, based on their proximity relative to one another, to create development corridors which are used as a mechanism to predict spatially focused investment opportunities. This means that the relevance of the study is based on determining the strength of the spatial relationship between various entities using numerical algorithms. Therefore, part of the research design is based on the modelling of economic spaces to create the opportunity to predict investment opportunities. When comparing the index of designs (Table 2.2), it is clear that the prototypes relate to modelling, simulation, mapping and visualisation as the research design.

Modelling, simulation, mapping and visualisation (Techopedia, 2017) refer to the imitation of real-world processes or systems and are used in various contexts, such as the modelling of economic processes to gain insight into the functioning and outcomes of economic activities. In essence, modelling, simulation, mapping and visualisation are used to illustrate the eventual real effects of specific conditions, as well as the required courses of action. Furthermore, the conditions surrounding modelling, simulation, mapping and visualisation require that a model be developed that represents the key characteristics, behaviours and functions of the selected system or process, i.e. the model developed represents the system itself, whereas the modelling, simulation, mapping and visualisation represent the functioning of the system. In the view of Bivand (2002) and Mayhew (2005), it is important to know and understand that the key issues surrounding modelling, simulation, mapping and visualisation include: 1) the acquisition of valid source information about the relevant selection of key characteristics; 2) the use of simplified approximations and assumptions; and 3) the validity of the eventual outcomes. It should also be noted, according to Du Toit *et al*. (2013), that the procedures and protocols for model verification and validation are an ongoing field of academic study.

Furthermore, Du Toit *et al*. (2013) also noted that research designs were strictly associated with context and flexibility, i.e. it is necessary to explicate the study's design by using other designs to research the objectives and questions listed earlier. Therefore, considering contextualisation and framework as key components of the research, it is evident that the study is also a discipline of researching case studies and methodology and, therefore, constitutes comparative and meta-methodological types. When comparing the index of designs (Table 2.2), it becomes evident that the prototypical relates to case studies and meta-research as part of the research design. The distinctive need for case studies, according to Hendrick *et al*. (1993), Dion (1998), George *et al*. (2004) and Johnson *et al*. (2004), arises from the desire to understand complex phenomena such as economic spaces. In brief, Yin (2009) remarked that case studies contributed to our knowledge by retaining the holistic and meaningful characteristics of real-life events. This knowledge was then used to create comparative analyses of specific conditions. However, although real-life analysis through case studies was relatively straightforward, the concept of meta-research was broader and was necessary for identifying subtypes to explicate the study. Yin (2009) further stated that meta-research was a method of combining data and evidence using multiple studies which identified what was common, as well as what varied in the outcomes. Therefore, meta-research based on the findings of Du Toit *et al*. (2013), is a widely used research method to evaluate evidence, and is referred to as a mechanism for synthesising data and evidence across studies. In this regard, suffice it to say that the meta-research subtypes typically include literature reviews, conceptual analysis, typology, theory construction and logical arguments.

2.4.3 Research methods

Table 2.1 show that, in addition to the overall design of constructing a Spatial Corridor Model (SCM), different literature reviews, and a set of case studies to establish a comparative analysis of lessons and real-life events outline the first three objectives. The main method employed in each design is briefly mentioned in Table 2.1 while, as mentioned before, each objective is further discussed in more detail within the subsequent chapters.

In constructing a Spatial Corridor Model (SCM), which relates to objective 4 and is dealt with in Chapter 8, secondary filters were used, in conjunction with algorithms, to determine the spatial relationship that exists between entities. The spatial relationship is generally based on locations; however, the most common spatial relationships are based on topology and distance (Bivand, 2002), which are two key variables further illustrated in Chapter 8. Modelling (Techopedia, 2017) is, in essence, a process of spatial analysis where special rules and procedures are used, in conjunction with a Geographical Information System (GIS), to properly visualise data for better understanding. The visual nature helps the researcher to simplify the understanding of the data for better deductive reasoning, which is sometimes difficult to formulate with simple numerical and textual data. Furthermore, it is also important to understand that the manipulation of information occurs in multiple steps, each representing a stage in a complex analysis procedure process (Bivand, 2002; Mayhew, 2005). Therefore, the process of constructing a Spatial Corridor Model (SCM) followed a three-step approach: 1) establishing the primary network of urban centres representing the locality of dominant economic spaces; 2) establishing how the sizes or strengths of economies of the primary network of urban centres correlate to one another; and 3) establishing potential development corridors upon which a spatial framework to restructure economic spaces can be built.

For the purpose of the research, secondary datasets, which are discussed in more detail in Chapter 8, were used to determine by means of statistical analysis the extent of the relationships that exist between two or more variables. Secondary data, according to Fielding *et al*. (1998), refers to data that was collected by someone other than the researcher, such as government departments, administrative records, or data that was originally collected for other research purposes. Furthermore, Johnson (2004) declared that secondary data, particularly in the case of quantitative research, provided larger and higher-quality data than primary data. In addition, when analysing economic conditions which are a key variable for the study, secondary data was considered essential, since it is virtually impossible to conduct a new survey that can adequately capture past changes.

The statistical analysis mentioned was carried out with the aid of a GIS. Using GIS allows the creation of simple association, or causal relationships determining the extent to which one variable influences another. This allows objectivity, avoiding any possible bias, which is important in quantitative research. The main emphasis of following a quantitative research approach is on creating deductive reasoning,

which tends to move from the general to the specific, also referred to as a top-down approach. Aristotles' famous example of deductive reasoning reads, "All men are mortal à Socrates is a man à Socrates is mortal" (Bäck *et al*., 1999). In essence, it means that if the premise of an argument is inaccurate, the argument is inaccurate. Therefore, the validity of conclusions is dependent on one or more findings being valid.

The secondary datasets mentioned, included 1) the Urban Functional Index (UFI), in conjunction with the city topology of the CSIR; 2) the GVA at basic prices as the economic indicator; 3) the 2011 Census population counts; 4) the 2011 Census economically active population counts; 5) centroid-to-centroid distance between urban centres; 6) passenger movement for principal airports; 7) cargo movement for principal sea and airports; 8) aircraft movement for principal airports; and 9) vessel movement for principal seaports. Of the different datasets, three are considered central to the study and are, therefore, briefly explained.

1) **Total population count** is defined as all usual residents, generally referred to as the *de jure* population, and the total of all persons present as the *de facto* population.
2) **Economically active population** is defined as the fraction of a population that is either employed, or actively seeking employment.
3) **GVA at basic prices** is defined as output valued at basic prices less intermediate consumption valued at purchaser's prices. Therefore, the GVA is known by the price with which the output is valued. GVA is a useful way of comparing regions with different sizes of economies.

These datasets were subsequently used to establish the economic impact factors (EIFs) between the primary networks of the dominant urban centres (details follow in Chapter 8 under step 1). To ensure consistency, continuity and certainty, the same year of the last census taken, namely 2011, was used. Even though these datasets are more than five years old, the resulting outcomes are virtually indistinguishable from the outcomes one would derive from using data collected more recently.

Regarding cargo, passenger, aircraft and vessel movements, a mean average was considered sufficient, considering that the mean is the most popular and well-known measure of central tendency and can be used with both discrete and continuous data. A further reason is that the study only focused on principal sea and airports with a specific nodality, which supports a mean average as being most objective. All of these datasets with their relevant applications are discussed in more detail in Chapter 8.

2.5 Summary and Conclusion

The chapter outlines the rationale for using an index of designs constituting subtypes and prototypes for this study. It is clear that the index of designs provides a more coherent methodological approach for the research. It provides the benefit of clarifying what constitutes as 1) a research design, 2) applicable

designs and 3) appropriate descriptions for different designs and design subtypes. The research design selected clearly illustrates coherence to support the validity of findings within the context of a particular methodological paradigm. A Distinctive feature of the research design is the fact that it provides a frame of reference for the research course and text, and is used as a tool to introduce the different prototypical designs to support the research. Modelling, simulation, mapping, visualisation, case studies and meta-research as the primary prototypical designs provide an interpretative map to an edifice of knowledge justified through appropriate findings. The prototypical designs selected are justified, considering that the aim of the research is to construct a Spatial Corridor Model (SCM) as the eventual research course. This means that the research design has an important influence on the reliability of the results, and provides a solid and coherent base for the whole research.

The research design is summarised in Diagram 2.1, which provides a holistic and integrated overview of chapters 1 and 2.

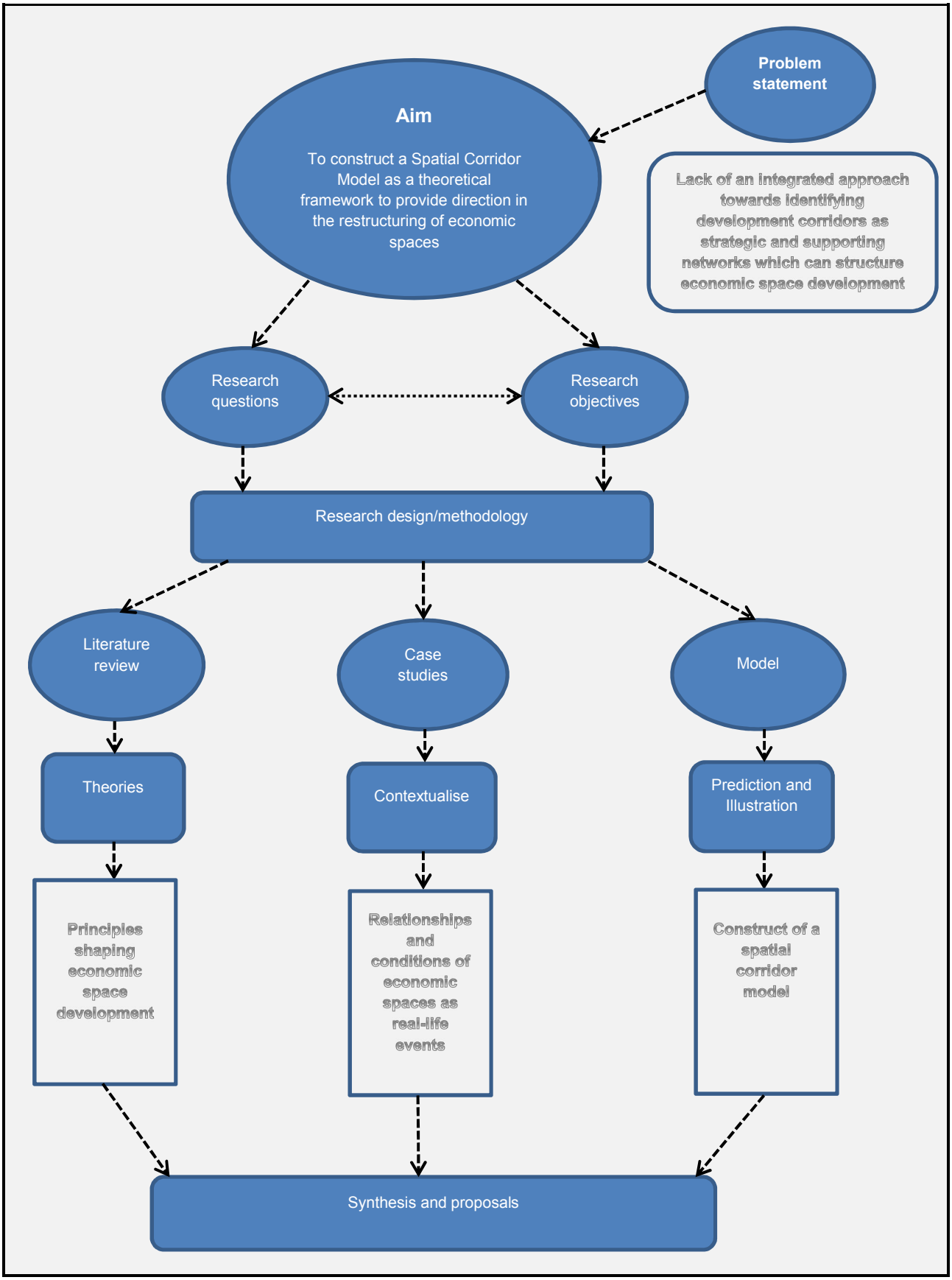


Diagram 2-1 Research design Source: Own compilation

Chapter 3 Nodal Development

3.1 Introduction

Regional and urban systems represent the most dynamic structural component of geographical space or, to be more specific, economic spaces (Surd, 2009). They form part of a network of systems all linked together and are key elements in economic space development (Pacione, 2009). Doxiadis (1969) referred to it as 'ekistics', i.e. a set of settlements in a region, that includes people, structures and networks which function as an integrated system. Friedmann (1972) referred to regional and urban systems as spatially organised space and suggested that they should not only be viewed as spatial entities, but also as locations or nodes that connect the flows of people, information and commodities, i.e. economic growth tends to occur in the matrix of urban regions or nodes and it is through this matrix that the evolving space economy is organised. It is evident that Friedmann's notion aligns with the earlier suggestion of Perroux (1950 & 1955), Philbrick (1957) and Boudeville (1961) that a network of functional economic interaction is considered the most appropriate framework that defines regional and urban systems, which suggests that regional and urban systems should be based on well-defined spatial frameworks.

Scott (2000) concluded that the general knowledge around economic geography, especially by the end of World War II, increased considerably. Economic recovery and development following the war led to the growth in economic geography, when geographers and economists became interested in understanding how, where and why the development of economic activities was taking place. It has continued to grow in popularity since the 1950s and 1960s, when geographers such as Hagget (1965), Woldenberg (1968), Berry (1969), Beckmann *et al*. (1970), Parr (1970), Beavon *et al*. (1975), Parr *et al*. (1975), Beavon (1977), Lloyd *et al*. (1977), Parr (1978a, 1978b & 1981), Sonis (1986b & 2005), Berry *et al*. (1988) and King (1996) made spatial theories around economic space development more quantitative.

Carter (1972), Needham (1977), Herbert *et al*. (1978) and Thomas *et al*. (1982) concluded that there was nothing as practical as a good spatial theory. According to them, spatial theories are more accessible and comprehensible in providing a holistic perspective of economic and social processes. Spatial theories (Coetzee *et al*., 1985) provide points of departure and a systematic frame of reference for analysis, i.e. the idea is to use well-tried theories of relevant regional and urban systems to make conditional predictions of functional and locational relationships that explain the shaping of economic and social development. The type of functions of a settlement determine a settlement's position within the overall hierarchy of settlements and, ultimately, economic spaces (Geyer, 2006; Geyer *et al*., 2012). Hawking (2001) best describes the usefulness of a theory, stating that a good theory describes a large range of phenomena on the basis of a few simple postulates, thereby making definite predictions that

can be tested. Although the explanatory powers of the different theories used for this chapter might be limited in today's reality, it still remains a useful pedagogic approach to illustrating the development of economic and social spaces. Therefore, the research method for this chapter is a literature review of well-tried theories to explore the forces that shape economic space development.

In viewing economic space development, emphasis is placed on the following key concepts: 1) locational principles, arguing the theory of optimum locality; 2) diffusion, arguing the theory of natural, as opposed to planned locality; 3) new economic geography, arguing the theory of centripetal forces pulling economic activities into a specific location; and 4) core-periphery, arguing the theory of core localities that are expanding in prosperity engulfing localities in proximity to ensure ongoing economic development and growth. All theories are considered in the evolution of a settlement's importance within the hierarchy of settlements, which allows for the shaping of economic and social spaces. Therefore, interchangeably, these theories play an important role in how economic and social space development is viewed, and understood.

3.2 Locational Principles

The concept and methodological basis of locational principles dates back as far as 1826, long before the existence of factories, highways, and even railroads, when Von Thunen published *The Isolated State*. The relevance of his theory is considered in the balance that exists between the cost of transportation, land and profit, and where to produce the most cost-effective product for the market (Fujita *et al*., 1996 & 2012; Fujita, 2011). It is considered to be the first model to argue the theory of location, and how economic and social elements contribute towards the interrelated development of economic spaces. Since then, spatial analysis of identifying the regularities of space economy has reached back to the first part of the previous century, when scholars such as Weber (1909), Christaller (1933), Palander (1935), Hoover (1937), Lösch (1954), Perroux (1955), Philbrick (1957), Ponsard (1958) and Boudeville (1961) formulated the basic principles behind locational theories. For the purpose of the study, focus was placed on the publications and highly original works of the following well-known scientists: 1) the geographer Walter Christaller, who published *The central place theory* in 1933; 2) the economist August Lösch, who published *The economics of location which deals with the location of profitability* in 1954; and 3) Perroux (1955) who introduced the theory on growth poles. Christaller noticed that towns of a certain size were roughly equidistant. By examining, and defining the functions of the settlement structure and the size of the hinterland, he found it possible to model the pattern of settlement locations using geometric shapes. Christaller referred to the geometric shapes as market areas or spheres of influence and considered them complementary because of the relationship that existed between the central place and its hinterland. Lösch, on the other hand, focused on how to maximise consumer welfare and create an ideal consumer landscape, where the need to travel for any goods or service was minimised and profits were constant. Perroux concluded that economic development or growth was not

uniform over an entire region, but, instead, took place around a specific pole. According to him, the pole is often characterised by a key industry around which linked industries develop, mainly through direct and indirect effects. However, the one common principle emerging from their theories and subsequent to other scholars is the consideration that the optimum location is where profit is the greatest, i.e. finding a zone of profitability. Before exploring the locational theories of Christaller, Lösch and Perroux, it is important to first understand the Von Thunen's theory as the basis for anticipating the theory of hierarchical central places.

The relevance of Von Thunen's (1826) theory is based on six basic assumptions:

1) The city is located centrally within an 'Isolated State' which is self-sufficient and has no external influences.
2) The 'Isolated State' is surrounded by an unoccupied wilderness.
3) The land of the 'Isolated State' is completely flat and has no rivers or mountains to interrupt the terrain.
4) The soil quality and climate are consistent throughout the 'Isolated State'.
5) Farmers in the 'Isolated State' transport their own goods to the market; therefore, there are no roads.
6) Farmers act to maximise profits.

According to his model, as illustrated in Figure 3.1, four rings of agricultural activity developed around the settlement: 1) Dairy and intensive farming was practised in the first ring closest to the settlement, since vegetables, fruit, milk and other dairy products had to be transported quickly to the market; 2) Timber and firewood were located in the second ring, and were produced for fuel and building materials – before industrialisation, wood was an important fuel for heating and cooking, and considering that wood is heavy and difficult to transport, it was located as close to the settlement as possible; 3) The third zone consisted of extensive fields of crops such as grain for bread. Since grain lasts longer than dairy products and is much lighter to transport, thereby reducing transport costs, it was located further from the settlement; 4) Farming with animals was located in the fourth ring – animals were self-transporting and could be walked to the city for sale or butchering; and 5) Beyond the fourth ring lay the unoccupied wilderness, which was considered too great a distance from the settlement to produce any type of agricultural products.

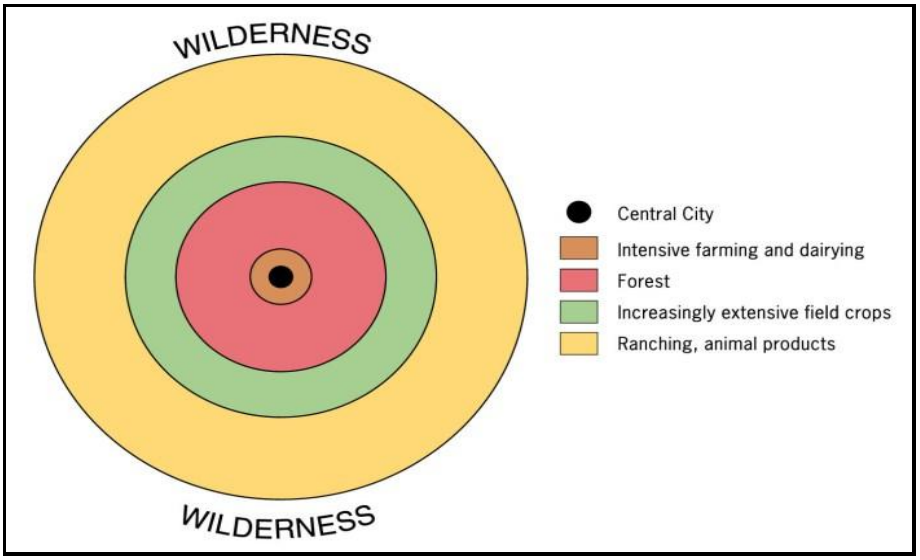


Figure 3-1 The Von Thunen model Source: Fujita (2011)

Von Thunen's model is an early example of modern economic geography. Although the biggest criticism is that the model was developed in an 'isolated state' and did not consider the differences in location conditions, Von Thunen's model represents the foundation of modern economic geography, which includes not only traditional economic geography and location principles, but also modern, urban economics, i.e. this model explains economic space development based on the cause and effect of market forces (Schumpeter, 1954; Alonso, 1964; Nerlove *et al*., 1991; Fujita, 2011). Von Thunen made the observation that, when evaluating the location of industries in the context of a system of settlements, the nature of the industry determines the best location. Therefore, it can be argued that his observations anticipated the theory of hierarchical central places, which was later formulated and enhanced by scholars such as Weber (1909), Christaller (1933), Palander (1935), Hoover (1937), Perroux (1950 & 1955), Lösch (1954), Ponsard (1955 & 1958) and Boudeville (1961), using economics and geography to explain how market forces impacted the distribution, size and number of settlements. As seen, although various hierarchical, central-place theories have been formulated since the beginning of 1900, for the purpose of the study, only Christaller's, Lösch's and Perroux's theories on location are further explored. The reasons are that their theories synthesise the details and basics behind market forces in a more simplified way when exploring the following principles: 1) why and how settlements locate, in relation to one another; 2) how the total market area is controlled; 3) and why some central places function as higher or lower-order settlements.

Christaller (1933) based his theory on the relationship that exists between the central place and its hinterland, considering two types of interactions:

1) the central place that provides services and produced goods to its hinterland; and

2) the hinterland that provides basic products to the central place (and through the latter, also to other central places).

He deduced that because of this complementary relationship, settlements' market area or sphere of influence would tend to form in a hexagonal lattice, as this was the most efficient pattern to serve areas without any overlap, resulting in the arrangement of an urban hierarchy where different principal orders of settlements are created, as illustrated in Figure 3.2.

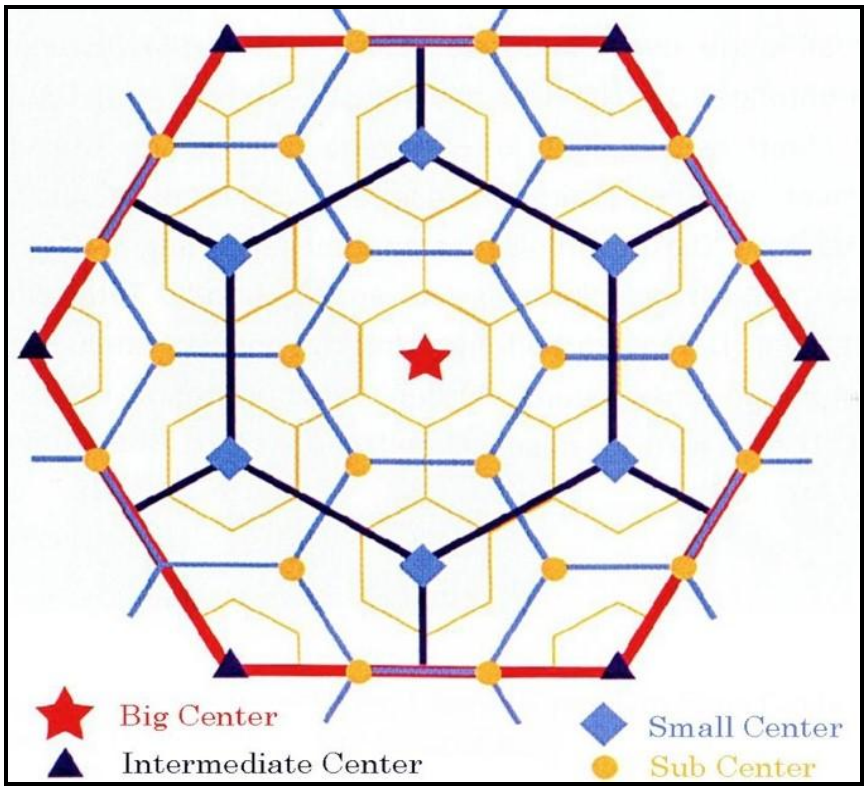


Figure 3-2 Different principal orders of settlements

Source: Surd (2009)

According to Christaller (1933), these settlements are regularly spaced – equidistant spacing between same-order places, with larger places located farther apart than smaller places. Each settlement has a hexagonal market area, and is most efficient in numbers and functions. The different layouts predicted by Christaller are illustrated as *K-values*, which show the central place sphere of influence – the central place itself counts as 1 and each portion of a satellite counts as its portion. Christaller's predicted *K-values* are based on market, transport and administrative principles, as illustrated in Figure 3.3.

According to the marketing principle, $K = 3$, the market area of a higher-order place occupies 1/3 of the market area of each of the consecutive lower-size places. The lower-size places (6 in total) are located at the corner of the largest hexagon around the high-order settlement. Each high-order settlement gets 1/3 of each satellite settlement, thus $K = 1 + 6 \times 1/3 = 3$.

Although the distance travelled is minimised, according to the $K = 3$ marketing principle, the transport network is not the most efficient, as there are no intermediate transport links (network) between the larger places. According to the $K = 4$ transport principle, the market area of a higher-order place includes half of the market area of each of the six neighbouring lower-order places. This generates a hierarchy of central places which results in the most efficient transport network. The transportation principle involves the minimisation of the length of roads connecting central places at all hierarchy levels. In this system of nesting, the lower order places are located along the roads linking the higher order places. This alignment of places along a road leads to minimisation of road length. However, for each higher-order place, there are now four places of immediate lower order, as opposed to three places under the marketing principle, thus $K = 1 + 6 \times 1/2 = 4$.

According to the $K = 7$ administrative principle or political-social principle, settlements are nested according to sevens. The market areas of the smaller settlements are completely enclosed within the market area of the larger settlement. Since tributary areas cannot be split administratively, they must be allocated exclusively to a single, higher-order place, thus $K = 1 + 6 \times 1/1 = 7$.

In essence, Christaller's theory, which is built on nesting principles 3, 4 and 7, establishes seven different principal orders of settlements and generates three geometrical sequences of the hexagonal market area sizes: 1, 3, 9, 27… 3n; 1, 4, 16, 64… 4n; and 1, 7, 49, 343… 7n. Therefore, considering the conclusions of Parr (1981); Huff *et al*. (1986); Sonis (1986b & 2005); Robison *et al*. (1991) and Surd (2009), it is possible to interpret these principles as principles of optimal organisation of economic spaces, with the marketing principle presenting the minimal number of market areas; the transportation principle presenting optimal organisation of space, where the transportation network between two bigger central places passes through the smaller central place; and the administrative principle presenting optimal organisation of space, where the administrative hinterland of the larger central place includes almost the full set of administrative hinterlands of smaller central places.

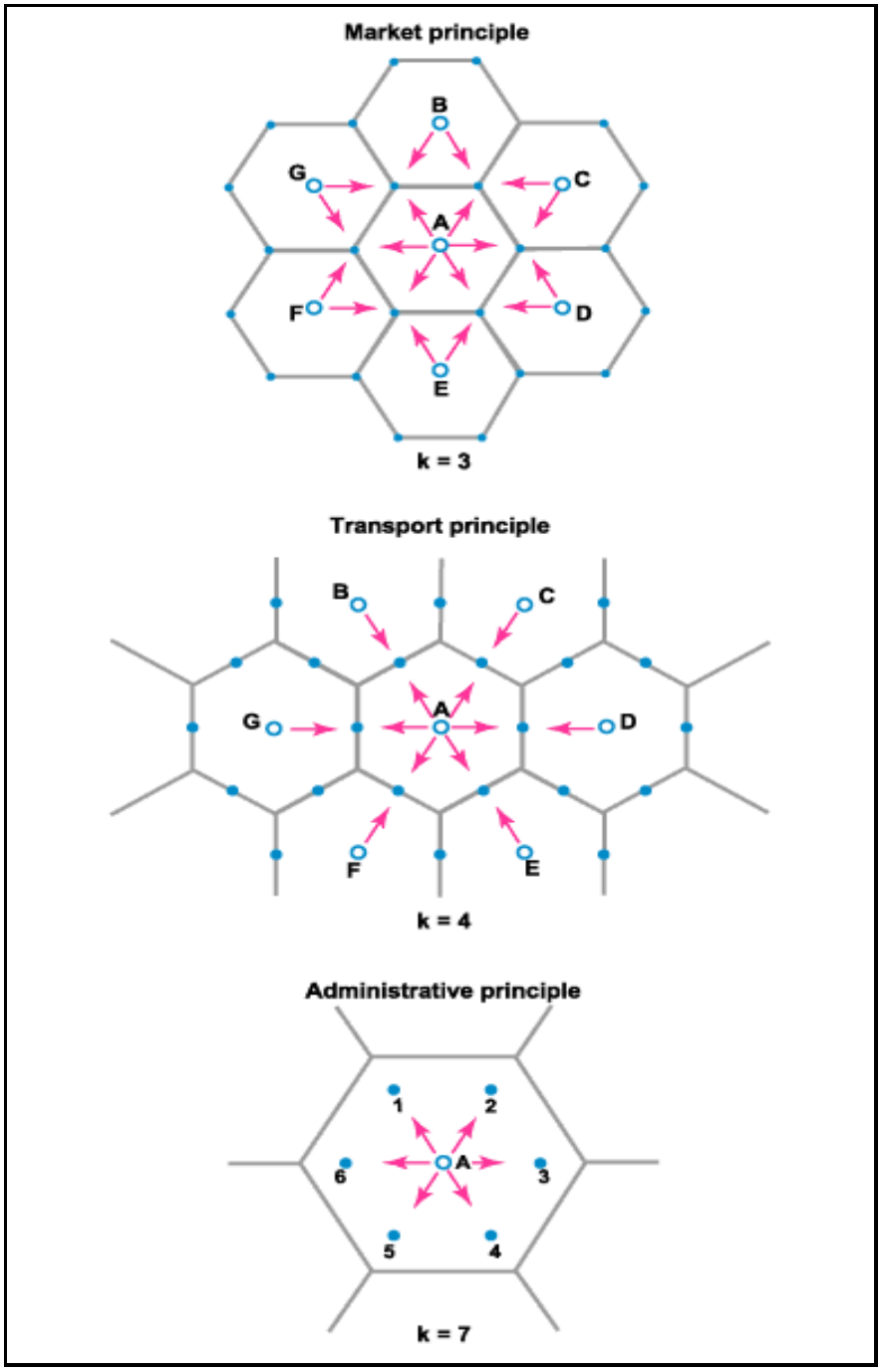


Figure 3-3 K – Values Source: Surd (2009)

Although Chirstaller's model, in principle, delineates patterns where the distribution of goods and services and the accumulation of profit is a function of transportation and location, Lösch (1954), on the other hand, extended the notion of fixed *K-values* from seven principal orders of settlements to 10 (3, 4, 7, 9, 12, 13, 16, 19, 21 and 25). Lösch's model also consists of hexagons, similar to those of Christaller, but superimposed on a common central place. This common central place is the hub of the settlement system, dominating the trade of goods and services in the surrounding region. Each hierarchical level includes the primary hexagonal covering with its own geometric scale and secondary hexagonal covering with a definite nesting factor built up on the primary covering. Lösch claimed that goods and

services should have their own market area and that production points would then be established at the centre of each different-sized market area. These market areas are purposefully rotated in such a way that 'city-rich' and 'city-poor' sectors emerge, reflecting the varying numbers of production points that coincide with the underlying hexagon – the intersection of these hexagons will maximise profitability. Twelve sectors are produced, six with many production points (city-rich) and six with few (city-poor). Therefore, using the same basic hexagonal system and the same concept of *K-values* from Christaller, he created a different hierarchy where each sector had the same number of central places, but the volume of activities at these central places varied across the economic landscape – consisting of a continuous sequence of centres rather than distinct centres. By rearranging and superimposing the various hexagonal systems, as illustrated in Figure 3.4, the Lösch model provides a more realistic spatial division of the economic landscape (Marshall, 1977; Diappi *et al.*, 1990).

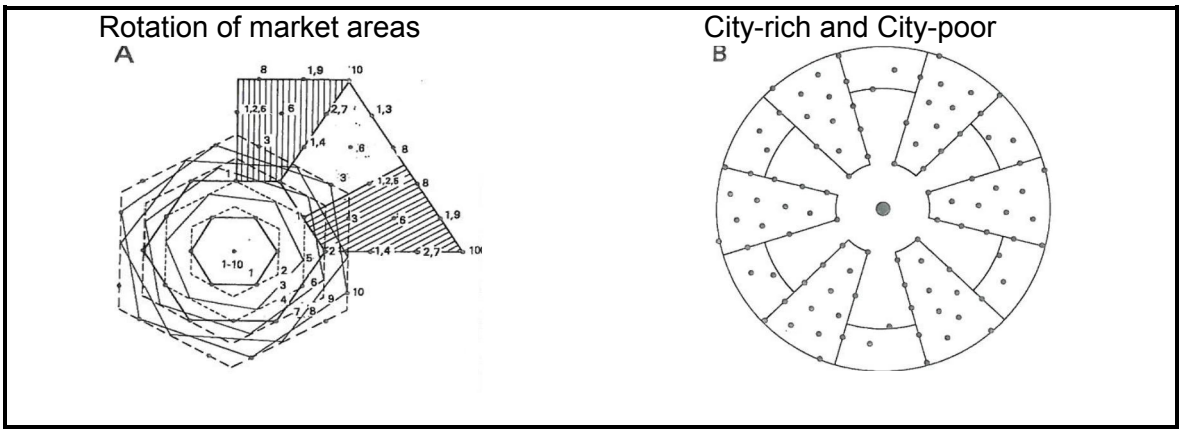


Figure 3-4 Lösch economics of location Source: Van der Merwe (1987)

Therefore, Marshall (1977) and Diappi *et al*. (1990) asserted that the essence of the Lösch model was that it determined one superior centre as the most profitable i.e. where all goods and services were produced. They stated, Lösch argued that the size of the hexagon is not only related to a geographical centre, but also related to the goods and services produced. Thus, a particular centre may have several hexagonal markets for its different products and considering that transport cost is a function of distance, a particular industry with lower transport cost will have a bigger hexagonal market area than another industry given the same economics of scale. Also, according to Lloyd *et al*. (1977), Lösch's spatial arrangement of urban centres was consistent with the principle of least effort (Zipf principle).

Perroux (1955) based his theory on the assumption that growth appears at development nodes with variable intensities with varying effects on the whole of the economy. Furthermore, according to him, development nodes with variable intensities spread along diverse channels, in essence, underpin the concept of what constitutes corridors, which is discussed in detail in Chapter 5. One of Perroux's basic objectives is taking the concept of innovative firms, which relates to the NEG (discussed in more detail in section 3.4) as the starting point. As illustrated in Perroux's growth pole theory (Figure 3.5), large

economic units are innovative, i.e. they exert their influence on the economy through linkages. According to Perroux, the concentration of economic activities is characterised by a dominant firm (as in Lösch's model with one superior centre) which is growing rapidly, innovating and exerting substantial influence on other firms through strong inter-industry linkages. This expansion of a dominant firm sets in motion a process of development sustained by a high super-multiplier. In Moore's (1974) view, firms operating in such an environment grow quickly because of advantages such as: 1) economies in investment expenditure relative to what would be required for scattered development; 2) the proximity to markets and supplies; 3) access to larger and more diversified labour markets; 4) the rapid diffusion of technological innovation; 5) the benefits of specialisation; and 6) the organisation and access of common infrastructure facilities. He noted that for a pole to lift itself to a higher income level, it should develop within itself while linking with other regional centres of economic strength. Boudeville (1961) provided geographical content to Perroux's theory, defining a growth pole as a set of expanding industries all amalgamated in an area that supports economic development through its zone of influence (related to the sphere of influence described by Christaller and Lösch), i.e. the place where these expanding industries are located becomes the pole or central place of the region whereby agglomeration tendencies which relate to NEG are promoted. Such agglomeration tendencies, according to Boudeville (1961), arise because of external economies, which results in the polarisation of economic activities around the pole. External economies, according to Boudeville (1961), refer to: 1) economies external to the firm – lower average cost of production resulting from an increased rate of output; 2) economies external to the firm, but internal to the industry – associated with localisation on account of close proximity of linked industries; as industry expands at a particular location, cost per unit of output to a firm declines; and 3) economies external to the industry, but internal to the urban area, termed 'urbanisation economies', which include development of an urban labour market, access to larger markets and the provision of a wide range of services. Wojnicka-Sycz (2013) took it a step forward, stating that Perroux's theory was a product of agglomeration economies in a dynamic industry or sector that served as an engine for development, creating forward and backward linkages, and promoting diversified production and consumption throughout the pole's area of influence. Therefore, in her view, Perroux's idea of economic space consisted of centres (poles) from which centrifugal forces emanated and to which centripetal forces were attracted.

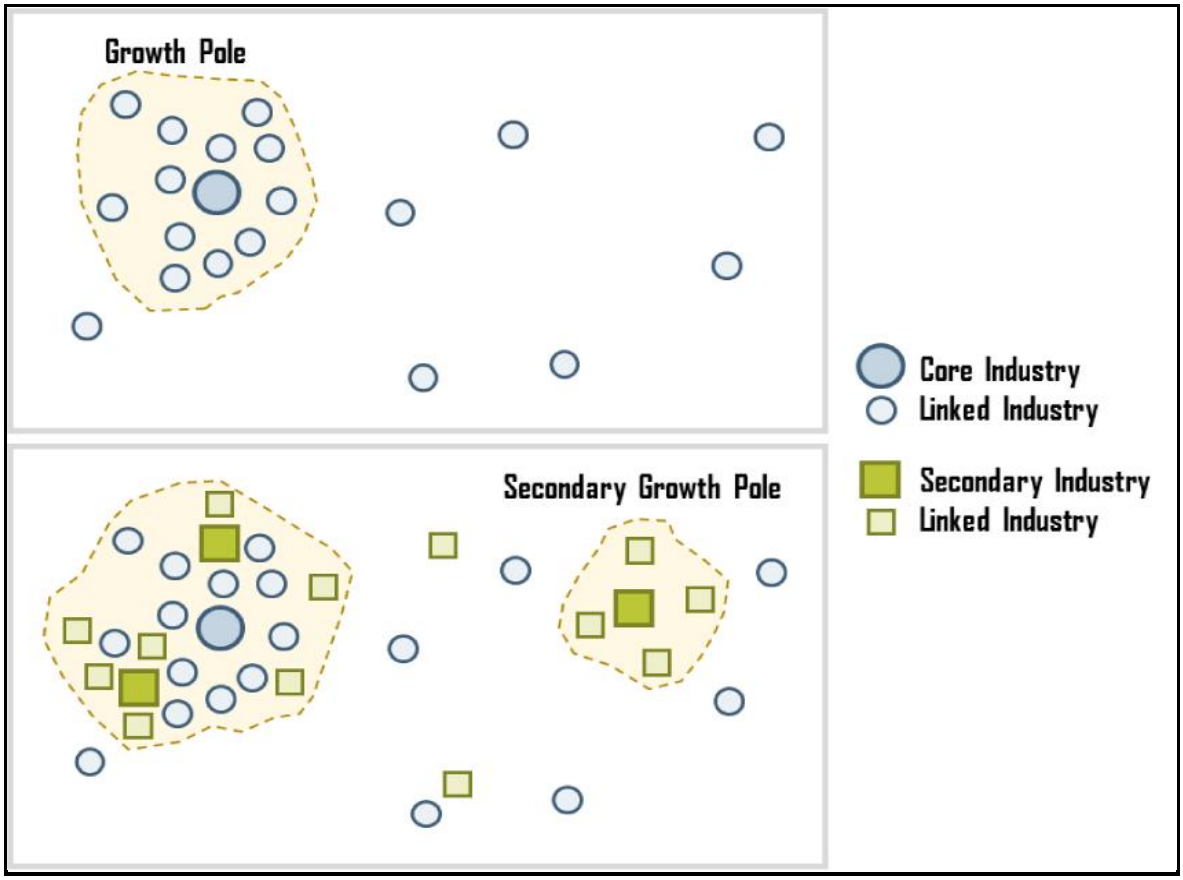


Figure 3-5 Perroux's growth pole theory Source: Perroux (1955)

Perroux (1955) concluded that such clusters would become growth poles, if several leading and expanding industries came together to form a complex large enough to exert a determining influence over its economic environment. Perroux's conclusion, according to McCann *et al*. (2009) and subsequently embedded in geographical space by Boudeville (1961), is based on an assumption that economic growth, manifested in the form of innovations, is spread throughout a growth centre's periphery to lower-order cities and localities in proximity. In their view, innovations once generated in a certain central location are expected to spread among regions from one location to another. According to Parr (1973), Perroux calls attention to the essential role innovations play in the process of economic space development. The expansion of a key industry induces subsequent expansion of the affected industries – those which are directly connected by forward and backward linkages (forward and backward linkages are explained in more detail under the core-periphery theory in section 3.5). A pole or centre induces change and growth, and is a place from where changes start and are experienced by the wider area later on.

In today's realities (Pacione, 2009; Fujita, 2011), the locational principles as described above are still considered some of the most influential concepts of economic geography. The main criticisms of the locational principles are that they have a static nature; they are limited to service centres (central places); they exclude historical and unique circumstances; they incorporate little governmental influence;

and they do not incorporate the temporal aspect in the development of central places. However, according to Haggett (1983), locational principles in the analysis of economic space development emphasise three important elements: firstly, the relationship between the size and patterns of settlements summed up by the rank-size rule is stable enough to over time project future patterns of settlement sizes; secondly, it underpins the urbanisation process (see section 4.3) – settlements tend to move from a primate to a rank-size form as population and economic activities increase; and thirdly, settlements, irrespective of rank-size, are more closely integrated with each other – sphere of influence. Therefore, in essence, locational principles are still considered the basic principles in the progression of development forces that create economic spaces. The latter is evident when one considers the basics that constitute the theories on diffusion, NEG and core-periphery.

3.3 Diffusion

Notwithstanding the importance of central places, their static nature does not allow, or respond easily to social and economic changes. Therefore, according to Scott (2000), a number of economic geographers during the 1960s felt that a more nuanced conception of human motivation and the behavioural environment might offer a more fruitful foundation for scientific investigation. This resulted in the understanding of natural settlement establishment as opposed to planned settlement establishment in the progression of development forces that create economic spaces. The Centre for Regional, Urban Innovation and Statistical Exploration (CRUISE) (Geyer *et al*., 2012) found that this natural process of initial occupancy was directly linked to the evolution of corridor development (to be discussed in detail in Chapter 5). In Pacione's (2009) assessment, the alternative was to establish a process of settlement diffusion considering the historical spread of settlements across a region.

In Haggett's (1983) view, diffusion has two distinct meanings, 'expansion diffusion', which is the process by which innovation move from one place to another and 'relocation diffusion', similar to spatial spread, which is the process whereby innovation leaves the area of origin to move to a new area. Early literature from Bylund (1960), Morrill (1963) and Berry (1967) identified three phases of diffusion: *Colonisation*, which involves the establishment of settlements into new territories; *Spread*, where increasing population density results in settlement clustering; and *Competition*, which produces the regularities in settlement patterns as suggested, and supported by the central place and growth pole theories of Christaller, Lösch and Perroux. This supports the notion of expansion diffusion as defined by Haggett (1983) that settlements diffuse through a sequence of orders, classes or hierarchies. Initially, Hägerstrand (1968) classified the diffusion profile into four stages: the primary stage, which marks the beginning of the diffusion process; the diffusion stage, which signals the start of the actual diffusion process with the creation of new, rapidly growing settlements; the condensing stage, which sees the relative increase of other settlements equal in location accepting the same innovations; and the saturation stage, marking innovations diffused being accepted throughout the region, resulting in little regional variance. However,

according to Gregory (1978), Hägerstrand's idea to track the interacting paths of natural settlement establishment had less influence on understanding the progression of development forces which create economic spaces. Vance (1970) on the other hand, as illustrated by Figure 3.6, employed a historical diffusion perspective to devise a settlement evolution model. He envisaged five stages in the development of economic spaces:

1) *Exploration*, which involved the search for economic possibilities by prospective colonial powers
2) *Harvesting of natural resources*, which involved the periodic harvesting of products in limited settlements
3) *Emergence of farm-based staple production*, which involved increased settlements exporting commodities to the mother country which, on its part, supplied the colony with manufactured goods
4) *Establishment of interior centres*, which involved settlements penetrating inland along preferred routes to facilitate the movement of products from the interior to the settlements of attachment, which also began to grow manufacturing sectors. Inland settlements were established at strategic locations to serve as collection points
5) *Economic maturity and central place infilling*, which involved the growth of manufacturing sectors, leading to economic maturity accompanied by the emergence of a central place where the collection points took on a service function and developed as regional centres.

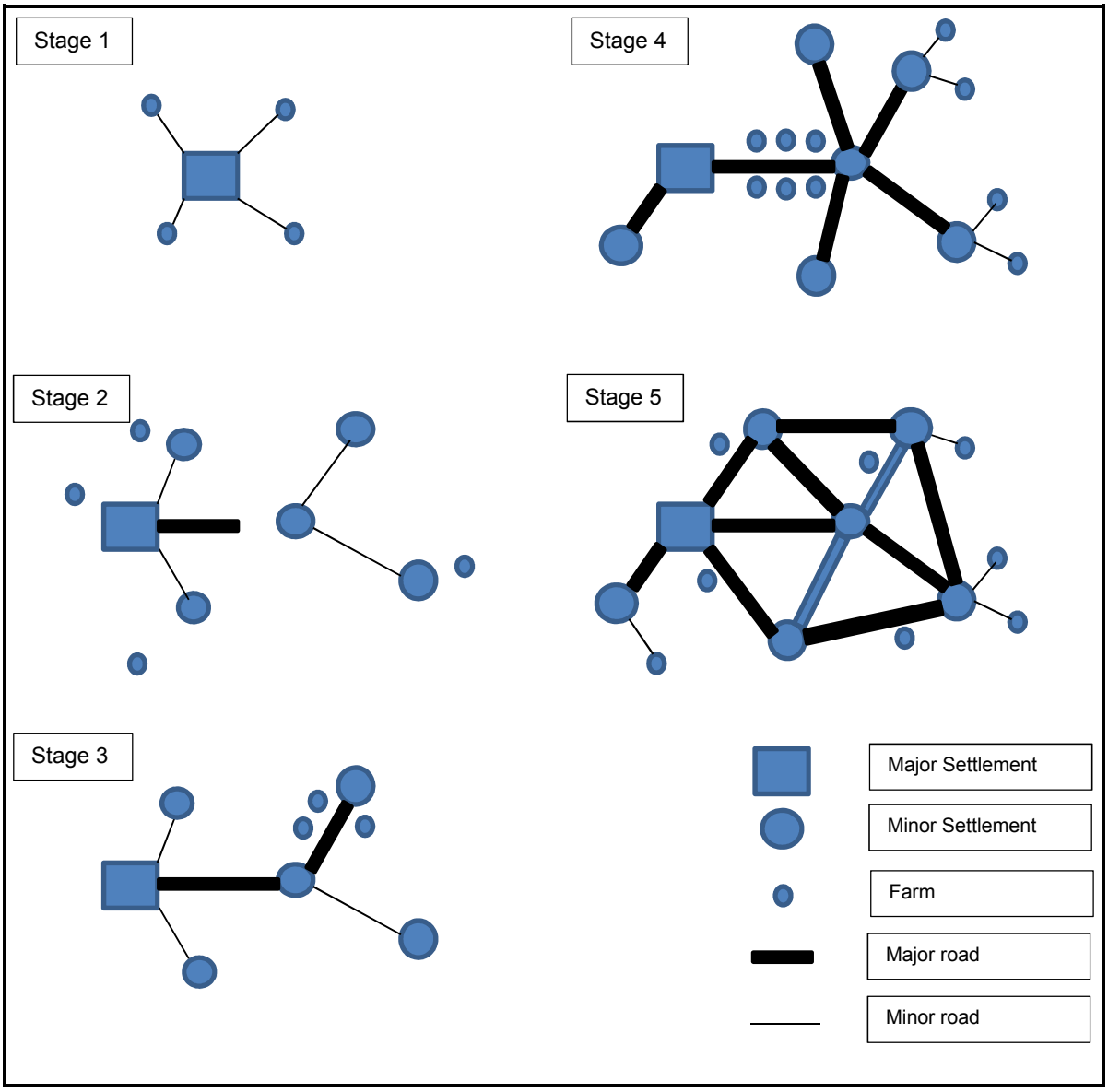


Figure 3-6 Spatial diffusion Source: Vance (1970)

Grossman *et al*. (1991), Mitchell *et al*. (1995) and Otterstrom (2007) noted that settlement diffusion was exogenic, considering that locational economies were largely determined by external forces – human motivation. Notwithstanding external forces, however, strong similarities existed between settlement diffusion and the locational principles formulated by Christaller, Lösch and Perroux, particularly when settlement diffusion entered its last stage of economic maturity, where function determined the position of the settlement within the hierarchy of settlements. In Scott's (2000) view, it meant the scene was set for a large volume of research on economic geography of particular localities. Geographers and economists such as McPherson (1970), Parr (1970), Beavon *et al*. (1975), Parr *et al*. (1975), Beavon (1977), Lloyd *et al*. (1977), Parr (1978a, 1978b & 1981), Sonis (1986b & 2005), Berry *et al*. (1988) and King (1996) offered a diversity of publications. Notwithstanding the original works produced by these scholars, it was Krugman (1991), in his study of the location, distribution and spatial organisation of

economic activities across space, who introduced the renewed interest in economic geography which is, in today's reality, considered the most applicable representation of space as economic geography.

3.4 New Economic Geography (NEG)

Despite the pedagogic value of locational principles and settlement diffusion, it is still difficult, according to Bunce (1982), to avoid the conclusion that a general theory to explain economic geography based on location, size and spacing, is unattainable. As seen, much of literature has ignored the specifics behind market forces, and instead, has been obsessed with geometry – the shape of the market areas. In Pacione's (2009) assessment, times have changed and urban geographers and economists are acknowledging the need to take into account other concepts which allow for the dynamics of economic space development.

In re-establishing the concept of economic space development, Krugman (1991) considered three key questions to explain its dynamics: What is the impact of trade on the geographical distribution of industries?; How does economic integration shape spatial disparities?; and Why do firms agglomerate in certain places as integration deepens? The outcome resulted in the emergence of the NEG, as illustrated in Diagram 3.1, which, according to Krugman, is the study of the location, distribution and spatial organisation of economic activities across space, i.e. it is based on the fundamental elements of why self-reinforcing centripetal forces pull economic activities into a location that persists over time. The innovative contribution of the NEG is comprised of concepts which allow for the dynamics of spatial clustering (and dispersing) of economic activities when trade barriers are progressively removed, which couldn't be explained by subsequent previous theories. In essence, the NEG represents the renewed interest in the 'general theory of location and space economy'. Ascani *et al*. (2012), who later confirmed Krugman's findings, indicated that increasing returns to scale, competition and the occurrence of external economies collectively underpinned the functioning of economic geography.

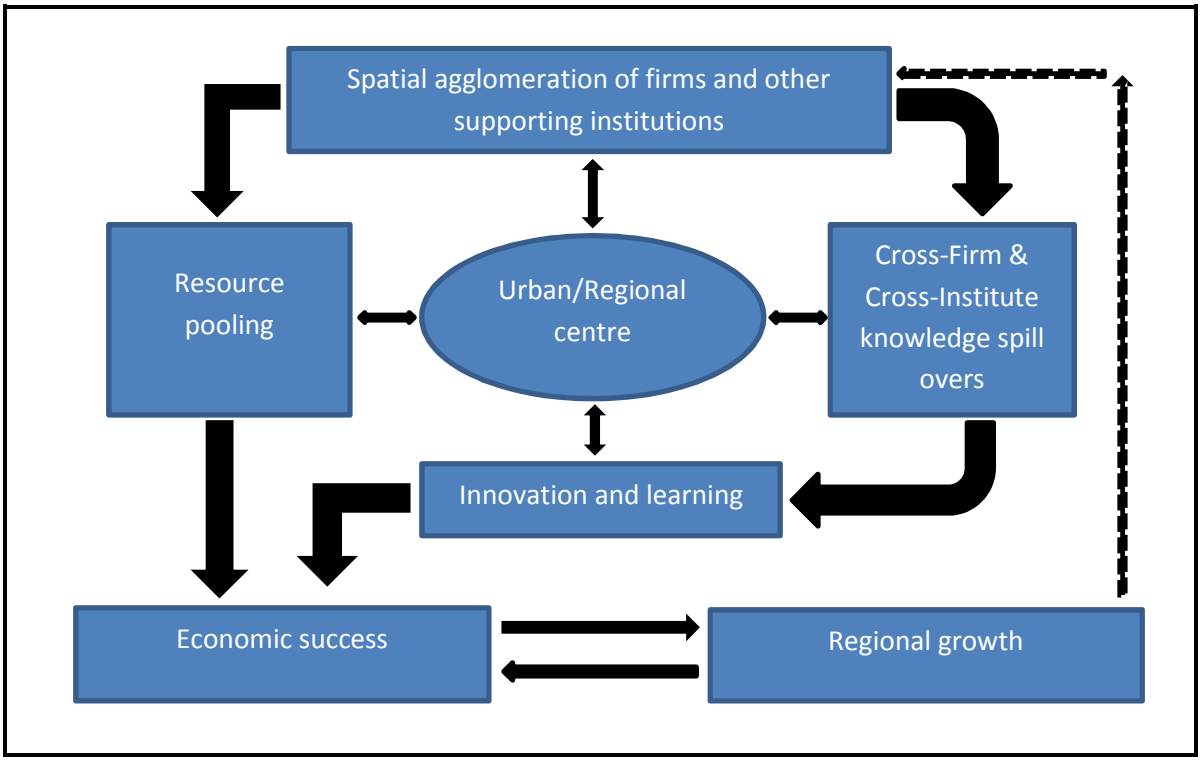


Diagram 3-1 New Economic Geography Source: Krugman (1991)

In traditional theories (Ohlin, 1933; Predöhl, 1950; Balassa, 1961), when economic liberalisation occurs between two regions, both regions benefit from the gains of comparative advantages. This fundamentally results in higher consumption levels in each region, as a result of trade. However, while the notion of economic integration mainly evokes trade-related issues, it also entails other relevant elements for spatial development. According to Fujita *et al*. (2004), although it is only later on that these elements were explored more deeply, it is not a new notion that the concept of economic integration is intimately connected to location. As far back as 1956, Isard indicated that location embraced the spatial array of economic activities. Therefore, the emergence of NEG explains the formation of many different types of economic agglomeration (or concentration) in geographical space.

The NEG explains the geographical unevenness of the economic landscape as a situation of equilibrium when considering the following four elements:

Firstly, increasing returns to scale are fundamental when accounting for the uneven spatial distribution of economic activities. As highlighted by Scotchmer *et al*. (1992), the importance of increasing returns stimulates economic production to cluster in space. As the NEG model allows for increasing returns, manufacturing firms concentrate production in space as a way to benefit from the advantages of scale economies. In other words, increasing returns represent an incentive for firms to geographically concentrate their productive activities rather than dispersing them, due to the benefits derived from lower production costs.

Secondly, also reiterated by Samuelson *et al*. (2001), adopting imperfect competition becomes essential for considering the benefit of scale economies and explaining a spatial pattern in the location of economic activities. In contrast, in perfectly competitive markets, the assumption of increasing returns cannot hold, as the cost of producing an additional unit of product implies negative profits. Therefore, the existence of increasing returns allows for the creation of larger production units that are, in turn, more efficient than smaller ones, since, when a firm decides to concentrate production in one single location, the benefits of scale economies give it an advantage over spatially dispersed firms. According to Combes *et al*. (2008), this is very different from a situation of perfectly competitive markets where constant or decreasing returns eliminate the occurrence of economies of scale. Therefore, firms are not concerned with any location choices, since they cannot benefit from increasing returns by concentrating production. Thus, they will decide to produce in all locations where consumers are, thereby distributing economic activities.

Thirdly, transport costs also reiterated by Howitt (2004) and Nafziger (2006), are inclusive as a critical element that influences location. The NEG adopts a form of transport costs where only a fraction of the value of the unit of product transported from one location to another arrives, while the rest is paid as cost of transportation. Therefore, the impact of transport costs on location choice depends on the level of transportation costs. As a consequence, firms decide whether it is more convenient to concentrate in just a single location and serve other regions by exports, or, alternatively, to establish at a different location. This aligns with the notion of Samuelson (1952) that the interaction between transport costs and increasing returns constitutes a crucial force towards agglomeration (or dispersion) in location behaviour.

Lastly, external economies are incorporated to give account of the high level of localisation of individual industries or localisation of manufacturing as a whole. This is also confirmed by Howitt (2004), Mayer (1996), McCann (2004) and Nafziger (2006), indicating that the type of economies considered as agglomeration economies are localisation economies, which aligns with the notions of Marshall (1920), Hoover (1937) and Isard (1956) that locality is the source of scale economies and the driver of urbanisation economies. Furthermore, Howitt (2004), Mayer (1996), McCann (2004) and Nafziger (2006) identified three sources of localisation economies:

1) The emergence of labour workforce pooling. Large populations of skilled labourers enter a region exchanging knowledge, ideas, and information. The more businesses there are in a region, the greater the competition is to obtain workers and vice versa.
2) The access to specialised goods and services provided. The access to specialised goods and services is known as intermediate inputs and provides increasing returns to scale, due to the proximity to available sources needed for production.

3) Technological spillovers, resulting in the diffusion of ideas or adoption of ideas. New innovations of technology increase risk, while the clustering of businesses reduces uncertainty in the use of new technology.

It seems that arguments in support of the NEG, in relation to functional economic development are more than just theoretical. In the view of Van Huyssteen *et al*. (2009), the NEG contributes different concepts of insight useful for context-specific investment, which, according to Drewes (2015), provide the strong advantage of explicit representation of space as an economic geography.

3.5 Core-periphery

It is evident that the aforementioned theories in the views of Brunner *et al*. (2005), Henning *et al*. (2012), and Roberts *et al*. (2012), interact dynamically to create patterns of urban and regional development centres or nodes – a hierarchy of higher and lower-order settlements – thereby creating superior performance of certain urban centres when analysing complex economic networks structured under specific regional integration initiatives. In their view, the spatial dimensions of these elements are critical for understanding the impact of economic space development in creating investment opportunities when consideration is given to the performance of urban centres, in relation to one another.

The core-periphery theory (Baldwin, 2001) is based on the notion that, as one urban or regional centre expands in economic prosperity, it engulfs other urban or regional centres nearby, creating a continuous evolution of economic development and growth, whether negative or positive. In essence, the core-periphery theory helps to explain why certain urban centres enjoy more prosperity, in relation to other urban centres.

The core-periphery theory is not a new concept. As early as the 1960s, Friedmann (1966) introduced the concept. However, the core-periphery theory was further elaborated on by Krugman (1991b & 1991c), Venables (1996), Puga (1999) and Fujita *et al*. (2000). The conventional core-periphery model, as adapted from Friedmann, illustrated in Figure 3.7, represents the emergence of a regional urban system through four major stages:

1) The *pre-industrial* stage – localised economies and a small-scale settlement structure. Each settlement is fairly isolated, activities are dispersed and mobility is low.
2) The *transitional* stage – the concentration of the economy in the core city begins as a result of economic accumulation and industrial growth. A dominant centre, representing the growth pole, emerges. Although trade and mobility increase, they are still dominated by the core. The transitional stage contains strong elements of spatial diffusion when considering the beginning of colonialism (see section 3.3).

3) The *industrial* stage – through a process of economic growth and diffusion, other growth centres start to emerge. The main reasons for deconcentration are increasing input costs (mainly labour and land) in the core area. Furthermore, this stage is also linked with increased interaction between elements of the urban system and the construction of transport infrastructures.
4) The *post-industrial* stage – the urban system becomes fully integrated and spatial inequalities, which are part of the previous stages, are reduced significantly. The distribution of economic activities creates innovation and specialisation. Spatial inequalities, favoured in the initial process, are eventually reduced and a functionally integrated urban system emerges.

In summary, according to Krugman (1991b & 1991c), Venables (1996), Puga (1999) and Fujita *et al*. (2000), the core-periphery theory differentiates the following as key elements:

1) It highlights the inequality in the levels of development between core and periphery.
2) It can be measured at different scales, e.g. international versus national or national versus region.
3) It measures the performance or level of interaction between urban centres, also known as the core-periphery relationship.
4) It places emphasis on what are known in spatial development as the spread effect and backwash effect.

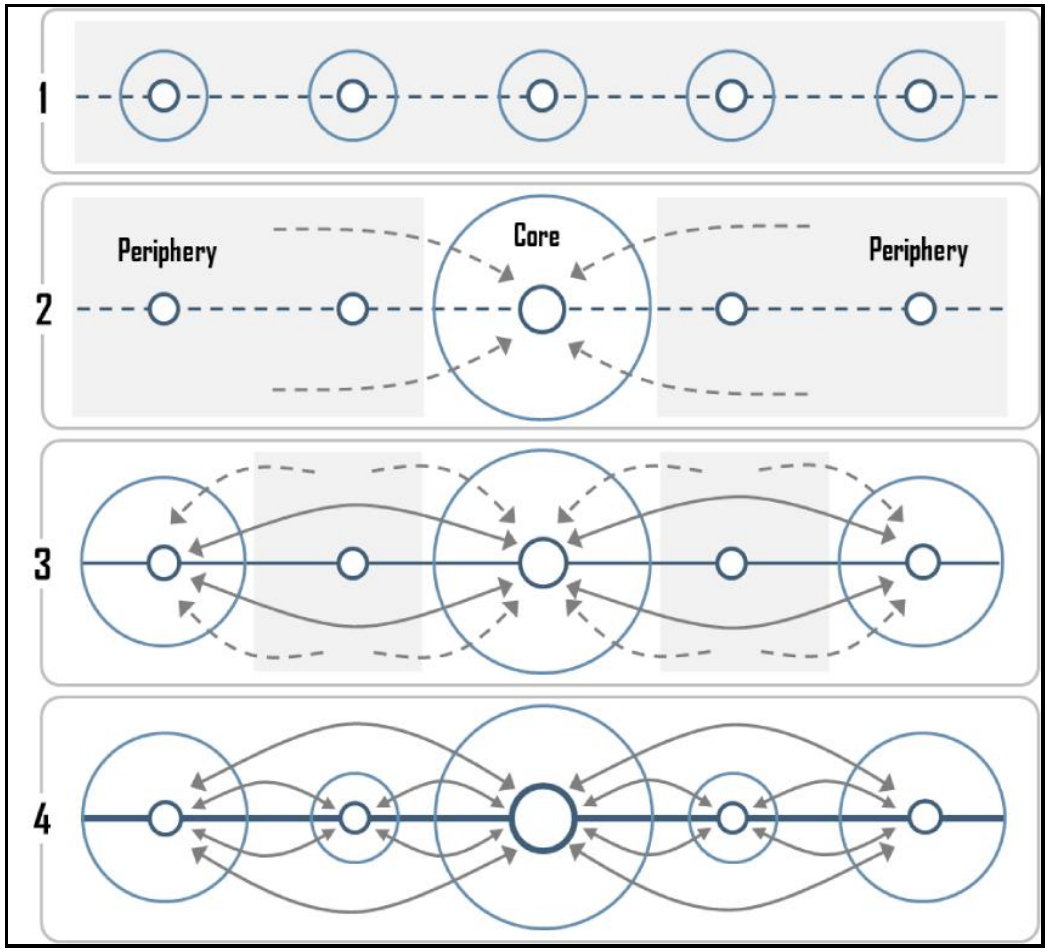


Figure 3-7 Core-Periphery theory Source: Friedmann (1966)

The one key element standing out from what the core-periphery differentiates is the creation of a spread and backwash effect – Perroux (1955) referred to it as forward and backward linkages. The Swedish economist Myrdal (1957) referred to the creation of a spread and backwash effect as the economic development effect. In the view of Chen *et al*. (2013), backwash takes place when the adverse effects dominate and the level of economic activity in the peripheral community's decline, i.e. if one particular area starts growing or developing, it causes people, human capital as well as physical capital, from other parts to gravitate towards this growing centre. According to Myrdal (1957), this essentially leaves the other areas worse off than before because their best brains and capital left to go to the growing centre. In brief, backwash means that growth in one area adversely affects the growth in another. Chen *et al*. (2013) argued that the reason for backwash taking place was that the resulting industry's structural change and productivity growth from agglomeration was particularly attractive to outside communities and investors.

Counter to the backwash effect is the spread effect. In the view of Chen *et al*. (2013), spread refers to the situation where the positive impacts on nearby localities and labour markets exceed the adverse impacts, i.e. when one particular area starts to grow or develop; it positively effects the growth in adjoining areas. Myrdal (1957) summarised it by saying that the development in one place spreads to

areas located in its proximity, leaving the adjoining areas better off than before. Furthermore, Myrdal (1957) and Chen *et al*. (2013) postulated that, in the earlier stages of development, the process of urbanisation normally worked hand in hand with technological and innovational changes in producing spread and backwash effects. Myrdal (1957) made the statement that backwash effects and spread effects could explain the longer or more changeable processes of urban growth which underpinned the notion of urbanisation. Therefore, it can be argued that the urbanisation processes and the associated spread and backwash are often two sides of the same coin. This becomes clearer with the discussion on urbanisation in Chapter 4 under section 4.3.

3.6 Summary and Conclusion

It is evident from the discussions that settlements and, ultimately, economic spaces do not develop at the same rate. This notion is contributed to the fact that, due to the uneven distribution of factors such as natural resources or political considerations, certain urban systems grow faster over time than others. The result is that settlements fulfil a specific role in the context of their regional and urban environment. Therefore, settlements are classified into various functional types, according to the number and types of commercial, industrial and service functions provided by each. These functions are normally referred to as ‘central functions’ and the characteristics of central functions ultimately determine the settlement's position within the hierarchy of settlements, which also determines the settlement’s place overall in the economic spaces. The outcome is a regional and urban system comprised of lower-order settlements (large in number) and higher-order settlements (few in number), each having different impacts on and contributions towards economic space development. The reason is based on the fact that settlements of a higher-order normally offer a larger variety of functions and services and are, consequently, spaced further apart and referred to as multifunctional, thereby having a stronger impact on economic space development. Conversely, settlements of a lower order offer a smaller variety of functions and services and are usually closer to one another and referred to as monofunctional, thereby having a lesser impact on economic space development. In conclusion, the key principle highlighted in the chapter is the fact that the development of economic spaces and their continuous modification take place at a variety of scales which are the result of the cause and effect of market forces influenced by natural, planning or strategic considerations.

It is, therefore, clear that the various theories strongly underpin the rationale behind economic space development, which is discussed in Chapter 4, where consideration is given to the following: 1) with a central place orientation, a given community is only effected by its nearest higher-tiered urban centre of a given size, i.e. market potential from differing tiers of the urban hierarchy affects regional and urban growth (locational principles as discussed in section 3.2); 2) with a diffusion orientation, the effect of external forces leads to the occurrence of centrality having the same orientation as a central place (diffusion as discussed in section 3.3); 3) with a NEG orientation, the creation of an aggregated or

greater market potential, due to self-reinforcing centripetal forces (the causes and effect of market forces leading to the agglomeration effect), generally has a favourable impact on regional and urban growth (NEG as discussed in section 3.4); and 4) with a core-periphery orientation, the process of change and the response to the change have an adverse effect, either positive or negative, on urban growth (core-periphery discussed in section 3.5).

The importance of this chapter is seen in the following: 1) it explores the basic principles and elements behind the creation of economic spaces, i.e. the how, where and why economic spaces develop the way they develop; 2) it creates the foundation for step one in the construction of a Spatial Corridor Model (SCM), which is to establish the primary network of urban centres, i.e. identifying regional and urban centres which represent the most dominant economies in the country; and 3) it justifies the first research question, namely that locational principles quantify the outcome of development forces – cause and effect of market forces – which ultimately creates economic spaces.

Chapter 4 Economic Space Development

4.1 Introduction

Foucault (1970), Watts (1993), Gildenhuys (1994) and Mallick (2005) stated that, internationally, there was consensus that economic development in a country could hardly take off successfully if specific attention were not paid to the development of the urban environment. In their view, economic space development is a normative expression i.e. economic space development is subjectively constructed and the variety is dependent on theoretical approaches. This aligns with the previous chapter which focused on the basic principles and elements behind the creation of economic spaces when considering different theoretical approaches. The approaches involved a conservative connotation in keeping with tradition and customs labelling these theories as traditionalism. On the other hand, the focus of Chapter 4 is on elements that distinguish the stages of modernity i.e. that characterise the rationale that conforms to the present or future of economic space development. Therefore, opposite traditionalism is modernism, which is in connotation to relations and functions that link distant localities in such a way that economic space development is shaped by events and interactions.

Jacobs (1984) and Dewar (1988) stated that cities, and not nations, played a key role in the economic development of a country, which is confirmed by Drewes (2015) arguing that economic space development is built on the basis of opportunities and comparative advantages, resulting in a spatially selective approach where certain cities or regions are selected as preferred locations of development. According to the South African Cities Network (SACN) (2009), the clustering of economic activities at these preferred locations creates competitive advantages, which emphasises the argument that cities are becoming engines for economic growth. Therefore, the view that cities are places dominated by distressed communities, declining industries and decaying, physical structures has been turned around, with a new emphasis on cities as sites of renewed economic dynamism. Furthermore, Clarke (1991) argued that the economic growth and prosperity of a country was, to a large extent, dependent on the efficient functioning of cities. He suggested that the national economic growth of a country was becoming more and more dependent on the ability of cities to perform crucial functions within the macro and microeconomic environment. Therefore, to recognise the importance of cities as sites of renewed economic dynamism which determines the place of cities in the broader economic environment of a country, emphasis is placed on the following key concepts: 1) the development of economic stages, arguing the evolutionary explanation of economic change; 2) urbanisation, arguing the transformation of economic conditions on an urban and regional scale; 3) agglomeration economies, arguing the idea of economies of scale and network effects; and 4) network cities, arguing the flow and interaction of economic activities.

4.2 Development of Economic Stages

As mentioned earlier, the concept of modernism, which is in connotation to economic space development shaped by events and interactions, had its beginnings in the classical evolutionary explanation of economic change (Giddens, 1991 & Smith, 2003). According to Giddens (1971), although scholars such as Durkheim, Marx and Weber theorised economic transformation, it was Rostow's (1960) concept of economic growth that defined each sequential economic step towards modernism. Rostow (1960) argued that, although the steps were linear in function, they evolved towards a higher state of economic development over time. Rostow (1960), as illustrated in Figure 4.1, identified five stages of economic growth:

1) *Traditional* – The economic system is stationary and mainly dominated by agriculture with traditional cultivation and subsistence activities. Productivity by man-hour is lower, compared to the following stages of economic growth. Lastly, communities characterise a hierarchical structure, resulting in low vertical and social mobility.
2) *Preconditions for Take-Off* – During this stage, the rate of investments is increasing, due to specialisation, surpluses and infrastructure development initiating a dynamic development stage. This kind of economic development is a prerequisite for the Take-Off stage. Therefore, as a consequence of this transformation, workforces in the primary sector become more redundant.
3) *Take-Off* – This stage is characterised by dynamic economic growth, due to industrialisation, growing investment, regional growth and political changes. The main characteristic of this stage is self-sustained growth, which requires no exogenous inputs. Therefore, a few leading industries are able to support development.
4) *Drive to maturity* – This stage is characterised by continual investments, diversification and innovations, resulting in economic and technical progress being dominant. New types of industries emerge and, as a consequence, social and economic prosperity are transformed, especially for the latter.
5) *Age of high mass consumption* – This stage is consumer-orientated, resulting in most parts of society living in prosperity. The service sector dominates, offering individuals abundance and a multiplicity of choices.

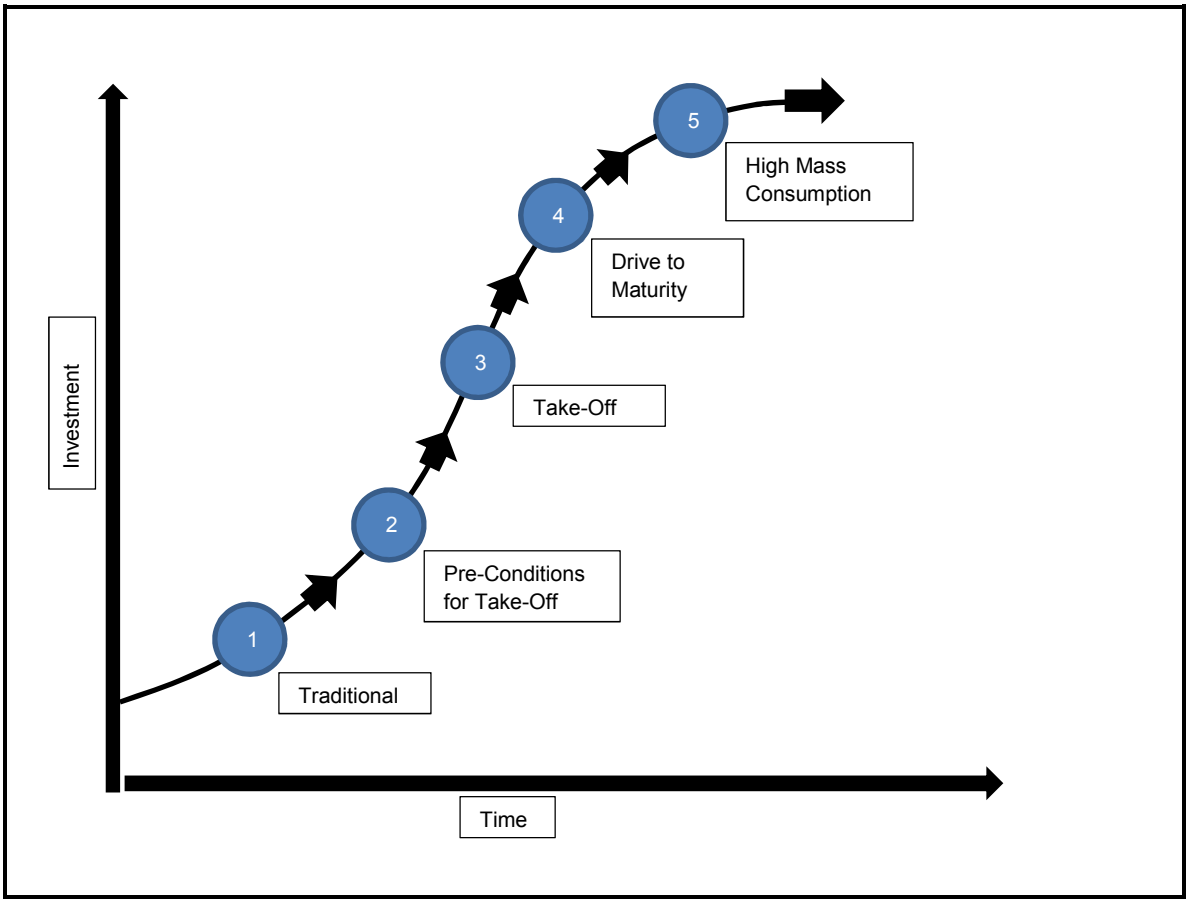


Figure 4-1 Rostow's model of economic development Source: Potter *et al*. (1999)

According to Mallick (2005), the aim of economic stages is that, within the economic history, specific criteria distinguish the stages of modernity from each other. Generally, modernism characterises a rational conformity to the present or future requirements, i.e. modernism is the opposite of traditionalism (Giddens, 1991). Modernism is considered an endogenously induced process, while traditionalism, which is discussed in detail in Chapter 3, is considered a spatially induced process. Therefore, an endogenously induced process is based on the assumption that each sector of the economy contributes at different levels – stages of growth – of economic development. The contribution of different sectors based on the sector theory (illustrated in Diagram 4.1), is accompanied by a shift in economic activities, as well as employment patterns, first, from the primary to the secondary and, later, to the tertiary sector (Clark, 1991). The sector theory divides economies into three sectors of activities:

1) *Primary sector* – This sector is concerned with the extraction and production of raw materials, which is essential for the industrial or manufacturing sector. Furthermore, the primary sector is self-reliant, in terms of food security. In less developed economies, the primary sector comprises the biggest part of the economy. Typically as an economy develops, increased labour productivity will enable workers to leave the agricultural sector and move to other sectors, such as manufacturing and the service sector.

2) *Secondary sector* – This sector is concerned with the transformation of raw materials or intermediate materials into goods, i.e. it includes all branches of human activity that transform raw materials into finished products. According to economic theories, economies dependent on the primary sector grow slowly and remain under-developed. Therefore, the secondary sector is considered the engine of economic growth, is crucial for all developed economies and forms a substantial part of the Gross Domestic Product (GDP). The development of the secondary sector is attributed to the demand for more goods, which leads to industrialisation, i.e. although the primary sector is vital, there is a natural limit on how much can be extracted. However, when economies move into the secondary sector, new techniques are used and industrialisation becomes dominant as the goods are transformed into articles of need.
3) *Tertiary sector* – This sector is concerned with the provision of services to consumers and businesses. The service sector is comprised of the production of services, instead of end products, i.e. the focus is on people interacting with people and serving the customer, rather than transforming physical goods. Services (also known as 'intangible goods') include access, experience and affective labour, i.e. the service sector is comprised of the 'soft' parts of the economy creating productivity (effectiveness), performance improvement, potential and sustainability. At present, the tertiary sector is the highest of all the sectors and generally accounts for the greatest contribution towards the GDP, i.e. income and employment growth lies within the tertiary sector.
4) Lastly, although the production of information has long been regarded as a service, some economists now attribute it to a fourth sector, the quaternary sector.

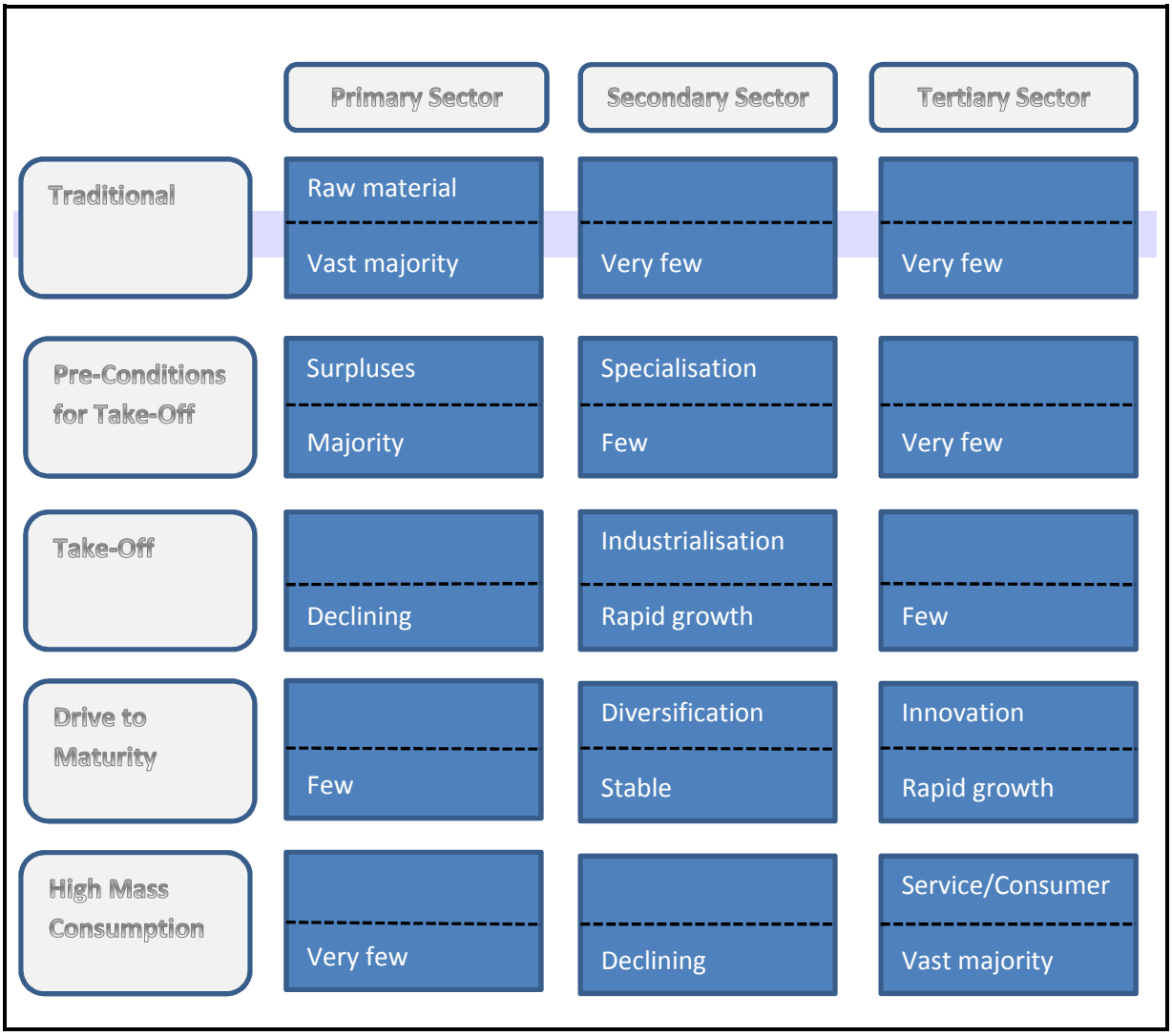


Diagram 4-1 Sector theory shift in economic activities and employment pattern

Source: Potter *et al*. (1999) & Clarke (1991)

In Clarke's (1991) view, the main focus of an economy's activities when shifting from the primary through to the secondary and, finally, to the tertiary sector, is considered as essentially positive i.e. results in the increase in the quality of life. Higgings *et al*. (2017) postulated that quality of life, which was interlinked with economic development, referred to raising the general level of welfare above the present national standard. Diagram 4.1 illustrates how the shift of economies from the one sector to the next increases quality of life. The diagram illustrates that economies with a low per capita income are placed in an early stage of development, i.e. the main portion of income is achieved through production in the primary sector. The diagram also illustrates that economies in a more advanced state of development, with a medium income, generate their income mostly from the secondary sector, and a highly developed economy with a high income is where the tertiary sector dominates the total output of the economy, ultimately presenting societies with a multiplicity of choices, which results in the creation of prosperity.

4.3 Urbanisation

The most common and probably the most important and prominent concept in an urban system, which ultimately shapes economic space development, is the process of urbanisation. However, according to Cohen *et al*. (2015) urbanisation is not a modern phenomenon, but a specific condition at a set time. This condition is evident when considering Rostow's (see section 4.2) stages of economic development, especially the Take-Off stage, which characterises industrialisation as the leading condition in economic development. Urbanisation is quantified either in terms of the level of urban development relative to the population, or the rate at which the urban population increases. Urbanisation is the rapid and historic transformation of economic and social conditions on a regional and global scale, whereby a predominantly rural culture is being replaced by a predominantly urban culture, thereby creating enormous social, economic and environmental changes (Cohen *et al*., 2015). This is especially evident when considering theories around spatial diffusion (see section 3.3), the core-periphery (see section 3.5) and the development of economic stages (see section 4.2).

Historically, although the world has witnessed remarkable changes in urban development, urbanisation is still considered a recent phenomenon. Urbanisation took place in waves as and when new territories were pioneered or conquered. By 1800, the majority of people still lived in rural areas and, only between 1800 and 1950, did the world population increase dramatically, which resulted in urban areas starting to transform rapidly and growing in size and importance. By 1900, just 15 per cent of the world's population lived in cities. The 20th century transformed this picture, as the pace of urban population growth accelerated very rapidly around the 1950s and grew to 27 per cent in 1975. Forty years later, it is estimated that more than half of the world's population live in cities (National Research Council (NRC), 2003).

As mentioned earlier, the 'take-off' in the process of urbanisation (Bairoch *et al*., 1985) aligns strongly with Rostow's stages of economic development, with dynamic economic growth taking place, due to the beginning of industrialisation and modernisation. Landes (1969) shared the same notion and considered modernisation and industrialisation essential ingredients of urbanisation. In their view, urbanisation not only explains the process of change, but also the responses to that change. It also looks at internal dynamics while referring to economic and social structures and the adaptation of new technologies. According to Burgess *et al*. (2004), urbanisation is the most predominant process by which regions, cities and towns are formed, and best demonstrates economic space development.

Urbanisation tends to evolve through different phases of urban development. This is when people settle in various parts of a region in a country to establish the initial settlements which, in essence, support the process of spatial diffusion. During this initial phase, most of the urban centres are central places that support a widely distributed population. However, due to the uneven distribution of natural resources,

certain urban centres tend to develop faster than others, thereby attracting more people (Geyer, 2002). This, according to Van der Merwe (1987) and Van Huyssteen *et al*. (2009), over time, resulted in the development of a hierarchy of urban centres (see Chapter 3, also section 7.2 and Table 7.1). Geyer *et al*. (1993 & 1996) took the concept further and incorporated it into a theory of differential urbanisation, which postulates that large, intermediate-sized and small cities evolve through successive periods of fast and slow growth in a cycle of development as illustrated by Figure 4.2. According to them, the differential urbanisation theory is subdivided into three main phases:

1) *Urbanisation phase* – Once the urban settlement cycle has been completed, i.e. the period during which urban settlements (central and non-central places) become established in an area, the urban system enters the urbanisation phase. This is the phase when the process of urban establishment comes to an end and an urban hierarchy is formed. During this period of urbanisation, urban centres evolve through different phases. Smaller urban centres become either stagnant, or grow at a slower pace because people often tend to leave for places that offer greater opportunities, such as employment. Larger urban centres become primate cities, while others become intermediate-sized cities. According to Geyer (2006) and Geyer *et al*. (2012), the urbanisation phase is subdivided into three stages:

    a) *Early primate city* – This is the stage when primate cities attain spatial dominance over the urban system, attracting large proportions of the population.
    b) *Intermediate primate city* – This is the stage when the rapidly growing primate city is still monocentric in form, attaining suburbanisation features, i.e. multimodality emerges as a result of favourable location attributes.
    c) *Advanced primate city* – This is the stage when, due to inter-regional decentralisation, primate cities develop a metropolitan structure and dominate the urban system economically and spatially.

2) *Polarisation reversal* – Over time, urban centres enter what has been termed the turnaround phase, called ‘polarisation reversal’. It’s a phase associated with population and industrial re-concentration to intermediate-sized cities closer to the large urban agglomerations. Basically, primate cities grow so large that they become economically inefficient. Due to the generation of agglomeration disadvantages, these large urban agglomerations start losing their appeal to entrepreneurs and industrialists, and people start moving to smaller-sized cities: first, to satellite locations on the fringes of large metropolitan areas; later, to intermediate-sized cities; and, eventually, to locations deeper into the periphery. According to Richardson (1977 & 1980) and Geyer (1996; 2002 & 2006), the polarisation phase is subdivided into two stages:

a) *Early intermediate city* – This is the stage when the primate city, although still gaining population, starts to lose, in relative terms, to the intermediate city, i.e. suburban centres within the primate metropolitan region are growing faster than the central city.
b) *Advanced intermediate city* – This is the stage when the suburbanisation process characterising the development of the primate city during the advanced primate city stage is reproduced in the faster-growing intermediate size cities, albeit on a smaller scale.

3) *Counter urbanisation* – Finally, counter-urbanisation kicks in when not only intermediate-sized cities, but also smaller centres in the deeper periphery start gaining migrants and growing economically. Smaller cities start representing a continuation of the previous stages, and may eventually grow at a faster rate than either the primate or intermediate-sized cities. At the end of this phase, the urban system has reached a 'saturation point', where the rural population cannot reduce further and rural-urban migration ceases to be a major contributory factor in the urbanisation cycle.

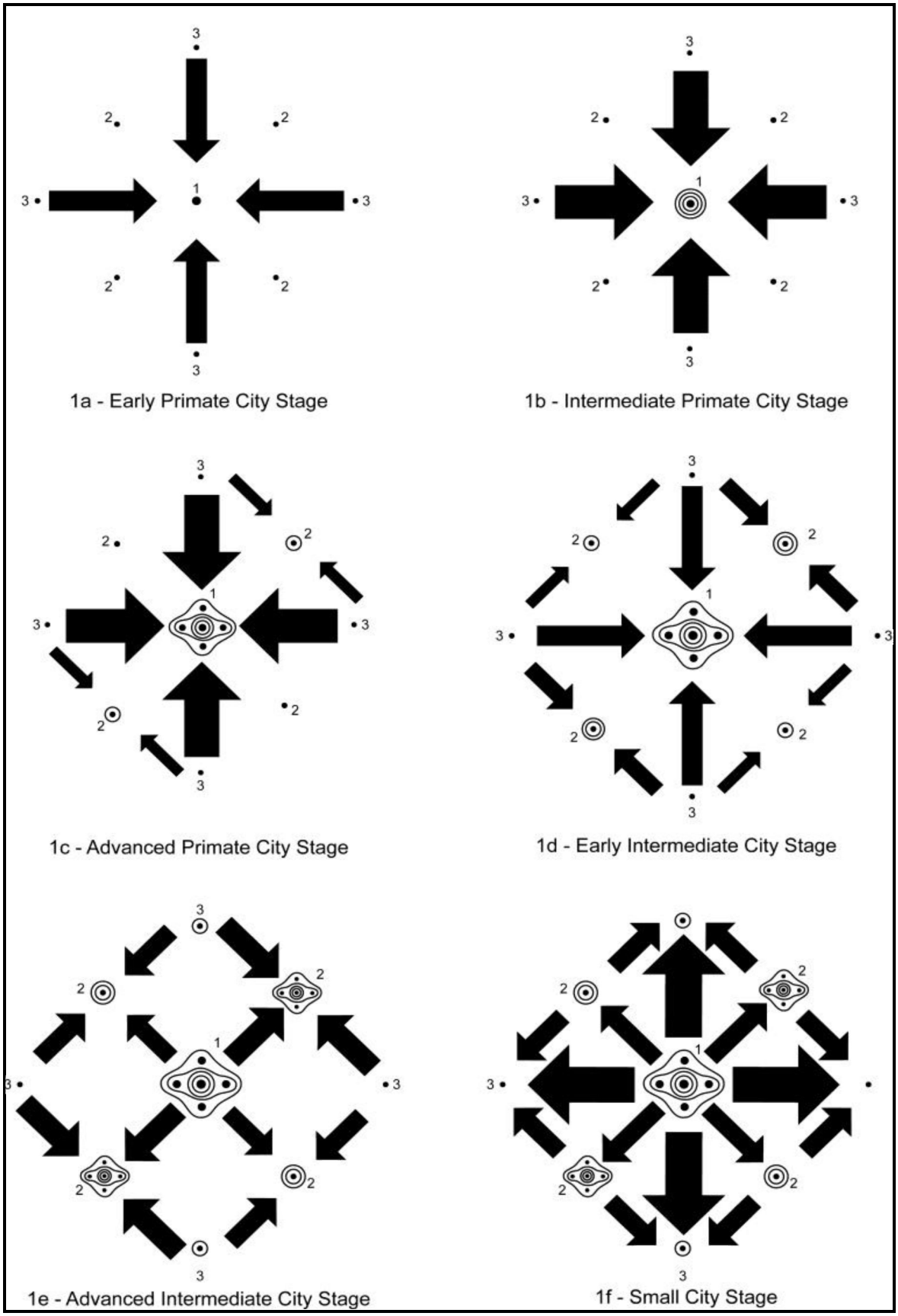


Figure 4-2 Urbanisation process Source: Geyer (2006) & Geyer *et al.* (2012)

Davis *et al*. (2003), in their assessment of the urbanisation process, concluded that urbanisation and economic development went hand-in-hand as regional and urban systems moved from a rural-agricultural base to an urban-industrial base. In their view, urban concentration, the extent to which urban resources are concentrated in one or more larger cities, is very directly affected by economic development. This view supports Richardson's (1977 & 1980) notion that the locational advantages created by the establishment of such core regional and urban systems, ultimately result in strong interactions of spatial economic networks and integration, which is further discussed under agglomeration economies (see section 4.4) and network cities (see section 4.5), thereby supporting the arguments put forward by Jacobs (1984), Dewar (1988), Clarke (1991), the SACN (2009) and Drewes (2015) that cities are the engines driving economic development.

4.4 Agglomeration Economies

Agglomeration refers to the benefits businesses obtain when locating near each other (agglomerating). The concept, established by the NEG (see section 3.4), relates to the notion of economies of scale and network effects, i.e. if industries amalgamate together, production costs will reduce. Therefore, the formation and growth of cities are directly linked to exploiting economies of agglomeration to create opportunities for investment.

The clustering of industries is normally a result of investment strategies flowing in and through areas of economic activity. This helps to accumulate information, as well as the flow of new and innovative ideas among businesses, to achieve increasing returns to scale. Basically, with the location of an industry, there is always a fixed cost of production to consider, i.e. increasing returns to scale are either internal or external to an industry. According to Isard (1956), economies of scale that are internal to a business allow for the establishment of more of the same types of businesses outside the region, while economies of scale external to a business are the result of spatial proximity and are generally referred to as agglomeration economies. Other important elements of agglomeration economies are location and urban economies (Ohlin, 1933; Hoover, 1937; Isard, 1956). In the view of Parr (2002), the benefits created by agglomeration economies are based on production costs being reduced, due to the spatial amalgamation of economic activities. According to Glaeser (1998), these benefits are mainly derived from savings in transportation costs. The only real difference between a nearby firm or industry and one that is found across the region is that it is easier to connect with a neighbour. As a result of this amalgamation, other industries which can take advantage of these economies are established, causing sustained cumulative growth in preferred localities. This process, in the view of Krugman (1991), Fujita *et al*. (1996), Mayer (1996) and Nafziger (2006), is one of the key underlying principles of urbanisation (the process of urbanisation is discussed in more detail under section 4.3). In simple terms, the basic principle behind agglomeration economies is that production is regulated when there is an amalgamation of economic activities, which, according to Richardson (1973 & 1977), initiates economic growth. The

existence of agglomeration economies, highlighted by Howitt (2004), Mayer (1996), McCann (2004) and Nafziger (2006), is how cities increase in size and population. According to Drewes (2015), agglomeration economies lead to a greater concentration of people, economic entities, infrastructure and institutions, which means that resources are used more efficiently. Nicholson (2003) noted that these principles of amalgamation were linked through integrated transportation networks, which supported the idea of creating better opportunities in the restructuring of economic spaces, and, in effect, supported the argument that cities were considered engines of economic growth. Furthermore, core-periphery conditions, as illustrated in Figure 4.3, tend to lead to the gravitation of economic activities to core areas. The concentration of economic activities in such areas, allows economic growth and expansion to occur.

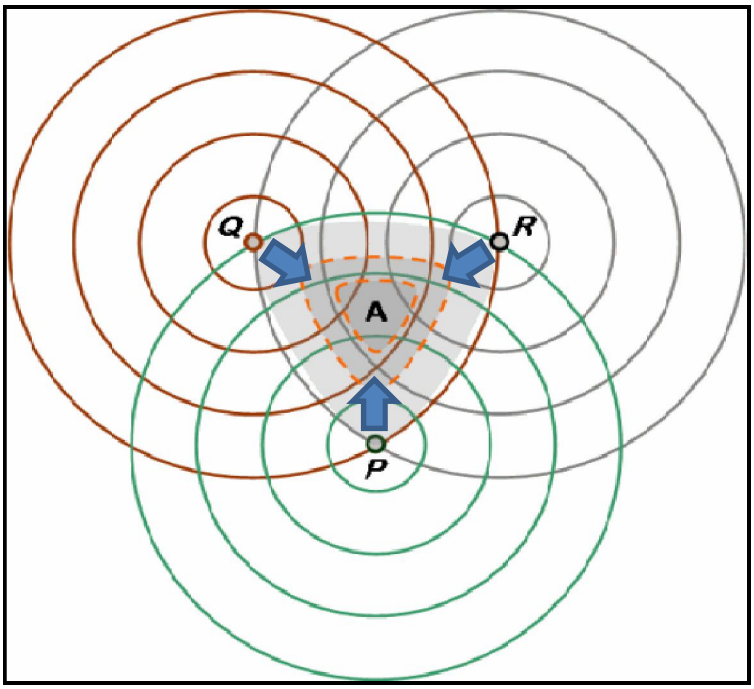


Figure 4-3 Agglomeration economies

Source: Own compilation

A central place (Christaller, 1933 & Lösch, 1954) is described as a locality or place that provides goods (central) and services to its service area and, importantly, the service area also includes all the people who are dependent on the central place as the provider of central goods and services. In essence, as noted by Van der Merwe (1987) and Geyer (2002), these people may be living in the service area of the centre, or may be living around it. Therefore, a central place not only meets its own demands, but its economic base is also supported by the people living in its surrounding area of influence. According to Van der Merwe (1987), reiterated by Geyer (2002), the term, 'central' refers to goods and services that are typically urban in character. Furthermore, in their view, there also exists a direct relationship between the economic base of an urban settlement, the size of its population and the size of its area of influence. This supports the argument of Lösch (1954) that the size of a service area not only relates to a

geographical area, but also to the goods and services provided. This means that, the larger the urban centre, the larger its area of influence. However, according to these researchers, to be realistic, cities are complex spatial entities; which is the reason for the combination of urbanisation and location economies when forming large cities.

Graham *et al*. (2010) took the concept further, referring to agglomeration as the scale of location accessibility. According to them, accessibility may be direct continuity within urban areas or between different main urban areas linked by transportation routes, emphasising the notion of a network. The network concept is considered to mean the underlying principles of the complex relationships that exist between different urban centres, due to the amalgamation of economic activities. Friedmann (1972) referred to these relationships as "gravitational properties which emphasise the magnitude of interaction between two development centres, resulting in the creation of a development axis derived from the sizes of the economies of the two centres relative to the distance separating them". Moreover, the network concept is associated with economies of scale and synergy. Therefore, the network concept, according to Meijers (2005), has become part of the standard vocabulary of planners and policymakers.

Friedmann (1972), Graham *et al*. (2010) and Rosenburg (2014) referred to accessibility as the modified law of gravitation, taking into account the population size of places, the distances between them and the size of their economies. In the view of Rosenburg (2014), "larger places attract more people, ideas and commodities than smaller places, resulting in different degrees of attraction between places". This aligns with Haggett's (1983) notion that "accessibility highlights the balance that exists between urban systems and the transport networks that connect them" (the law of gravitation is one of the key variables behind the construct of the Spatial Corridor Model (SCM) and is explained in more detail in Chapter 8).

Synergy, the outcome of agglomeration economies, is associated with the idea of multinodality. The assumption is that cities in close proximity to one another, relate to each other in a synergetic way, making the whole network of cities more than the sum of its parts (Meijers, 2004). Synergy expresses the rise in the performance of a network through effective and efficient interactions. Capello *et al*. (1998) analysed the concept of synergy and arrived at two distinct meanings, namely synergy is positive when two or more cities interact, or synergy is external caused by individual cities which voluntarily or non-voluntarily form part of a group of cities (proximity and synergy when collapsing a group of cities into core regional economic nodes are key variables in establishing a primary network of urban centres, and are explained in more detail in Chapter 8). Although interest in multinodality has grown, literature on the concept is limited, with the result that a diversity of related concepts is linked to it. Concepts that are linked to it include network cities, city regions and city networks, which are largely synonymous with the polycentric city concept (Bailey *et al*., 2001). Polycentric cities, according to Kloosterman *et al*. (2001), have coalesced in functional and morphological terms into larger and more dispersed urban systems. In their view, polycentric cities are independent cities all located in close proximity to one another, all well

connected through infrastructure. This explains the strong belief that polycentric or network cities are considered the most important aggregated spatial level, believed to be the next stage in the evolution of economic space development.

4.5 Network Cities

In simplistic language, city networks mean the linking of cities. These networks may be of a different nature and of different importance. In the modern conception of cities, networks as mentioned in the previous section play an important role in understanding city functionalities and development. City networks are not only physical connections such as roads, railroads, ship routes or airways, but also non-physical connections such as trade, finance, markets, migration, culture and shared social spaces.

According to Haggett (1983), the flow of trade and exchange along axes is the distinctive feature that allowed urbanisation to emerge. Basically, in his view, two types of economic flows can be distinguished: 1) transport economic flows, which involve the physical movement of something and 2) communication economic flows, which expand the concept of the sharing of information. Therefore, the former refers to the 'traditional' conception (Gottmann,: 1961; Boudeville, 1974), while the latter refers to the more 'recent' concept of network flows within a network of cities and nodes (Friedmann, 1966; Doxiadis, 1970; Castelles, 1996; Graham *et al*., 1996; Taylor, 2009). It is clear that transportation systems are a key feature of a city's economic development landscape. As early as 1850, Köhl created a series of networks that served regions. Furthermore, his ideas were adopted by Christaller to explain the development of urban systems. It is evident that both Köhl and Christaller identified two important features relating to networks: 1) that networks are hierarchical, in that they consist of a few major feeders and many tributary feeders; and 2) that networks have a branching structure that relates to flows. This means that the linkages within a network should affect the accessibility of cities connected to it. This supports the notion of economic growth and development that results from interactions between dominant urban centres. Furthermore, according to Haggett (1983), as illustrated in Figure 4.4, networks consist of two important elements: 1) nodes, denoting location and size, which are the intersection points and 2) links, denoting distance and capacity that display the forces of interaction (discussed in more detail in Chapter 5). The city itself is considered the node connecting different networks. According to Batten (1994), network cities evolve and grow when independent cities that are complementary in function, strive to co-operate and achieve significant scope economies aided by fast and reliable infrastructure. When considering the principles of locational theories, some of these networks are more powerful than others, creating higher and lower-order settlements which support the outcomes of economic space development and cities as sites of renewed economic dynamism. Many scholars have argued that a city can only be understood if the context of its connections is understood. It has also been argued that network cities are a key ingredient of what defines economic space development.

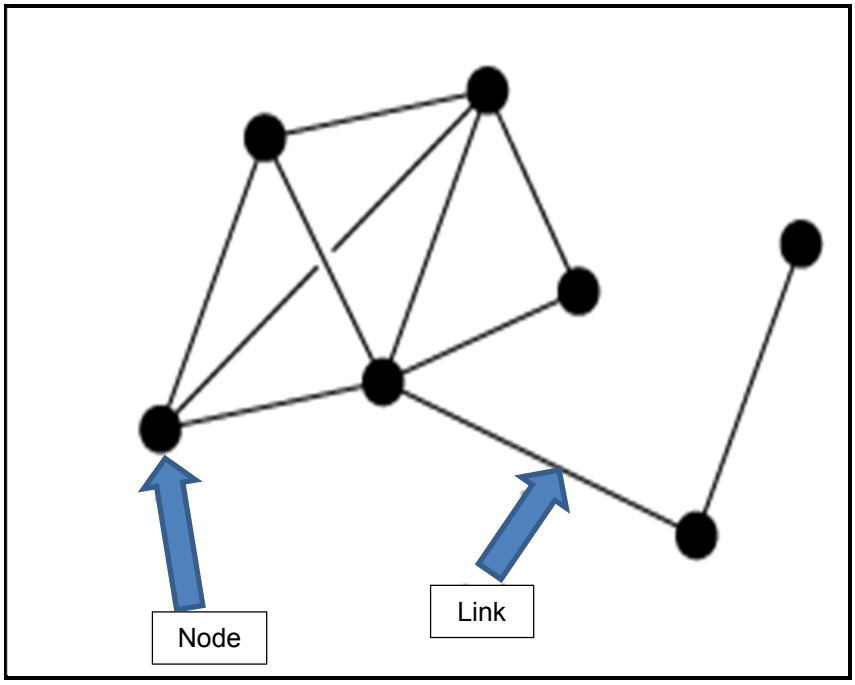


Figure 4-4 Network cities Source: Own compilation

The SACN (2016), in their interpretation of network cities after consolidating a wide range of urban functionalities located in different centres with different dominance, concluded that network cities provided the following key conditions:

1) A diversified economic environment through the amalgamation of various urban functions
2) Development corridors promoting interaction and economic growth
3) International city globalisation
4) Restructuring of current industries along with the incubation of new business opportunities – creating investment opportunities
5) A sophisticated polycentric urban structure/landscape
6) Promotion of multimodal integration and interoperability.

Therefore, as illustrated by Figure 4.4, do not operate in isolation. They are networked globally, nationally, regionally and locally, and form part of feedback loops in a competitive playing field. Cities, in the view of the SACN (2016), are complex, dynamic and constantly evolving environments, with new technologies rapidly shifting the context in which they operate.

4.6 Summary and Conclusion

It is evident from the study that cities play a key role in economic space development. Cities provide opportunities for creativity and innovation, resulting in certain cities or regions being selected as preferred locations for development. It is also evident that economic spaces are shaped by events creating different stages of economic development. These stages of economic development create a

shift in economic activities and employment patterns, moving from the one economic sector to the next. This shift is considered essentially positive because it increases quality of life, i.e. a highly developed economy presents societies with more choices and opportunities. Presenting societies with a multiplicity of choices and opportunities ultimately helps to generate urbanisation as a condition, which transforms economic and social conditions on a regional and global scale. Furthermore, urbanisation is interlinked with the beginning of industrialisation and modernisation, and is considered the most predominant process through which regions, cities and economic spaces are formed. The locational advantages produced by urbanisation ultimately result in strong interactions of spatial networks, leading to the notion that cities are the engines driving economic development. Furthermore, urbanisation is a result of exploiting economies of agglomeration, thereby creating opportunities of scale. The existence of agglomeration economies is central to how cities grow and develop, i.e. agglomeration economies lead to a greater concentration of people, economic activities and infrastructure, which means that resources are used more efficiently, resulting in more freedom in the structuring of space economies among regions and cities. Furthermore, agglomeration is also associated with synergy, which refers to positivism, i.e. one or two cities co-operating to voluntarily and non-voluntarily form a group or network of cities, supporting the notion that a network of cities is the most important spatial level or stage in the evolution of economic space development. The reason for this notion is based on the fact that city networks are more than physical connections; they are also non-physical connections such as trade, finance, markets, migration, culture and shared social spaces. Furthermore, a link to a network affects the relative accessibility of all the cities connected to it. This, in essence, supports the notion of economic development as a result of interactions between cities. This basically means that network cities are considered a key ingredient of what defines economic space development. Lastly, for cities to find their ‘place’ in a globalised world to support economic space development, they need to be attractive in spatial transformation.

The importance of this chapter is seen in the following: 1) it explores the basic elements behind the reasons why cities are considered key in transforming economic spaces; 2) it creates the foundation for step one in the construction of a Spatial Corridor Model (SCM), which is to establish the primary network of urban centres, i.e. to illustrate how regional and urban centres developed over time to represent the most dominant economies in the country; and 3) it justifies the first research question that economic space development quantifies the outcome of development forces.

Chapter 5 Development Corridor

5.1 Introduction

It is becoming clear that a different approach is needed towards the confluence of economic integration and inclusive growth at regional levels. It is also clear that when potential corridors are modelled along economic spaces, large cumulative benefits can become apparent. According to Brunner (2013), an approach that maps the economic landscape in a more dynamic way will allow for the distribution of benefits between regions. In essence, Brunner's notion of mapping economic spaces in a dynamic way underlines the basic principles for the construction of a Spatial Corridor Model (SCM) model (see Chapter 8), whereby specific investment opportunities are created to guide economic development.

Although an initial overview of literature does not reveal a picture of what development corridors entail, it is still possible to distil the key characteristics of development corridors that are more commonly known and accepted in the literature studies. The corridor concept, especially in German and French literature, has been regarded as an important planning instrument in geography for many decades. The first to study the concept of corridor development in great detail were Hurd (1924), Christaller (1933), Lösch (1954) and Perroux (1955). Pottier (1963) however, was the first to extensively study the origin of the development of corridors as a phenomenon in economic spaces. According to him, during the first initial stages of urban development, transportation routes serves merely as a link between two or more nodes. However, over a period of time, as more and more infrastructure is established, the purpose of the original transportation routes changes into multi-purpose axes. He deduced that these axes, defined as a nodal lines, serves as arteries to facilitate the creation of agglomeration economies, especially economies of scale which align with the basic principles of the NEG (see section 3.4). Studies expanding on the pioneering work that was done, include Friedmann (1966 & 1972), Berry (1969), Doxiadis (1969), Papaioannou (1969), Bähr (1976), Koch (1976), Tuppen (1977) and Geyer (1988). Their studies all reiterated the importance of urban centres in the creation of development corridors. However, there are indications that there is still uncertainty on what constitutes development corridors, especially what specific significance is attached to the vibrancy and interdependency of urban nodes that lead to the establishment of economic spaces. It seems that the issues that contributed towards this uncertainty are functional and locational relationships, in relation to dependency and interactions, rather than the achievement of development, due to proximity. In this regard, the research method for this chapter is a literature review to explore four key concepts to better understand what a development corridor is: 1) the basic concepts which describe what development corridors are; 2) the fundamental attributes and properties considered deterministic for the development of corridors; 3) the fundamental characteristics of network effects which enhance accessibility and interaction to create an environment of high economic cohesiveness; and 4) corridor systems which augment the growth and development of

economic spaces – multimodal systems serving as connectivity and key gateways to unlock commerce and economic development opportunities.

5.2 Concept of a Development Corridor

The concept of what a development corridor entails is by no means regarded as simplistic. Most definitions and descriptions put forward indicate that different perceptions exist around the concept. As a concept, it is generally referred to as promoting urban reconstruction and the enhancement of urban growth. However, corridors also bring forward other important alternatives such as the channelling of economic growth, the reconstruction of fragmented spatial disparities, the building or rebuilding of regions and the mapping of economic spaces. According to literature, there are many descriptions that are relevant, such as the following:

1) An upward transitional region connecting two or more development centres; intensity of axial development directly proportional to the product of the centre's economies and inversely proportional to the distance separating them (Friedmann, 1972).
2) A linear focus around which the spatial and functional organisation of a wide territory revolves, formed by more than one nodal region (Tuppen, 1977).
3) A planning mechanism that lends itself to the concentration of development within or between cities or nodes (Geyer, 1988).
4) A linear strip of land or area, connecting large activity nodes, traversing urban or inter-urban areas, surrounding a major transport facility or facilities providing an appropriate regional level of mobility and accessibility to adjacent areas, and containing a high concentration of population and mixed land uses (Andersen *et al*., 1998).
5) Mixed land use element of urban development, which occurs on a series of transportation routes working together (the CSIR, 1999a & 1999b).
6) Arvis *et al*. (2011), Buiter *et al*. (2011), Henning *et al*. (2012), Srivastava (2012) and Brunner (2013) had the same understanding, describing the concept as "economic agents along a defined geography that provide connections between economic nodes or hubs in which large amounts of economic resources and actors are concentrated, linking the supply and demand sides of markets".

It is evident that these descriptions all highlight important elements of what constitutes a development corridor. Two key elements are prominent: 1) there is a link between nodes providing access to different levels of economic opportunities; and 2) the intensity of economic development at nodes varies in size and dominance.

5.3 Attributes and Proprieties of a Development Corridor

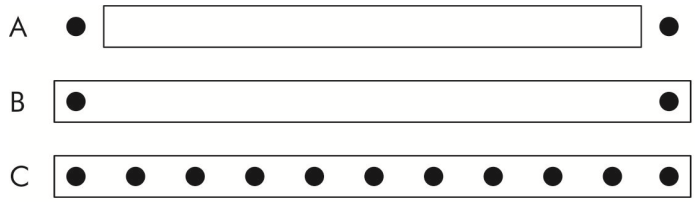
From Chapter 4 a development corridor originates from axes which express the forces of development that resulted from interactions between centres leading to the manifestation of development and economic growth. This is further emphasised by Geyer (1988) when referring to the axis as a nodal line which not only generates socio-economic interaction, but also accommodates the concentration of communication and infrastructure. According to him, when combined with the establishment of urban development (urbanisation in section 4.3 explains the concept of urban development), it constitutes what can be regarded as a development corridor. Arvis *et al*. (2011), Buiter *et al*. (2011), Henning *et al*. (2012) and Srivastava (2012) took it a step further, emphasising that development corridors connect economic agents along a defined geography. According to them, development corridors provide linkages between economic nodes in which large amounts of economic resources are concentrated, i.e. they link the supply and demand sides of markets (the concepts behind connections [networks], nodes [hierarchy] and concentration [agglomeration] are explained in detail in chapters 3 and 4). Their argument is based on the fact that development corridors are more than just linkages along which people and goods are moved; development corridors are integral to the economic footprint of a region and country. They concluded that development corridors did not channel economic growth in isolation, but rather as a network. This supports the notion of Hohenberg *et al*. (1985) that the concept of nodality is the linking of a network of cities within which trade occurs. According to them, combining the various nodes within a network of cities forms a unique, flexible exchange environment which allows urban partners to benefit from these dynamic synergies of interactive growth, whereby, according to Batten (1994), scope economies aided by fast and reliable infrastructure are achieved. Their notion aligns with the fact that cities are sites of renewed economic dynamism, described in Chapter 4. In Pacione's (2009) view, the focus is based on modern, urban agglomerations of economic activities that are comprised of an intricate web of cities where the functional and locational relationships provide holistic and competitive advantages.

Although Geyer (1988), also supported by Chittenden *et al*. (1990) and Druce (1997), distinguished the fundamental attributes and properties relating to development corridors, Gottmann (1961) initially made the argument that a development corridor is basically a "confirmation of the complex process of interaction, be it social, economic, or administrative, between two primary development centres, which tends to augment the development process in each centre, as well as in secondary centres on the axes in between". A simplistic way of explaining the same thing is to look at the process of the growth of a development node, whether it is a commercial or an industrial centre, a town, a city or a metropolis, as a result of its interaction with another node or nodes (see sections 4.3, 4.4 and 4.5). Gottmann's argument aligns with that of Hurd (1924) and Whebell (1969) that corridors are very persistent and are considered one of the most basic and important geometric systems in urban and regional development.

Therefore, according to Geyer (1988), Chittenden *et al*. (1990) and Druce (1997), there are specific fundamental attributes and properties allocated to development corridors, which are:

1) Corridors must have a vibrant development centre or node at both ends, with an axis linking the two centres. The development centre concept refers to any kind of economic node which functions as a nodal point in economic space, such as commercial or industrial nodes, a town or a city.
2) The centres must be mutually dependent, in order to support the flow of economic activities along the axes. A corridor is a phenomenon which comes into being as a result of social or economic interaction between two mutually dependent development centres.
3) Interaction must create the potential for further development. A corridor originates at the gravity point of a centre, follows an axis as the linear apex of the development axis field of centrifugal and centripetal forces, and ends at the gravity point of another centre functionally and strongly interrelated with the former.

Figure 5.1 simplifies or summarises the key attributes illustrating the connection of two or more development centres – the intensity of the axes directly linked to the product of the centre's economies, population size and the distance separating them.



A - Development centre linked by axes

B - Flow of economic activities resulting in economic interaction

C - Economic interaction create potential for further development

Figure 5-1 Key attributes linked to development corridors Source: Geyer (1988)

As already mentioned, Geyer (1988), Chittenden *et al*. (1990) and Druce (1997) also identified the fundamental properties which define the potential chronological development process of corridors which are:

1) *Morphological or structural properties* – Ideally, a corridor consists of two primary centres at both ends of an axis with possible secondary centres located on the latter. The sizes and scales of the economies of the centres on either end of the axis could have an impact on the distribution of

development along the axis with larger centres exerting greater forces of attraction on the axis than smaller ones.

2) *Evolution or chronological properties* – The growth of a corridor evolves over four stages. These stages include the potential, infant, mature, and advance stages of maturity. The *potential stage* consists of two economic nodes not yet displaying a significant degree of mutual interaction. The *infant stage* consists of fully developed centres with some degree of interaction between them. The axes become *mature* when one or more secondary centres develop along the axes between the primary centres on either end. Such a structure would probably take on a typical metropolitan form. The *advanced stage of maturity* is associated with high levels of urban concentration. The corridor now loses its prominence as a conduit and the associate urban structure takes on a polycentric urban form.
3) *Spatial properties* – Two forms of classification are possible under this rubric: classification, in terms of urban scale or regional scale. In terms of urban scale, corridors can be classified as intra-urban, inter-urban, inter-metropolitan or even inter-megalopolitan. Referring to regional scale, corridors can be local, regional, national or international. These classifications can be applied simultaneously in order to obtain a more refined classification of corridors.
4) *Dynamic properties* – Corridors could be classified in terms of their degree of development as: tertiary (the lowest order), secondary (middle order) and primary (highest order). If a corridor only consists of primary centres linked by an axis, it is of the lowest order, if secondary centres have developed in between, it is of the middle order and when one or more of the secondary centres have developed to such an extent that they compare favourably with one of the primary centres, then they are of the highest order.
5) *Functional properties* – Corridors are classified, in order to use them as development instruments. Four aspects are of importance in the classification of corridors, in terms of their functional value: the size; economic weight or vitality of the development centres; the distance separating the centres; the mutual interdependency; and the physical and economic circumstances under which the corridor operates.
6) *Properties of content* – Due to the composition of urban and regional areas, different urban or regional functions may dominate, allowing for the classification of corridors in accordance with the dominant function or combinations thereof. However, note should be taken that scale can play a role as well. Looking at development at a higher scale may result in the classification of a corridor as regional, or, considering development at a smaller scale may result in classification, in accordance with predominant land use, as urban. However, it is advisable to avoid confusion with the extent of development and use information such as the predominant types of interaction to assist classification.

Although Schutte (2003), Mommen (2011), Campbell *et al*. (2012) and Giersing *et al*. (2013) are in agreement with Geyer (1988), Chittenden *et al*. (1990) and Druce (1997), they also added two properties under which development corridors should take place:

1) *Economic viability* – Research conducted by Marrian (2001) in countries such as the United States of America, Canada and France, as well as local sources, suggested that the area in which a corridor is to be developed must show a pre-existence of strong economic growth, a natural propensity and strong effective demand for further development. If corridors are not economically feasible and do not offer investors a cash return, they are not economically viable. Corridor development must vary from one regional area to another to be able to compete with other potentially more favoured locations.
2) *Multimodal transportation systems* – It is imperative to integrate the existence of multimodal transportation systems to enable optimal economic functionality between regions. *S*trong functional links must exist between nodes as, without such links, there will simply be no reason for movement or interaction. Corridors must enable economic growth that attracts activities adequately linked by multitransportation systems (see section 5.5 for more detail).

Figure 5.2 simplifies or summarises the key properties illustrating the chronological development process of corridors. What is significant about the chronological development process of corridors is how it resembles Rostow's stages of economic development as described in section 4.2.

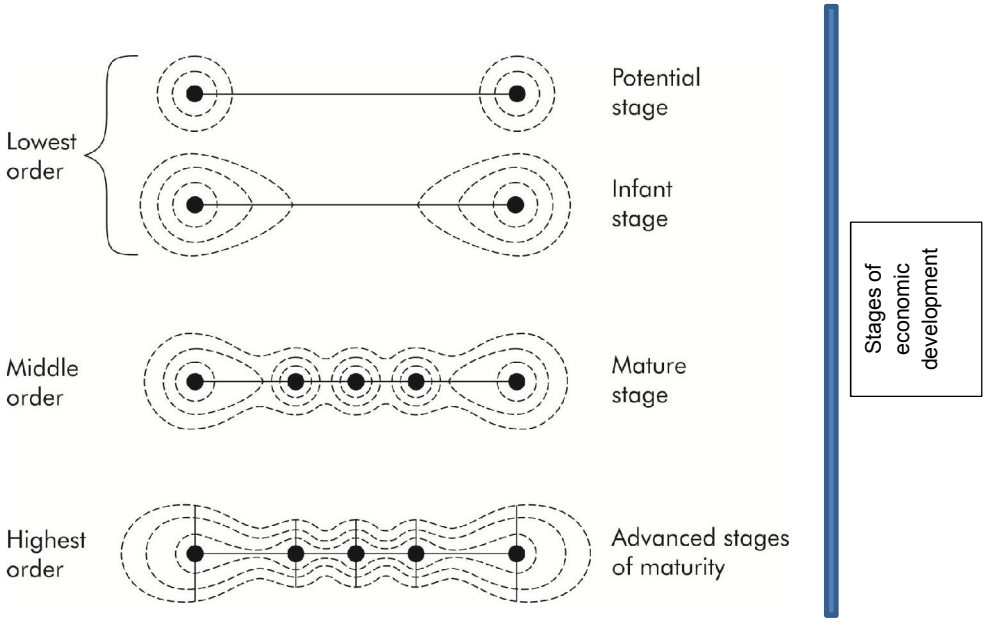


Figure 5-2 Chronological development process of corridors Source: Geyer (1988)

It is important to note that the attributes and properties presented above should not be generalised. Considering the arguments of Ohlin (1933) and Hoover (1937)), also supported by Geyer (1988), Chittenden *et al*. (1990), Schutte (2003), Mommen (2011), Campbell *et al*. (2012) and Giersing *et al*. (2013), that the creation of economies of scale leads to the amalgamation of industrial activities, which

leads to the creation of locational economies, the basic principles underlying NEG (see section 3.4), and the above attributes and properties are considered deterministic for the development of corridors.

5.4 Network Effects of a Development Corridor

The previous discussions highlighted the concept of networks supporting economic growth. Brunner (2013) concluded that networks displaying high economic cohesiveness normally resulted in the impact of development corridors tending to be more distributed and, conversely, networks displaying low economic cohesiveness resulted in the effects of development corridors tending to cluster. Therefore, according to him, the impact of development corridors is not limited to specific regions. He emphasised that it was important to measure the creation of potential corridors against the economic cohesion of high and low networks in which potential corridors are embedded. This measurement establishes three key classifications: 1) the degree of development; 2) the geographical scale – local, regional, national and continental; and 3) the status of integration, ranging from local to continental. The importance of network effects aligns with the economic viability discussed in section 4.5, as well as the level of attraction and integration between urban centres, which is discussed and supported by the outcomes in Chapter 8.

Hausmann *et al*. (2006), Pula *et al*. (2009), Henning *et al*. (2012), Cantner *et al*. (2006), Easley *et al*. (2010) and Felipe *et al*. (2012) took this a step further and identified the following as fundamental characteristics in creating network effects, which is illustrated in Figure 5.3:

1) *Vertical network integration* – Corridors are successful as part of an economic network of interactions. The characteristics and shapes of vertical networks are critical to the development of a corridor; an increased network density increases economic interaction, thereby improving the physical and informational accessibility in and between economic hubs. Population and land use densities play an important role in the shaping of vertical networks. Population densities and the change in densities through growth in economically active populations, and in and out-migration, co-determine the density of networks of economic interaction and influence supply, demand and diversification (technological) in markets. Land use density greatly influences movement patterns and volumes. It affects movement behaviour by affecting the number of trips made and the distance of trips travelled between destinations; the lower the density, the fewer the trips made and the longer the distances travelled, and *vice versa*. Land use and population provide a more diverse and sizeable base to support vertical network integration (this is used as a key variable in establishing a primary network of urban centres and is illustrated in more detail in Chapter 8).
2) *Information network integration* – Information networks shape the exchange of know-how, technology and market information. Information networks more effectively allow diffusion of knowledge, thereby strengthening regional integration and investments, which increases density and centrality. Furthermore, information networks ease the transmission of know-how, as they constitute collective processes of learning and absorption.

3) *Transport network completeness* – A transport network that has a high degree of completeness decreases the transaction length (in terms of cost and time) in and between economic hubs, thereby allowing industries to be reached more frequently and more reliably. Interconnectivity in transport networks and technologies is essential for regional economic and trade integration. Increased intermodal connectivity adds to the completeness of a transport network and the establishment of linkages. Interconnectivity is also associated with market accessibility. Market accessibility is strongly associated with trade expansion, diversification, attractiveness for investment and economic growth. Well-established and efficient transport networks have important economic characteristics, effects and consequences that enhance market access, either domestically and/or internationally (section 5.5 deals with this concept in more detail).

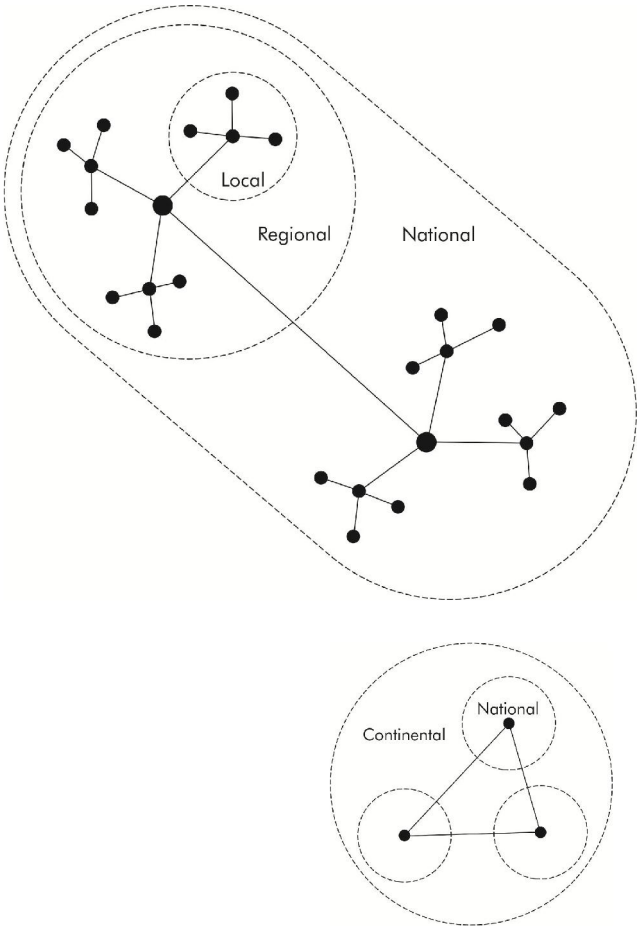


Figure 5-3 Network effects of development corridors Source: Batten (1994)

Therefore, according to Hausmann *et al*. (2006), Pula *et al*. (2009), Henning *et al*. (2012), Cantner *et al*. (2006), Easley *et al*. (2010) and Felipe *et al*. (2012), in order to realise network effects there must exist a network of some sort. They based their argument on the fact that, although networks can take on many forms, well-established and efficient network effects enhance accessibility and interaction, thereby

creating high economic cohesiveness, which is an important element in the establishment of development corridors, ranging from local to continental.

5.5 Development Corridor Systems

Evident from the previous section is the fact that the existence of a strong network of some sort is needed to enhancing accessibility and interaction (refers to the fundamental properties described in section 5.3, as well as transport network completeness highlighted in section 5.4). It is important to understand the existence of an ever-changing world, which is often linked to the rate at which networks, also referred to as transportation systems, are developing. Dynamic societies and the development of cities are leading to an ever-changing demand for transport, not only the availability of transport, but also faster and more efficient means of transportation systems. In Botha's (1966) view, there is a continuous evolution of transportation systems during the process of development and progress. Krynauw (2000) put it differently by indicating that it was evident that a proper, integrated transportation system was a precondition for not only addressing the need for transport, but also supporting economic development. In his view, the ability to guarantee smooth and efficient transportation of people and goods is a fundamental requirement for a successful, modern economy. Failure to achieve this represents a threat to growth, development and competitiveness, as well as reflecting the unsustainable use of the transport infrastructure. Needham (1977), Owen (1987), Queiroz *et al*. (1992), Vasiliauskas (2002), Eddington (2006), Kleynhans (2007) and Litman (2014) made the same observation that the complexity of interaction required finding the right balance between interoperable systems which provide adequate capacity, in line with economic needs. Interoperable systems, according to them, refer to the deployment of multimodal transportation systems as an integrated network enabling the creation of agglomeration economies (see section 4.4), thereby promoting multimodality as an integrated development process.

In simplistic language, a multimodal transport system is a combination of different modes of movement creating a network of some sort. However, according to Needham (1977), movement does not take place for its own mysterious reasons. Movement takes place because of connections between activities, which supports the notion of Friedmann (1972) that organised space relates to location that connects the flow of people, information and commodities; therefore, it is fundamental to understand that movement is a function of connecting activities. This is also highlighted by Botha (1966), stating that transportation systems ensure that the basic economic factors of supply and demand link the essential processes of production, distribution and consumption. In Botha's (1966) view, a well-integrated transportation system opens up larger markets, ensuring greater opportunities and competition, which are essential for economic development and growth in alignment with the NEG's third element (see section 3.4), namely that transportation is a critical entity that influences location. However, according to Litman (2014), in recent years, transportation planning has become more multimodal and comprehensive, considering a wider range of options and impacts. He proposed that multimodal transportation was complicated

because modes differed regarding various aspects, including availability, speed, density, costs, limitations, and their most appropriate use. Therefore, considering that economic development increasingly relies on a seamless, secure and efficient multimodal transportation system, transportation is being recognised as more crucial than ever.

The type of multi-modal transport systems which augment the growth of economic development are categorised as road; rail; sea; and air. However, these modes of transportation fall under two categories: general systems and key gateways. In the views of Owen (1987), Queiroz *et al*. (1992) and Eddington (2006), road and rail are considered general systems because they provide the basic connectivity needed to drive economic growth, while, according to the World Bank (WB) (2012), sea and air are considered key gateways because they provide an advancement in transportation technology whereby trade barriers are lowered, allowing for deeper integration of market access across the globe.

5.5.1 General systems

Road and rail transportation systems, according to Owen (1987), are considered the more common modes of movement. However, in the view of Queiroz *et al*. (1992), road and rail transportation are also considered essential for improving the economic prospects of a region. This is evident, considering the suggestion of Eddington (2006) that a compelling link has existed between road and rail transportation, and economic prosperity throughout history. He noted that road and rail connectivity played a critical role in driving economic growth. According to him, connectivity permitted new production processes that allowed regions to reap the benefits of increased returns to scale and competiveness, which aligns to the NEG's (see section 3.4) first element, namely that increased returns to scale stimulate economic production to cluster in space. In his view, the evidence is clear that the creation of basic connectivity is a very significant contributor towards economic growth.

Road transport by definition refers to the transportation of goods and people from one place to another using roads – a road refers to a route between two destinations which is either surfaced or gravelled. On the other hand, rail transport by definition refers to the movement of passengers and goods using wheeled vehicles made to run on railway tracks. Owen (1987) made the statement that a correlation of economic activities, and road and rail infrastructure was not meant to imply that road and rail transportation by itself was capable of developing a country or region, but that it was a necessary element in the economic development process of a region and/or country. Queiroz *et al*. (1992) supported his view, claiming that road and rail transportation was an important sector of economic activity and played an essential role in economic development. The statements of Owen (1987) and Queiroz *et al*. (1992) aligned with an earlier assessment by Assad (1980) declaring that a modern road and rail system was considered a critical element for the modernisation of economic development (see development of economic stages, section 4.2). This was further emphasised by Vasiliauskas (2002), indicating that a good road and rail system formed a major component of a highly developed economy.

Therefore, Owen (1987), Queiroz *et al*. (1992) and Vasiliauskas (2002) put forward the argument that a well-developed road and rail network was an integral part of a modern transportation network system. In addition, a good road and rail network maximises opportunities for trade, which ultimately benefits economic development. In their view, road and rail constitute an important mode of transport for both freight and passengers, and, furthermore, the primary function of road and rail transportation is to enable access and mobility for passengers, and goods and services, as illustrated by Figure 5.4. This should be executed in such a manner that it ensures movement between two points in the shortest possible time; movement that is convenient and safe; and movement that is reliable and cost-effective. Eddington (2006) later on added network coverage, also illustrated by Figure 5.4, as the additional, but all-important dimension within which the functions mentioned by Owen (1987), Queiroz *et al*. (1992) and Vasiliauskas (2002) should operate. However, they all had the same observation, stating that road and rail transportation was considered the heartbeat of development and performed the basic, but critical function of providing access, mobility and support for the execution of economic and social development. This observation was synthesised by Eddington (2006), stating that an appropriate road and rail transportation system could improve the way cities functioned within a network. He based his synthesis on the notion that people and businesses gravitated towards cities because of the benefits of being close to each other – close to potential jobs, potential employees, suppliers and customers. He concluded by indicating that road and rail improved the performance of agglomerations by improving links between cities or destinations.

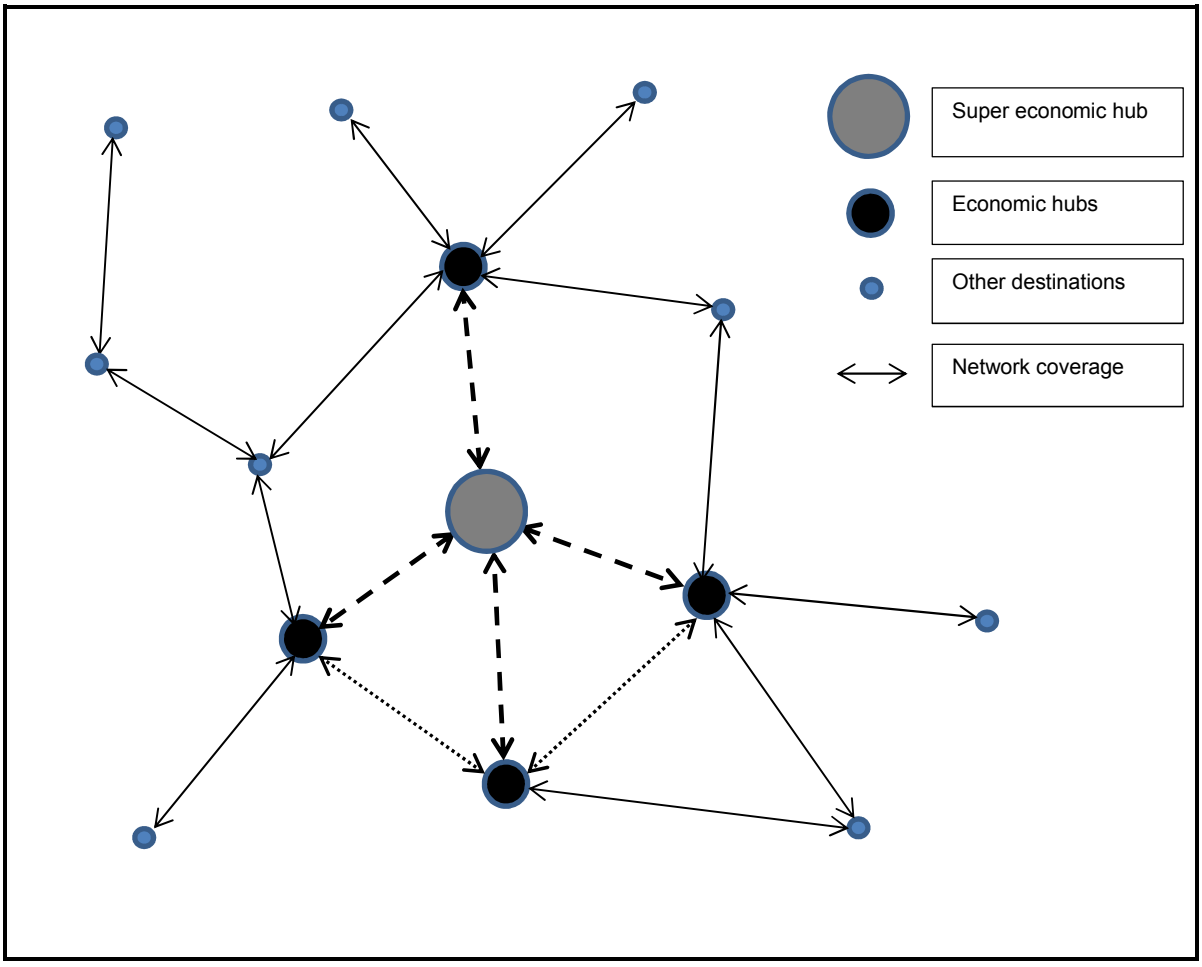


Figure 5-4 General transportation system Source: Own compilation

Therefore, to summarise the various observations made by Owen (1987), Queiroz *et al*. (1992), Vasiliauskas (2002) and Eddington (2006), road and rail transportation as a contributor towards economic development is based on three fundamental principles: 1) it creates a network coverage of connectivity enabling the movement of people and the delivery of goods between destinations; 2) it connects areas and destinations not catered for by other modes of transport such as sea and air; and 3) it provides access, mobility and support between major economic hubs.

5.5.2 Key gateways

Since 2001, the world economy has grown more than during any other period since World War II, and the advancement of information and transportation technology, which emerged as a key element in global economic change, is considered the contributing factor. This period is commonly referred to as the starting point of integrative trade, i.e. with the advancement of transportation technology, trade barriers have been lowered, which allowed for deeper integration of manufacturing, market access and the distribution of services across the globe. In essence, this aligns with the innovative contribution of the NEG that the spatial clustering (and dispersing) of economic activities, as a result of self-reinforcing centripetal forces, progressively removes trade barriers (see section 3.4). In this regard, the WB (2012)

escalated sea and airports as key gateways in the lowering of trade barriers to unlock the commercial and economic development of a country. They based their argument on the basis that cargo is moved in a secured manner (less damage and pilferage); cargo is easily and accurately tracked; greater volumes of cargo and people are moved; and the turnaround times (speed) between destinations are faster.

5.5.2.1 Shipping transport

Shipping transport by definition refers to vessels carrying people (passengers) or goods (cargo). Sea transport or coastal shipping, in Pillai's (2012) view, is considered the largest carrier of freight, estimating that some 90 per cent of all goods being bought are transported by sea. He describes coastal shipping as the movement of cargo over water, covering various distances by boat, ship or barge. It is a known fact (Pillai, 2012) that shipping has always been regarded as an important transport sector of economic activities and is well suited for the transportation of bulk cargoes. Maharaj (2014), supporting Pillai's view, asserted that the shipping sector was considered an integrated system within the global supply chain and, according to Merk (2014), seaports have traditionally been the drivers of economic growth, changing coastal cities into global hubs for trade and services. This was confirmed by the World Shipping Council (2017), declaring that the shipping industry transported some four trillion US dollars' worth of goods annually. Furthermore, the total of containers handled by all ports worldwide (including empties, transhipments and port handling) was estimated at more than 680 million. It is clear that the shipping industry has made a profound impact on economic development, especially on a global level. The reason for this, according to Mijajimi *et al*. (1989), Fleming (1989), Slack (1994), Coeck *et al*. (1997), Pillai (2012), WB (2012), Maharaj (2014) and Merk (2014), is that, in the 1950s, containerisation was considered one of the greatest inventions of the 20th century, revolutionising the shipping transport industry. In their view, containerisation is seen as the most powerful exogenous determinant in the seaport sector, which caught on fast because it drastically increased cargo-handling capacity (in terms of tons per hour), as well as protecting goods from damage and pilferage. Baird (1996) placed further emphasis on this assertion, stating that one of the biggest contributing factors of containerisation was the facilitation of the current globalised economy, i.e. when considering the spatial fragmentation of the manufacturing sectors across the world, sea routes connected countries, markets, businesses and people, allowing them to buy and sell goods on a scale not previously possible. The reality, in his view, is that the needs of a rapidly growing world population can only be met by transporting goods and resources between countries. Therefore, the container has allowed for the increase in economies of scale and competiveness, which, according to Porter (1990), is similar to the basic principles of NEG (see section 3.4). This is supported by Rugman *et al*. (1993) and Cartwright (1993), expressing the view that port operations mainly target markets in a domestic, as well as a global context. However, they also added that ports were more related to international competiveness and that the importance of seaports was directly connected to the activity clusters within ports. Moon *et al*. (1998) expanded the views of Rugman *et al*. (1993) and Cartwright (1993) by adding that the strength of a port as a transfer point was

fundamentally dependent on the strengths of other links and transfer points, as illustrated in Figure 5.5, which, in essence, supports the view of Hohenberg *et al*. (1985) that functional and locational networks form a unique, flexible exchange environment from which economic development benefits. Therefore, in their view, the continued efficiencies for global trade gained by the use of the shipping industry are dependent on the strength of other transportation networks to allow for the timely and efficient transfer of goods. Merk (2014) added to their view by indicating that the most critical aspect of port cities was the fact that they provided the required link to other important modes of transport, such as road and rail, when transferring goods.

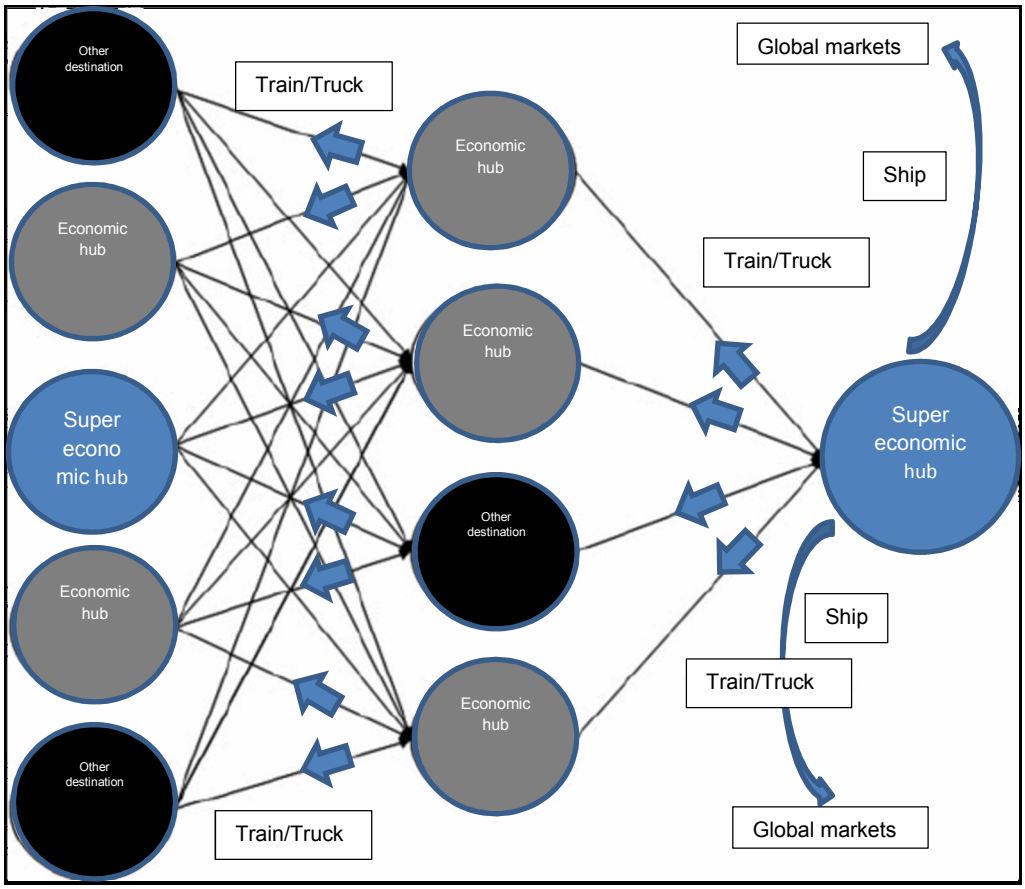


Figure 5-5 Seaports, strengths, links and transfer points

Source: Own compilation

The World Shipping Council (2017) made the argument that the shipping industry laid claim to being the world's first truly global industry, i.e. the industry, more than any other, had made it possible for a truly global economy to work. The council based its argument on the fact that the ability of the shipping industry to handle more bulk cargo than any other transportation system had changed the shape of the world economy, making global trade more accessible and efficient. Furthermore, the council concluded that the shipping industry as a global economic engine was based on two fundamental principles: 1) by

moving more bulk cargo, the industry contributed significant value directly to the global economy; and 2) by transporting goods and resources between destinations, the industry played a facilitating role in the economic growth of other industries.

5.5.2.2 Air transport

Air travel by definition refers to a form of travel that sustains flight, commonly described as responsible for the mobility of millions of people every day. *The Pretoria News* (2015) published a short article which provided a fundamental insight into the importance of the aviation industry in economic development, locally as well as globally. According to the article, air transport is separated into two general classifications, namely national/domestic and international flights. Flights from one point to another within the same country are domestic flights and flights from a point in one country to a point within a different country are known as international flights. Most air travel starts and ends at a commercial airport. Furthermore, according to the article, airports are well positioned as logistics and distribution hubs for trade and investment opportunities. Airports offer significant opportunities, as they play the role of magnets for industrial development and foreign investment. Therefore, by promoting air travel, businesses are connected with existing and prospective markets, i.e. air travel enhances the role of an airport from an infrastructure provider to a service provider, facilitating access to markets while simultaneously growing the local economy. The article concluded by stating that a combination of cargo capacity, locality, connectivity, accessibility and infrastructure positioned air transport as a logistic super hub, making this mode of transport a key element of economic development and competitiveness (see Figure 5.6). In essence, it reduces the impact of being on the periphery and provides an important link with domestic and international destinations. In the view of Guimera *et al*. (2005), which aligns with the article, it is obvious that air travel correlates strongly with socio-economic factors such as population density and economic development. This is evident, considering the fact sheet published by the International Air Transport Association (IATA) (2017) declaring that the aviation industry transports close to four billion passengers annually. Furthermore, also according to the IATA (2017) fact sheet, aviation's total annual global economic impact is in the vicinity of three trillion US dollars' worth, which includes the direct, indirect, induced and catalytic effects of tourism. This basically emphasises the fact that like any other critical infrastructure, air transportation has an enormous impact on national and international economies.

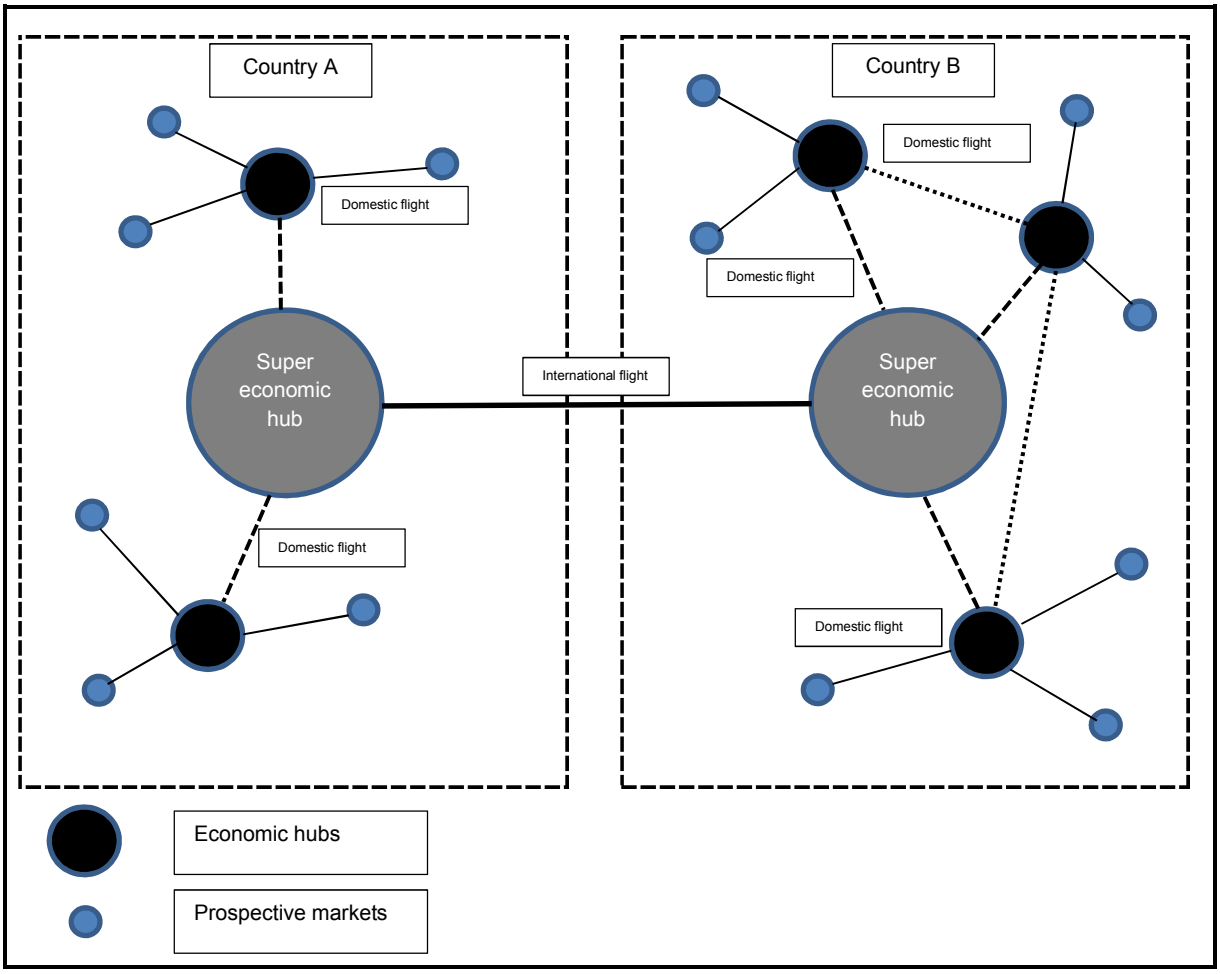


Figure 5-6 Airports: combination of locality, connectivity and accessibility

Source: Own compilation

The WB (2012) made the argument that the aviation industry was considered the only worldwide rapid transportation system. The WB based its argument on the fact that planes carrying passengers and cargo reached their destinations must faster than any other transportation system, which resulted in very quick turnaround times. Furthermore, according to the WB (2012), also supported by IATA (2017), the aviation industry as a global economic engine is based on two fundamental principles: 1) the industry moves cargo and people more rapidly, thereby increasing economic and social progress; and 2) the industry enhances access to global markets and destinations by distributing high-value, time-sensitive goods rapidly.

5.6 Summary and Conclusion

It is evident that a development corridor represents axes which express forces of development, i.e. it is an outcome of the flow of activities (goods, services and information) between urban centres, which leads to the manifestation of urban development and economic growth. The functional relationships between nodes play a more important and decisive role in the creation of corridors than the distance

between nodes or the demand threshold of each node. This normally results in urban configurations taking the form of corridors. Therefore, it is clear that development corridors create opportunities to strengthen partnerships and increase the spatial attractiveness of regions and cities to business and industrial sectors, resulting in economic growth and development. Linking regions and cities not only improves the operational and economic efficiency of a region or country, it also creates a myriad of new economic opportunities, more specifically, it creates integrated networks of systems supporting the flow of goods; improved infrastructure; increased and more efficient interactions; and expanded business involvement. Furthermore, improved infrastructure allows for increased movement and other improved transportation efficiency, pushing forward economic and regional integration. Corridors support the upgrade of existing core infrastructure to attract and maximise investment opportunities, and to ensure sustainability through the implementation of relevant policies and strategies. This also promotes transportation systems, which are essential ingredients contributing to sustainable economic development. It is evident that, in relation to a well-developed transportation system, the shipping and aviation industries are considered key gateways to unlocking commerce and economic development opportunities. The argument is based on the movement of bulk cargo; the fact that cargo is moved in a secured manner; the ease and accuracy with which cargo is tracked; and the turnaround times of the ships and planes carrying cargo or people, which together lowered trade barriers to unlock economic opportunities at a global level. Although the shipping and aviation industries are considered, first and foremost, key gateways, they cannot operate in isolation. They must function in a multimodal manner to maximise economic potential, i.e. their linkage with road and rail transportation is particularly important and warrants the attention of a network approach. It is, therefore, clear that the manner in which industries operate has significant implications for transportation requirements. Increased access and connectivity creates increased opportunities, which lead to long-term gains. These increased opportunities are analogous with the gains from lowering trade barriers. Therefore, knowing the circumstances in which these increased opportunities occur is an important part of understanding the economic benefits that arise from a well-developed, multimodal transportation system. In essence, a strong, multimodal transportation system offers improved access at lower costs, making it a catalyst for economic growth. The idea behind development corridors is that economic growth or economic space development is created from transforming the functional relationships that exist between urban centres into economic development zones. This produces benefits that include the enhancement of trade opportunities; the opening up of neighbouring markets to one another; the granting of access to global markets; and the encouragement of public and private investment opportunities.

In conclusion, the most critical elements applicable to development corridors are: 1) transportation systems – usually more than one mode of transport; 2) the economic viability of urban centres – high economic cohesiveness; 3) spatial governance – enhances economic sustainability; 4) private and public initiatives – creates investment opportunities; 5) strong networks – enhances accessibility and

interaction; and 6) strong, viable interactions between urban centres – the degree of strength between urban centres.

The importance of this chapter is: 1) to emphasise the role of development corridors in economic space development, i.e. what essential attributes and properties are needed to create investment opportunities; 2) to provide a measurement to establish prominent development corridors whereby investment opportunities, which ultimately enhance economic space development, are created; 3) to emphasise the role of well-developed network systems; and 4) to justify the second research question that development corridors are considered an important planning instrument for restructuring economic space development.

Chapter 6 International Perspective

6.1 Introduction

Case studies are, in essence, lessons of experiences distilled from real-life events. Each experience is actively taken into account for future consideration. One can argue that lessons are knowledge or understanding gained from experience. The experience may be positive or negative, but the lessons must be significant, in that: 1) they have a real or assumed impact; 2) they are valid, i.e. factually and technically correct; and 3) they are applicable, i.e. identify a specific design, process or outcome. Therefore, lessons are based on evaluating experiences abstracted from specific circumstances prepared for broader situations. The broader situation relating to the purpose of this research is to consider the importance of international lessons for gaining international insight into the utilisation of development corridors as an intentional design to enable inclusive and sustainable economic growth. In this regard, the research method for this chapter is a combination of literature review and comparative analysis, where real-life events in the broader European and South American context are explored in more detail.

6.2 Case Studies

The reason for selecting Europe and South America as relevant case studies is to establish the common line of thinking or consideration between developed and developing countries when approaching development corridors as an instrument towards economic space development. Although the selection reflects a continental scale and not a national scale, the relevance is applicable to network effects, which ultimately establish the geographical scale of development corridors (see section 5.4 and Figure 5.3). In this regard, it is important to understand that, although different terminologies across the various geographical scales are linked to corridors, development centres, which are classified as cities, core regions, growth points, growth poles, growth centres or gravity points and serve as activators of economic development, are primarily linked to a national and continental scale. This means that the model constructed as illustrated in Chapter 8 may be applied on either a national or continental scale, making the selection of Europe and South America as case studies comparable for the purpose of the study. Specific focus is placed on development corridors as a key instrument in creating economic integration, considering scale, intensity and status.

6.2.1 European development corridor initiative

Hajer (2000) and Priemus *et al*. (2003) stated that around the 1990s, the European Union (EU) started to explore development corridors as a concept to reshape the spatial structure, as well as stimulate and improve the economic performance, of Europe. They observed that ‘Project Europe 1992’, which aimed to create a borderless Europe to substantiate cross-border economic integration, played a pivotal role.

According to them, location had a great deal to do with this line of thinking, considering that cross-border and transnational infrastructure would offset remoteness and being on the periphery which, in general, would make economic integration more viable. This expectation led to the establishment of the Trans-European Transport Networks (TEN-T) project, which is considered one of the most important outcomes of the European infrastructure discourse.

In the observations of Priemus *et al*. (2003), this trend of thought primarily focuses on the idea of linkages which were brought together under the umbrella of the development corridor concept. In particular, various transnational studies under the auspices of the Commission of the European Communities (CEC), conducted in 1994, 1996, 1997 and 1999 to produce the European Commission (EC) report – Europe 2000+ – give prominence to the concept. These studies direct the development corridor concept to the emergence of cross-border cities with very high nodality. This notion of high nodality, which aligns with the concept of network cities as described in section 4.5, places strong emphasis on higher and lower-order settlements to improve economic development. However, the studies to achieve, stimulate and improve economic performance across Europe place more emphasis on higher-order settlements as independent cities, complementary in function and aided by fast and reliable infrastructure. Furthermore, according to Priemus *et al*. (2003), the development corridor concept is defined in these studies as a combination of one or more important infrastructure axes (road, rail, air and water lines), with heavy flows of cross-border traffic that link important urban areas. Therefore, the approach adopted by the CEC was based on identifying a hierarchy or network of cities with the highest order (offering the largest variety of functions and services), linked by well-developed transportation routes, which would ensure the strongest impact on economic development. Although the approach took into account the spatial distribution of settlements, according to economic dominance, which is a key element – high economic cohesiveness – in the creation of development corridors, it did not consider the strength of the economic advantages the cities provide, relative to one another, within an integrated and supporting network. The strength of economic advantages between cities is one of the key steps in the construct of the Spatial Corridor Model (SCM), which is explained and illustrated in Chapter 8. Furthermore, the basis of TEN-T is a planned set of multimodal transportation systems, which is another key element – more than one mode of transport – in the creation of development corridors, comprised of road, rail, air and water transport networks. TEN-T envisaged coordinated improvements to primary roads, railways, inland waterways, airports, seaports, inland ports and traffic management systems that would provide integrated and intermodal, long-distance, high-speed routes to enhance accessibility and interaction. This planned improvement of a set of multimodal transportation systems will ensure that none of the cities within the hierarchy will operate in isolation, but rather as a network represented at a global, national and regional level, forming part of a highly competitive playing field, i.e. creating potential investment opportunities that will enhance economic growth. Therefore, although development corridors are considered a strong means of boosting investment opportunities and economic growth, they are also a means of advancing and showcasing the achievements of the wider EU policy objective, which is to

stimulate and enhance the economic performance of Europe at a global, national and regional level. In this regard, nine core development corridors were identified as a means of promoting economic development opportunities through the creation of overarching transport solutions. The ultimate objective of infrastructure development along these corridors – and on the core network as a whole – is to complete seamless connections between cross-border cities with very high nodality, with the aim to create efficient, future-oriented and high-quality transport services that will support and enhance economic investment opportunities (EC, 2011 & 2014).

The nine core development corridors (see Figure 6.1), established through the EC (2011 & 2014) will function along the lines described below:

1) The Baltic-Adriatic corridor is one of the most important trans-European road and railway axes. It connects the Baltic with the Adriatic Sea, through industrialised areas between Southern Poland (Upper Silesia), Vienna and Bratislava, the Eastern Alpine region and Northern Italy.
2) The North Sea-Baltic corridor connects the ports of the Eastern shore of the Baltic Sea with the ports of the North Sea. The corridor will connect Finland with Estonia by ferry, provide modern road and rail transport links between the three Baltic States on the one hand and Poland, Germany, the Netherlands and Belgium on the other. Between the Odra River and German, Dutch and Flemish ports, it also includes inland waterways, such as the 'Mittelland-Kanal'.
3) The Mediterranean corridor links the Iberian Peninsula with the Hungarian-Ukrainian border. It follows the Mediterranean coastlines of Spain and France, crosses the Alps towards the east through Northern Italy, leaving the Adriatic coast in Slovenia and Croatia towards Hungary. Apart from the Po River and some other canals in Northern Italy, it consists of road and rail.
4) The Orient/East-Mediterranean corridor connects the maritime interfaces of the North, Baltic, Black and Mediterranean Seas, allowing optimisation of the use of the ports concerned and the related motorways of the sea. Including Elbe as inland waterway, it will improve the multimodal connections between Northern Germany, the Czech Republic, the Pannonian region and Southeast Europe. It extends, across the sea, from Greece to Cyprus.
5) The Scandinavian-Mediterranean corridor is a north-south axis, crossing the Baltic Sea from Finland to Sweden and passing through Germany, the Alps and Italy, linking the major urban centres and ports of Scandinavia and Northern Germany to continue to the industrialised high production centres of Southern Germany, Austria and Northern Italy further to the Italian ports and Valletta.
6) The Rhine-Alpine corridor constitutes one of the busiest freight routes of Europe, connecting the North Sea ports of Rotterdam and Antwerp to the Mediterranean basin in Genoa, via Switzerland and some of the major economic centres in the Rhein-Ruhr, the Rhein-Main-Neckar regions and the agglomeration of Milan in Northern Italy. This multimodal corridor includes the Rhine as an inland waterway.

7) The Atlantic corridor links the western part of the Iberian Peninsula and the ports of Le Havre and Rouen to Paris and further to Mannheim/Strasbourg, with high-speed rail lines and parallel conventional ones, including the Seine as inland waterway.
8) The North Sea-Mediterranean corridor stretches from Ireland and the north of the United Kingdom (UK) through the Netherlands, Belgium and Luxembourg to the Mediterranean Sea in the south of France. This multimodal corridor, comprising inland waterways in Benelux and France, aims not only at offering better multimodal services between the North Sea ports, the Maas, Rhine, Scheldt, Seine, Saone and Rhone river basins and the ports of Fos-sur-Mer and Marseille, but also better interconnection of the British Isles with continental Europe.
9) The Rhine-Danube corridor, with the Main and Danube waterway as its backbone, connects the central regions around Strasbourg and Frankfurt via Southern Germany to Vienna, Bratislava, Budapest and finally the Black Sea, with an important branch from Munich to Prague, Zilina, Kosice and the Ukrainian border.

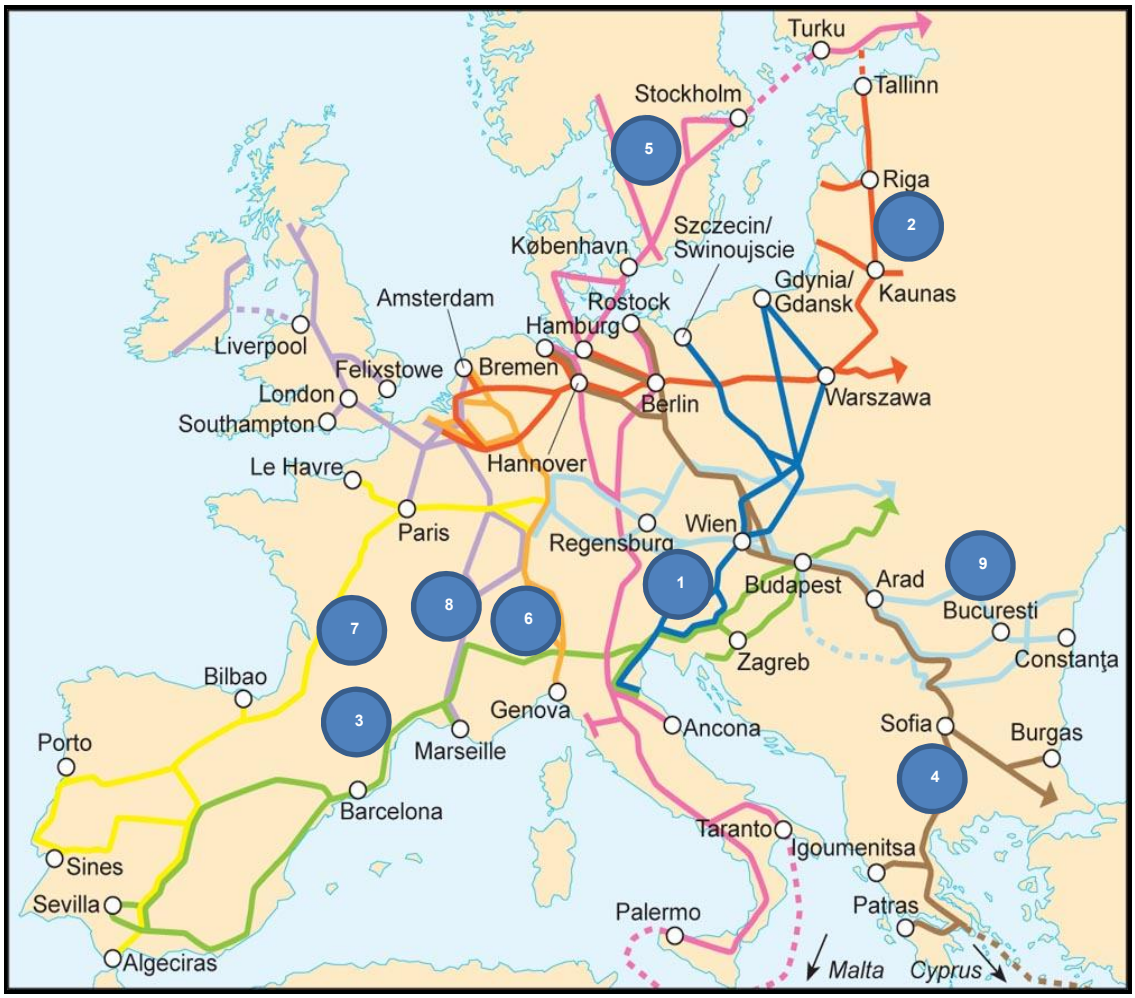


Figure 6-1 European development corridor initiative

Source: European Commission (2011 & 2014)

Note: Each number on the map represents a corridor which corresponds with the description provided for each corridor above

Although the EU policy objective is built on the premise to stimulate and enhance the economic performance of Europe at a global, national and regional level, the EC's White Paper on Transport – *Roadmap to a single European Transport Area – towards a competitive and resource-efficient transport system* – which was published in 2011, placed specific focus on strengthening the alignment of TEN-T and transport policies to enhance increased mobility as a condition for inclusive and sustainable economic growth. The White Paper (EC, 2011) sets out a range of policy measures which are, inter alia, aimed at:

1) removing boundaries between countries to create greater market access, which aligns with the NEG (see section 3.4)
2) extending transport and infrastructure policies to all countries to deliver closer market integration, which aligns with economic viability as described under the attributes and properties of development corridors (see section 5.3)
3) promoting global competitiveness by ensuring efficient connections with global markets, which also aligns with economic viability (see section 5.3).

One aspect emerging from the White Paper is that none of the policy measures can be implemented in a holistic way without the provision of corresponding infrastructure, i.e. the all-encompassing structure of the new TEN-T enables the promotion of a network approach creating stronger integration. Therefore, the strengthened network approach which aligns with the network effect of development corridors, as well as development corridor systems (see sections 5.4 and 5.5), with infrastructure management at a multimodal level, constitutes a strong basis for an enhanced accessibility and mobility system. In this respect, the nine core development corridors also contain a wealth of smaller projects, action plans and initiatives which – besides the large investment projects – will contribute to advancing economic development across Europe (EC, 2011 & 2014). Furthermore, the complexity of the core development corridors is a real challenge. However, on the other hand, the benefits expected from the multitude of interactions and synergies should be considered strong motivators to face these complexities and, with this ambition in mind, the commission would like to see the nine core development corridors being the forerunners of a full core network that will stimulate and improve the economic performance of Europe.

In conclusion, it is evident that the method or approach adopted by the EU to explore development corridors as a concept to reshape the spatial structure, as well as to stimulate and improve the economic performance of Europe, is built on four key elements:

1) To create a core network of cross-border cities with very high nodality, i.e. identifying a hierarchy of cities offering the largest variety of functions and services
2) To create overarching, multimodal transportation solutions linking each city within the core network and ensuring that each city does not operate in isolation, but rather as a network represented at a

global, national and regional level, which forms part of a highly competitive playing field that will support and enhance economic opportunities

3) To establish a network of core development corridors linking each cross-border city through an overarching, multimodal transportation system as a means of promoting economic investment opportunities
4) To define policies, with the vision to promote increased accessibility and mobility as a condition for inclusive and sustainable economic growth.

6.2.2 South America development corridor initiative

In the view of Phillips (2000) and Lee (2011), the most recent era of economic space development in South America, which began roughly with the Alliance for Progress in the early 1960s, the occupation and the shaping of geographical space to meet development requirement has been a predominant and ongoing activity. According to them, this is linked to the manifestation of economic cohesiveness, which is associated with the new emergence of regional integration. Furthermore, in their view, the most dominant manifestations of this phenomenon have been the steady emergence of development corridors promoting economic growth and development through regional integration.

The concept of the emergence of development corridors in South America, according to Lee (2014) displays two important elements:

1) Production functions that enhance the availability of basic goods and services, which aligns with economic viability as described under the attributes and properties of development corridors (see section 5.3)
2) Improved access to markets, both national and international, which aligns with the NEG (see section 3.4).

Although the production functions in South America have progressed enormously over the past three decades, access to markets, in Lee's (2011 & 2014) view, is perhaps the most dramatically evolving component. In South America, multimodal transportation systems such as railroads provide access to markets; maritime shipping offering the largest access to markets; and road transport, still responsible for transferring most exports, play a pivotal role in the economic development of South America. However, as Lee (2014) rightly points out, the introduction of technology in the rail, road, maritime and air transport sectors to serve as access modes to inter-regional and international markets, is still bringing about change, and allowing for a stronger emergence of regional integration through the development corridor concept.

Furthermore, as postulated by Phillips (2000) and Lee (2011), and previously highlighted by Batista (1997), development corridors as regional units stretching over three decades of modern development in

South America, dictating to, as well as taking from, the cities within their domain, thereby shaping economic space development i.e. the opportunity for South American cities to break from old development models; to maximise the advantages of decentralised political and economic decision-making; to fortify democratic institutions and public participation; and to encourage private sector investment is tied directly to their participation in development corridors. Development corridors are the vehicle of transformation to sustain economic and social development in South America. However, as pointed out by Phillips (2000), Cardoso (2000), Cervo (2001) and Lee (2011), cities should also be considered principal players in the creation of development corridors. In this regard, the development of cities is directly linked to the role cities as nodes play in the creation of development corridors. Therefore, the sustainability of urban and economic development is dependent on what guidelines are used to direct the evolution of development corridors.

During a meeting of South American presidents to enhance and support the concept of regional integration, the Initiative for the Integration of the Regional Infrastructure of South America (IIRSA), which is a development plan linking the South American economies through integrated axes, was launched (Phillips, 2003b). The initiative includes the 12 countries of South America which form the Union of South American Nations. Furthermore, it is being supported by the Corporación Andina de Fomento (CAF), the Inter-American Development Bank (IDB) and the River Plate Basin Financial Development Fund (Fonplata). Together, the three institutions form the Technical Coordination Committee (TCC), which provides technical and financial support for IIRSA activities. The initiative (IIRSA, 2005, 2009 & 2011) is comprised of 10 axes or hubs of economic regional integration crisscrossing the continent, promoting regional integration and improved global competiveness (see Figure 6.2). Embarking on justifying the scope of the IIRSA, the IDB (2010) prepared a document which began with understanding globalisation and the notion of regionalism as the new global and regional context attempting to set forth the appropriateness of building physical integration between the South American regions. In other words, according to the report, South America was put forward to comply with the requirements set by global economies, as well as to strengthen South America's position to be more attractive in the global economies, i.e. South America as a whole was pushed to maximise its comparative advantages. This justification aligns with Couto's (2007) view about the necessity to pursue the development corridor as a concept of promoting regional integration. Furthermore, he also highlighted the fact that development corridors permitted the notion of structure and function, i.e. it is evident that the initiative around economic regional integration is organised around economic development in an increasingly global economy, structured to promote growth and function to create a return on investment. This is further highlighted by Van Dijck (2013) indicating that the IIRSA was born to strengthen a comprehensive insertion of South America in world markets and, more particularly, according to the IIRSA (2011), to recognise regional identity. Also evident is the fact that, the same as with the European initiative, the development corridors are comprised of smaller integration projects to

create stronger regional integration, which demonstrates the level of cohesion among the South American countries to share development priorities (Couto, 2007).

The 10 core integrated and development axes, as illustrated by Figure 6.2 include: 1) the Amazon axis; 2) the Andean axis; 3) the Southern Andean axis; 4) the Capricorn axis; 5) the Escudo Guianes axis; 6) the Paraguay—Paranà axis; 7) the Central Inter-Oceanic axis; 8) the Mercosur—Chile axis; 9) the Peru, Brazil, Bolivia axis; and 10) the Southern axis. It is important to understand that these axes represent geographic areas encompassing existing urban systems, as well as new, growing urban areas, all linked by transportation systems inclusive of road, rail, air and water. In essence, different from the EU approach, is the fact that each geographical area representing a development axis includes all cities of higher to lower order and not only cities of high nodality. The reason, according to Lee (2011), is as mentioned earlier, to break down old development models and provide each city with the opportunity to participate in economic development.

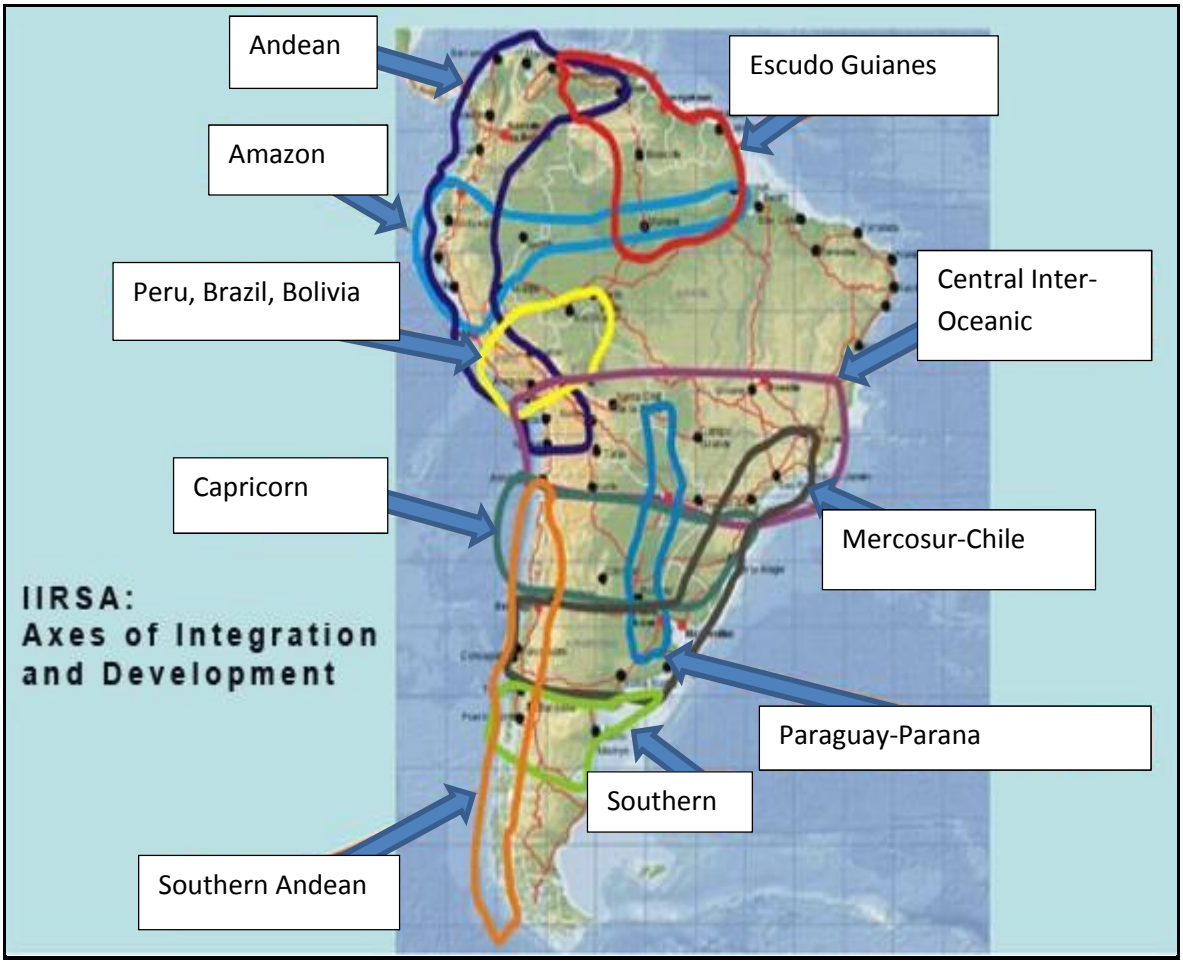


Figure 6-2 South America development corridor initiative

Source: IIRSA (2005) & Couto (2007)

Furthermore, according to Lee (2014), to achieve the above aims, the South American Council on Infrastructure and Planning was established in 2009 to emphasise the mandate conferred by the Union of South American Nations regarding physical integration, so as to obtain sustainable economic development and reduce existing asymmetries in South America via regional infrastructure integration. In order to accomplish the above mandate, as well as reinforce the legitimacy of the South American Council on Infrastructure and Planning, the Strategic Action Plan for the period 2012–2022, which contains the South American Council on Infrastructure and Planning objectives endorsed by the Union of South American Nations, was approved.

Lee (2014) asserted that these initiatives not only linked geographic areas containing natural resources, settled populations, economic and social infrastructure and consumer markets, but they also supported the already existing urban systems, as well as forging new relationships between dominant and growing urban areas. He concluded that although cities might be described as bound by their own parochial interests and issues, they were impacted by external forces. According to him, although a city can deal with some forces on its own, the external forces embodied in development corridors establish a city's position and its future. Therefore, the development corridor initiatives launched by IIRSA are the key mechanisms by which to integrate urban systems across South America, allowing each urban centre the opportunity to participate in something larger than the sum of the efforts.

Although these corridor initiatives face an array of challenges such as finding a balance between economic growth and environmental, political and social issues, the Union of South American Nations is hoping that the 10 core development corridors will stimulate and improve the economic performance of South America.

In conclusion, it is evident that the method or approach adopted by the Union of South American Nations to explore development corridors as a concept to stimulate and improve the economic performance of South America is also built on four key elements:

1) To create a geographical core area of cross-border cities, i.e. identifying a hierarchy of cities of higher and lower order that can participate in economic development
2) To create overarching, multimodal transportation solutions linking these geographical core areas and ensuring a geographical network represented at a global, national and regional level that will enhance economic development
3) To establish core development corridors linking each geographical area through an overarching, multimodal transportation system as a means of promoting economic investment opportunities
4) To compile strategic action plans with the vision to enhance the physical integration of each geographical area, so as to obtain sustainable economic development.

6.3 Summary and Conclusion

The key question investigated was, “Is there a difference in the line of thinking between developed and developing countries when considering development corridors as an instrument towards economic space development?” It is evident that the concept of development corridors, whether in developed or developing countries, is the result of decentralised thinking to create competitiveness, comparative advantages and access to global markets.

Furthermore, it is also evident that, for both developed and developing countries, urban growth poles or urban areas are being replaced by strategic considerations to create integrated economic investment opportunities within regions by expanding transportation infrastructure. According to the international cases, these strategic changes are increasingly needed to create national, regional and global investment opportunities for promoting economic growth. Therefore, the key lessons distilled from the international cases are that development corridors are the product of a collection of decisions at national level which are supported by regional initiatives. These development corridor initiatives reflect a strengthening of existing regions and cities, usually built around the presence of well-established infrastructure, with the focus on the potential, and benefits of regional integration and development that will stimulate, and improve economic performance for both developed and developing countries.

The importance of this chapter was to establish the common line of thinking or consideration between developed and developing countries when approaching development corridors as an instrument towards economic space development, i.e. “Is there a specific model, method or approach being applied when establishing development corridors?” Although no specific method or approach could be established, it is evident that each international case regarding the exploration of development corridors as a concept to stimulate and improve economic development, as illustrated by Diagram 6.1, considered four key elements: 1) the creation of an interconnected network of urban systems and functional economic regions; 2) the creation of a well-developed, multimodal transportation system providing mobility, and accessibility between urban systems and economic regions; 3) the establishment of a core of development corridors that would promote investment opportunities; and 4) defining policies or action plans that provided a common vision to promote economic growth and development. Each of these elements forms the overall basis for the next chapter, which explores real-life events pertaining to South Africa. However, the information relevant to each of the elements is discussed in much more detail.

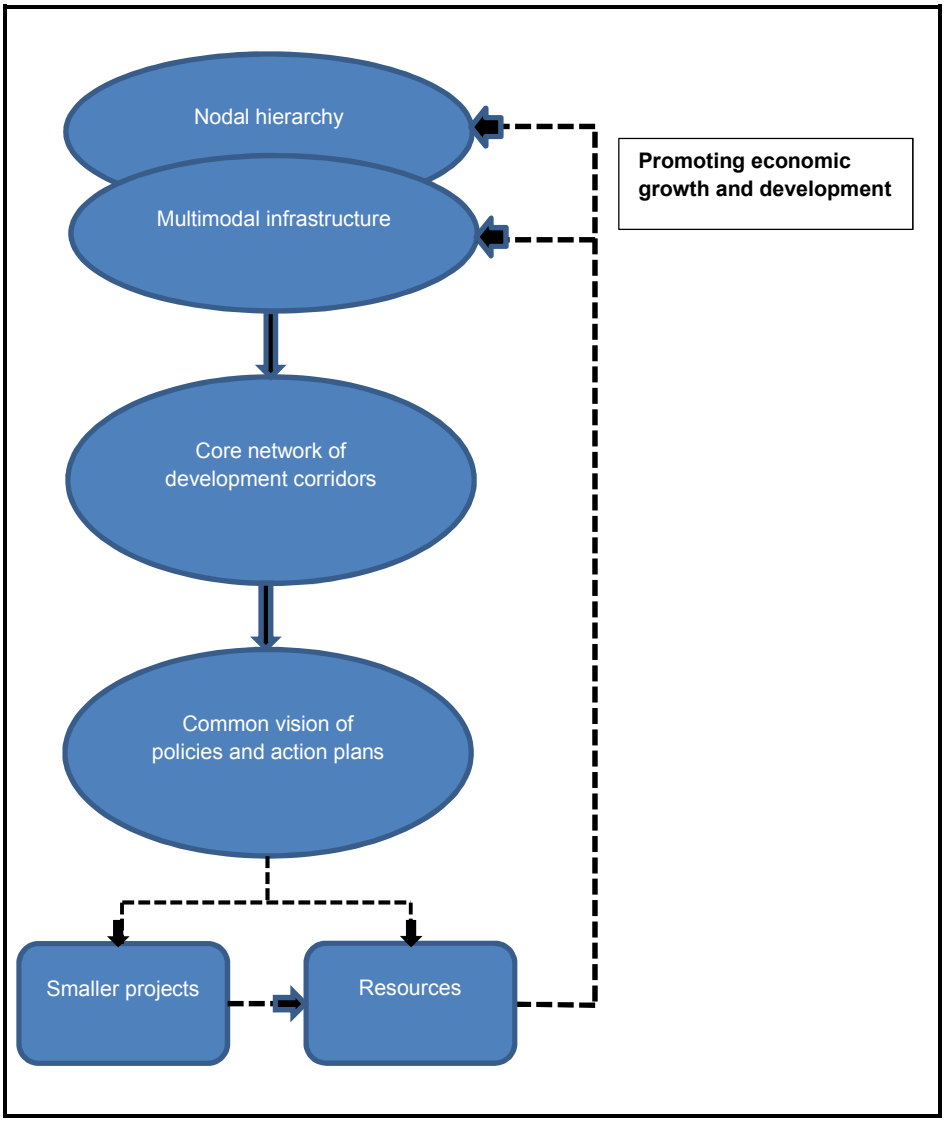


Diagram 6-1 International development corridor concept approach

Source: Own compilation

Furthermore, the overall differences between the international approach and the Spatial Corridor Model (SCM), as described and illustrated in Chapter 8, are synthesised in Chapter 9 (see section 9.4).

Chapter 7 South Africa

7.1 Introduction

Case studies excel at fostering an understanding of what is known through previous research or real-life events. Case studies contextualise the relationships between events or certain conditions. Basically, as summarised by Yin (1984 & 2009), case studies explain a contemporary phenomenon within its real-life context. Therefore, the research method for this chapter is a combination of a literature review and a comparative analysis, where real-life events in the South African context are explored in more detail. Specific focus is placed on: 1) urban systems and economic spaces; 2) transportation networks; 3) spatial planning; and 4) corridor initiatives as real-life events. The importance of this chapter is to contextualise each event against the phenomena described in chapters 3, 4 and 5, with the purpose of constructing a Spatial Corridor Model (SCM) (discussed and illustrated in detail in Chapter 8) as an integrated framework, whereby investment opportunities can be created to guide economic space development within the South African context.

7.2 Urban System

Based on the latest statistics, South Africa has a population count of more than 50 million (South Africa, 2016). Furthermore, the country has a long-standing network of cities, towns and localities. These have developed and become hierarchised over the course of a history during which population settlements and their distribution have been influenced by colonisation, segregation, industrialisation and globalisation (Giraut *et al*., 2012). From 1911, South Africa underwent a long phase of intense urban growth with urban areas, such as Johannesburg, Cape Town and Durban (eThekwini), agglomerating into dominating economic spaces with the emergence of mining and industrial basins (Jefferson, 1939). The end of Apartheid in 1994 was hailed with optimism by many people, as South Africa became one of the most advanced countries in Africa, with thriving cities integrated into global economies (South Africa, 2016). In the context of section 4.3, for the most part, the urban establishment phase of South Africa was completed towards the end of the 19th and the beginning of the 20th century. From then, until the early 1980s, the country was in the urbanisation phase (Geyer, 2003). By the mid-1980s, according to Geyer *et al*. (2015a & 2015b), there were signs that the country's urban system was entering the polarisation reversal phase. However, due to the political changes which took effect after 1994, the population redistribution patterns were significantly affected, which resulted in the urban systems slipping back into the urbanisation phase, only to return to the polarisation reversal phase towards the end of the first decade of the new millennium.

As concluded by Geyer *et al*. (2015a & 2015b), the political changes after 1994 had a profound impact on population and economic distribution patterns. The reason is considered against the background of Apartheid, when areas were (spatially) excluded from infrastructural development, and this exclusion

hampered economic development and growth. This aligns with the view of Acemoglu *et al*. (2012) that the political institutions that prevailed in South Africa throughout most of the 20th century created a dual economy, where the white elite initiated policies designed to produce a reservoir of cheap labour and reduce competition from black Africans. As illustrated in Diagram 7.1, Hendler (2015) summarised the creation and demise of the dual economic system across five distinct periods: 1) the pre-1913 period, which saw the rise of industrialisation with the discovery of diamonds, gold and the establishment of the mining industry; 2) the 1913–1948 segregation period which, in compliance with the Stallard principles, restricted black Africans from entering urban areas for any other reason than to serve white needs, and they had to depart immediately thereafter; 3) the 1948–1976 Apartheid period as a political system controlling the movement of black Africans through spatial planning regulations, which were conceptualised within the imperative to racially segregate cities; 4) the 1976–1994 revolt against the Apartheid system period, which led to the establishment of the Wiehahn Commission recommending the amendment of the Labour Relations Act to grant black trade unions legal recognition, the Riekert Commission which loosened influx control mechanisms, and abolished the pass laws and certain land use management controls, such as township regulations; and 5) the 1994 onwards period with the demise of Apartheid and the establishment of a new dispensation removing all Apartheid spatial planning and land use management regulations, and replacing them with new regulations to promote social and economic inclusion. This period on the creation of a dual economic system will be aligned with the spatial planning systems found in South Africa in section 7.4.

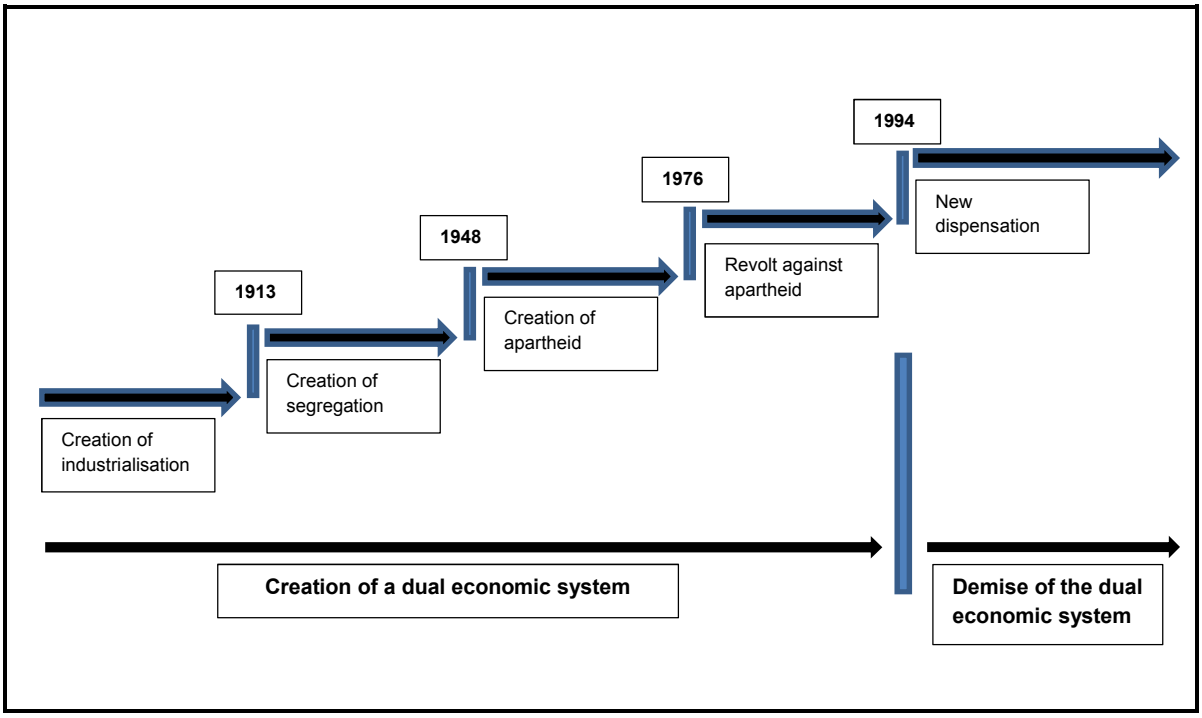


Diagram 7-1 The creation and the demise of a dual economic system

Source: Own compilation

It is evident that during the period after 1994, when Apartheid had ended, many people who had been prevented from migrating in the past, left rural areas for urban areas. This migration of people, mostly characterised by large numbers of black Africans and largely triggered by Todaro's (1969) 'bright lights syndrome', was essentially productionism-oriented i.e. when people migrate primarily with the aim of finding employment (Hart, 1973; Geyer *et al*., 1996; Bakker *et al*., 2016; South Africa, 2016). People in this category tend to be willing to endure, whatever conditions it takes to make a living at the destination they have chosen (Geyer, 1996). This caused unprecedented population explosions in towns and cities of all sizes in the country, which resulted in the urban system slipping back into the urbanisation phase (Geyer Jr. *et al*., 2012; Geyer *et al*., 2015a & 2015b; Bakker *et al*., 2016).

Despite this, over the last couple of years, the CSIR, with a number of other role-players, invested in building capabilities to provide spatial planning, analysis and modelling platforms for strengthening economic development through strategic regional, inter-regional and intergovernmental planning (Van Huyssteen *et al*., 2009, 2013 & 2014). This notion was supported by growing international awareness that location and place which, in essence, refer to cities, are important elements for productivity, growth and development. Chapter 4, emphasising cities as the engines driving economic development, contextualises this notion in more specific detail. These ideas have had an important influence on various other organisations such as the United Nations (UN), the Organisation for Economic Co-operation and Development (OECD), European Commission (EC) and World Bank (WB), as well as national governments and individual cities, where extensive rethinking followed which promoted the

benefits of urbanisation, as a result of the advantages cities offer for economic and social development. In this regard, the Counsel for Scientific and Industrial Research (CSIR) developed an Urban Functional Index (UFI) as part of the National Spatial Trends Overview project commissioned by the South African City Network (SACN). Subsequently The Presidency and the former Department of Provincial and Local Government (DPLG) used the index to inform Cabinet on urban development policy aspects, as well as during the process of developing a National Urban Development Framework (NUDF) (SACN, 2009). The development of the index was based on a classification of settlement patterns considering three main functionalities (Van Huyssteen *et al*., 2009, 2013 & 2014; Spocter *et al*., 2010; CSIR, 2013):

1) *Size* – Reflects the agglomeration of economies and population
2) *Function* – Indicates an area's economic role, e.g. mining, manufacturing and tourism, and its role, in terms of public and private service delivery. Function is based on the number of formal businesses, including industries, and private and public services, that are currently located in each centre. These indices delimit the economic catchment areas of each centre in the country, while determining nested patterns of higher and lower-order centres in the country's hierarchy of central places. These nested patterns show how the country can be subdivided into functional areas based on the economic catchment areas of higher-order centres in the country
3) *Institutional legacy* – Reflects inherited characteristics of past policies, particularly the land use policies that fostered economic and residential segregation within cities.

Applying the functional index allowed for the delimitation of the economic catchment areas of each settlement in the country and was used, at the same time, to determine nested patterns of higher and lower-order centres in the country's hierarchy of central places (the theoretical principles are discussed in detail in Chapter 3). Functional analysis entails characterisation of regional economic systems, in terms of dominant functions and their order of magnitude in their central places and points, to the actual and potential systematic linkages and relationships between economic composition and places. The importance of the index, according to Geyer (2002 & 2003), is found in the latter showing how the country can be subdivided into functional areas based on the economic catchment areas of higher-order centres, which, in turn, will determine agglomeration economies (the theoretical principles are discussed in detail in Chapter 4). This is also confirmed by Van Huyssteen (2009, 2013 & 2014), stating that the functional index provides a mechanism to profile, identify, calculate and analyse a set of development information, and trends pertaining to the range of towns and cities, as well as high-density settlements across South Africa. This simplifies analysis of the network of settlements, towns and cities, and their hierarchical and functional relationships, more specifically, when analysing economic space development.

The Urban Functional Index (UFI) has subsequently been used in the NDP (discussed in more detail in section 7.4.1) as a parameter to classify cities in South Africa (South Africa, 2013). The index is part of a

continuous regional and a continuous national landscape which are interrelated through complex economic, social, political and environmental forces. This means that the discrete consideration of lower-order centre development as completely distinct from higher-order centre development is, therefore, no longer valid. Instead, the index provides a balanced approach which addresses both ends of the continuum, rather than lower-order centres in isolation from higher-order centres. In summary, the index provides an inclusive development framework that complements the current and emerging economic development in the South African context (South Africa, 2009). Table 7.1 illustrates the categories and classification criteria in defining the South African urban system and, ultimately, the distribution of economic spaces, or rather where agglomeration economies exist.

Table 7-1 Settlement classification in South Africa

Category	Classification criteria	Examples
City regions	*UFI value:* above 40; *Size of population:* above one million; *Size and nature of the economy (ESI >5):* high level of economic activity in a diversified range of sectors; *Settlement structure:* multinodal.	Gauteng, Cape Town, eThekwini, Nelson Mandela Bay
Cities	*UFI value*: between 11 and 40; *Size of population:* between 500 000 and one1 million; *Size and nature of the economy (ESI 2-5):* medium–high level of economic activity in a diversified range of sectors; *Settlement structure:* one dominant node.	Bloemfontein, Nelspruit, East London, Polokwane, Pietermaritzburg
Regional service centres	*UFI value:* between 2 and 10; *Size of population* (three subclasses): i) 300k–500k; ii) 100k–300k; iii) 100k-40k; *Size and nature of the economy (ESI 0.25-2):* medium level of economic activity in a diversified range of sectors.	Upington, Rustenburg, Thohoyandou, Klerksdorp, Potchefstroom, Kimberley, Witbank
Service, and local and niche towns	*UFI value:* between 1 and 2; *Size of population* (two subclasses): i) 20k and 40k; ii) varied; *Size and nature of the economy (ESI 0.065-0.25):* medium–low level of economic activity, mostly in the service sectors; *Settlement structure/function:* the principal node of a strong, predominantly agricultural or subsistence-focused local region.	Estcourt, Malmesbury
High density/Dense and sparse rural settlements	*UFI value:* zero; *Size of population:* (two subclasses): i) > 100 persons/km^2; ii) > 10 persons/km^2; *Size and nature of the economy (ESI <0.065):* mostly low-level subsistence activity; *Settlement structure/function:* non-nodal areas with a significant spatial footprint; *Settlement structure/function:* i) a limited range of services to a small or sparsely populated hinterland; or ii) specific niche services (such as tourism); or iii) non-nodal areas with a significant spatial footprint.	Acornhoek, Clarens, Prince Albert; *Sub-places:* Mapate, Sinakanaka, Tamboekievlei

Source: CSIR (2013); Van Huyssteen *et al*. (2014)

According to the classification, there are five main urban categories with *city regions* being the most dominant. The *city regions* comprise Gauteng (City of Johannesburg; Tshwane and Ekurhuleni), Cape Town, Durban (eThekwini) and Port Elizabeth (Nelson Mandela Bay), each with over one million in population and having the highest level of economic activities (South Africa, 2009). A spatial analysis of the urban categories suggests that the *city regions* and *cities* significantly dominate the South African

space economy (Van Huyssteen *et al*., 2009, 2013 & 2014; CSIR, 2013). Therefore, one can argue that the backwash effect (see section 3.5), as defined by Perroux (1955) and Myrdal (1957), illustrated in Figure 3.7, is the contributing factor elevating *city regions* and *cities* as the most dominant economic spaces in South Africa.

Furthermore, a sector analysis of the *city regions* and *cities* not only illustrates diverse economies which play a significant role as the core cylinder of South Africa's agglomeration economies (illustrated by Figure 7.1), but also that *city regions* and *cities* provide key linkages for comparative advantages and investment opportunities (Van Huyssteen *et al*., 2009, 2013 & 2014). The spatial analysis referred to is illustrated in more detail in Chapter 8, in section 8.2.1 and Table 8.2 – the table provides figures on population counts and economic contributions. Furthermore, the NUDF (South Africa, 2009) concluded in its assessment that *city regions* and *cities* were increasingly being identified as the main spatial systems that dominated economic development in South Africa and, at the same time, were seen as the main drivers behind regional interconnectivity. The main reasons for this are:

1) *City regions* and *cities* generate the agglomeration economies needed to attract businesses and industries, offering a wide range of choices in available resources, as well as specialised services and infrastructure
2) *City regions* and *cities* provide both advantages of specialisation and diversity that allow for competitiveness in high value-added activities and high levels of innovation
3) *City regions* and *cities* provide greater endowments of human and physical capital, higher skills levels, more favourable demographic structures, as well as well-developed building and communication infrastructure.

It is clear that a national overview of *city regions* and *cities* not only illustrates the main agglomeration economies and increased opportunities, but also an increased concentration of interconnected networks of settlements and functional regions. Also evident is the uneven clustering of economic activities creating preferential zones for investment, resulting in uneven economic geographical spaces (evident from the findings in Chapter 8). Therefore, it can be argued that this awareness of functional economic networks and uneven economic spaces prompts urgent considerations of an integrated national spatial framework that gives priority to context-specific investments and policy responses.

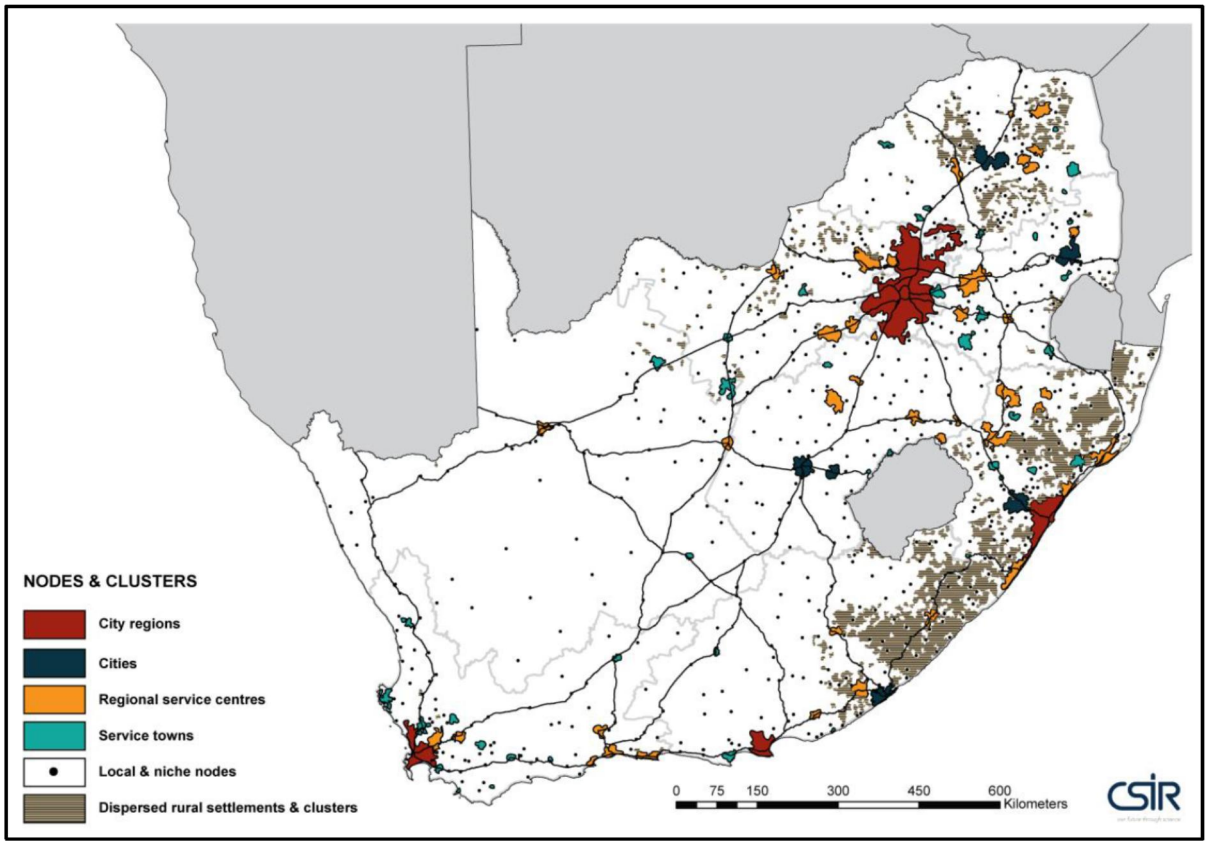


Figure 7-1 Distribution of South Africa's functional urban systems with relative size of population and formal economic productivity

Source: CSIR (2013); Van Huyssteen *et al*. (2014)

7.3 Transportation Networks

The transport sector has been highlighted by the government as a key contributor to South Africa's competitiveness in national and global markets. It is regarded as an important engine for economic growth and development. This was highlighted by the National Department of Transport (NDoT) when, in conjunction with the National Development Plan (NDP), it finalised the National Transport Master Plan (NATMAP) constituting a long-term plan to position transport as an enabler for economic development (South Africa, 2014). The National Transport Master Plan (NATMAP), discussed in more detail in section 7.4.4, focuses on an integrated transportation system ensuring that the different modes of transport complement each other when responding to the economic needs of South Africa. In this regard the department established 12 public entities to deliver on certain elements of the government's operational activities: 1) the Airports Company South Africa (ACSA); 2) the Air Traffic and Navigation Services (ATNS); 3) the Cross-Border Road Transport Agency (CBRTA); 4) the Passenger Rail Agency of South Africa (PRASA); 5) the National Ports Regulator (NPR); 6) the Railway Safety Regulator (RSR); 7) the Road Accident Fund (RAF); 8) the Road Traffic Infringement Agency (RTIA); 9) the Road Traffic Management Corporation (RTMC); 10) the South African Civil Aviation Authority (SACAA); 11) the South African Maritime Safety Authority (SAMSA); and 12) the South African National Roads Agency

(SANRAL). Furthermore, commercial entities such as Transnet and South African Airways (SAA) are also considered key role-players when delivering on government priorities. Although the department established the 12 entities, their deliverables manifest within the four key multimodal infrastructure entities, namely shipping, aviation, road and rail which are discussed further in detail.

7.3.1 Ports and shipping

Major shipping lanes pass along the South African coastline in the South Atlantic and Indian oceans. The South African ports process some 200 million tonnes of cargo annually, of which 80 per cent is exported and 20 per cent imported, and represents conduits for trade between South Africa and its southern African partners, as well as hubs for traffic to and from Europe, Asia, the Americas and the eastern and western coasts of Africa. The NPR was established in terms of the National Ports Act, 2005 (Act 12 of 2005), with the primary aim to regulate the South African port system, in line with governmental strategic objectives to promote access to ports and monitor the activities of the Transnet National Port Authority (TNPA). The TNPA is the largest port authority in Africa and owns and manages the eight principal commercial ports of South Africa (South Africa, 2014). Based on the White Paper on the National Commercial Port Policy (2002), the vision for South African ports is to establish a system of ports, seamlessly integrated with the multimodal transportation system. SAMSA, in conjunction with NDoT, is working on mobilising the maritime sector, in an effort to draw attention towards what the sector can contribute towards South Africa's economic development. According to the NDoT, the maritime economic sector is of central and strategic importance to the National Growth Path (NGP), the BRICS (Brazil, Russia, India, China and South Africa) block and South Africa's influential role within the African Union (AU) (South Africa, 2014). The eight principal commercial South African ports illustrated in Figure 7.2, where Port Elizabeth and Ngqura are combined, due to proximity, are:

1) Richards Bay, located in KwaZulu-Natal: In 1965, the previous South African government decided to build a deep-sea harbour at Richards Bay, which is the largest coal export facility in the world today. A dedicated railway line connects the port with Mpumalanga and Gauteng, and was designed specifically to handle the majority of South Africa's coal exports. Local exports besides coal also include aluminium, titanium and other heavy minerals, granite, ferrochrome, paper pulp, woodchips and phosphoric acid. The combination of specialised cargo-handling facilities, deep-water infrastructure and excellent rail links to the hinterland has made the port of Richards Bay one of the worlds' leading bulk ports, handling in excess of 85 million tonnes of cargo annually, which represents 46 per cent of South Africa's seaborne cargo. The port also handles some 1 700 vessels and 11 000 containers annually (WB, 2012; South Africa, 2016).
2) Durban, located in KwaZulu-Natal: Durban is the busiest port in South Africa, the second largest container facility in Africa (after Port Said in Egypt) and the fourth largest container facility in the Southern Hemisphere (after Jakarta in Indonesia, Surabaya in Indonesia and Santos in Brazil).

Durban handles some 2.5 million containers annually, representing 62 per cent of all containers being handled in South African ports. Durban also handles the greatest volume of sea-going traffic in southern Africa, with some 4 000 vessels visiting the port and cargo, amounting to 40 million tonnes annually (WB, 2012; South Africa, 2016).

3) East London, located in Eastern Cape: East London is classified as a common user port, i.e. it operates on a first-come-first-served basis. The port is comprised of three main terminals, namely a multipurpose terminal which mainly deals with containers; a grain elevator with a storage capacity in its silos of 76 000 tonnes, the largest in South Africa; and a car terminal, which was responsible for the turnabout in the port's fortunes and is geared to handle 50 000 units annually. Annually, East London handles some 275 vessels, 48 000 containers, of which the majority are for the local motor industry, and cargo amounting to 1.2 million tonnes (WB, 2012; South Africa, 2016).
4) Port Elizabeth and Ngqura, located in Eastern Cape: Agricultural and farming play an important role in the port's activities, particularly citrus fruit and wool. Other principal products include manganese ore, which is railed from the Northern Cape, and petroleum products, which are imported from other South African ports. The motor industry has long been an important industrial activity for the Eastern Cape and the port plays an important role with a large car terminal. More recently, containers have assumed a prominent role in the fortunes of the port, which has formed an alternate port for containers for whenever the Durban or Cape Town container terminals are congested. The Port of Ngqura is the deepest container terminal in Africa, and is a key location of Coega, one of South Africa's strategic Industrial Development Zones (IDZs). The Port of Ngqura, which began commercial operations in 2009, lies some 20 kilometre from Port Elizabeth and was developed to serve as a primary location for new industrial development for export-driven industries. In the initial stages, the port was to handle manganese and other bulk ore exports. However, that changed following an initiative to develop a container terminal. Although the impact on the nearby Port Elizabeth port remains unclear, much of the emphasis switched to clean cargo with a strong focus on containerised cargo. Therefore, it would appear that the future of the port lies in growing it into a transhipment hub for the sub-Saharan Africa and Western Indian Ocean regions. Annually, Port Elizabeth and Ngqura combined handle some 1 500 vessels, 610 000 containers and cargo amounting to 5.6 million tonnes (WB, 2012; South Africa, 2016).
5) Mossel Bay, located in the Western Cape: Mossel Bay is located halfway between Cape Town and Port Elizabeth, and is classified as the smallest of the commercial ports along the South African coast. The importance of the port is that it is home to Mossgass (Petro SA) and oil industry projects that started as far back as the 1980s. Today, Mossel Bay is a major base for the fishing industries of the region, with sophisticated facilities to process catches. Its accessibility by road and railway networks makes it an excellent connection point to the consumer markets and industrial zones of the Western Cape hinterland. Even though the Mossel Bay port is not popular for commercial traffic, it remains an important port for the oil industry and the local community, which make their living from fishing.

Annually, Mossel Bay handles some 900 vessels and cargo amounting to 1.3 million tonnes (WB, 2012; South Africa, 2016).

6) Cape Town, located in the Western Cape: Cape Town is considered one of the most beautiful harbours in the world and is situated on one of the world's busiest trade routes, making it an important strategic hub for economic development. Cape Town is also a busy container port, second to Durban, and handles the largest amount of fresh fruit. Fishing has a significant place in the economic activity of the port, affecting the ship repair industry, in particular, with large Asian fishing fleets using Cape Town as a transhipment logistics and repair base. The emerging oil industry in West Africa has also become a significant factor for the port's repair and maintenance facilities. Annually, Cape Town handles some 2 700 vessels, 840 000 containers and cargo amounting to 3 million tonnes (WB, 2012; South Africa, 2016).
7) Saldanha, located in the Western Cape: The port only recently developed into a modern harbour, when it became necessary to facilitate the export of iron ore from the Northern Cape. Iron ore is delivered to the port along a dedicated ore railway (800 kilometre) from the mines near Sishen in the Northern Cape. In addition, the Saldanha Steel Mill, located near the port, has also been commissioned for the export of steel manufactured at the mill. Annually, Saldanha handles some 540 vessels and cargo amounting to 47.3 million tonnes, representing 25 per cent of South Africa's seaborne cargo (WB, 2012; South Africa, 2016).

The details pertaining to the information (vessel, container and cargo movement), described above, are illustrated in section 8.2.3 under Table 8.4.

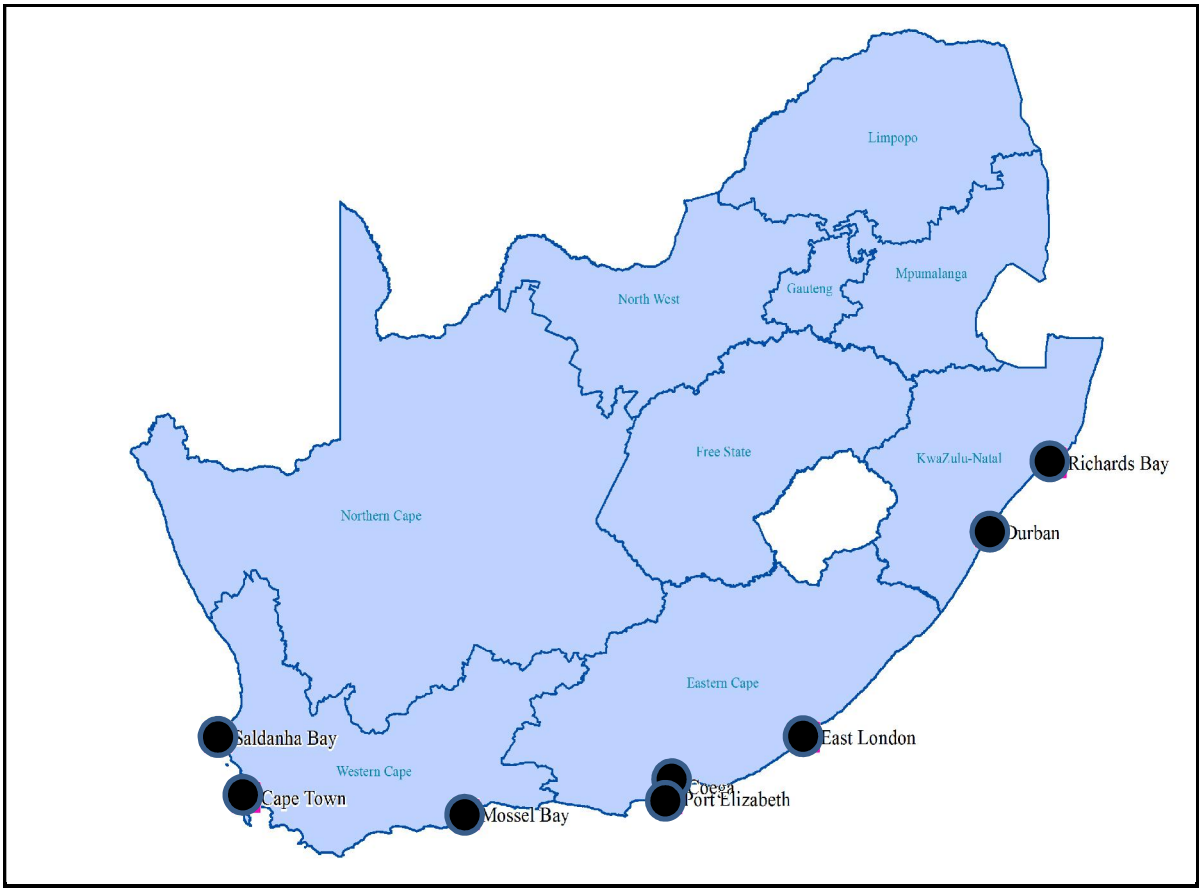


Figure 7-2 South African commercial ports Source: Own compilation

7.3.2 Airports

Civil aviation serves as a major catalyst for global and local economic development. ACSA maintains an efficient, reliable and sustainable South African aviation industry which caters for changing needs and circumstances. South Africa's airport network is comprised of 135 licensed airports, 19 military airports and up to 1 300 unlicensed aerodromes. ACSA was established in 1993 to own and operate the nine principal South African airports, including the three main international gateways of OR Tambo (Johannesburg), Cape Town and King Shaka (Durban). ACSA is responsible for processing between 93 and 95 per cent of all passengers departing from the nine principal airports (South Africa, 2014). The nine principal South African airports illustrated in Figure 7.3, are:

1) OR Tambo (Johannesburg), located in Gauteng: OR Tambo Airport is South Africa's busiest airport, situated in Kempton Park in Gauteng, which is near Johannesburg. OR Tambo Airport is the hub for most international and domestic travel from and in South Africa, and processes up to 18.6 million passengers annually, representing 53 per cent of all passenger movement in South Africa. The OR Tambo Airport is also the centre for SAA, which is South Africa's largest domestic and international flight carrier, and local airlines that fly domestically. A total of 215 000 aircraft traffic

movements are recorded annually, the majority being domestic services. The cargo terminal also has a capacity to move 356 000 tonnes of cargo annually (WB, 2009 & 2012; ACSA, 2016).

2) Cape Town, located in the Western Cape: Cape Town Airport is the primary airport serving the city of Cape Town, and is the second busiest airport in South Africa, representing 24 per cent of all passenger movement in South Africa. Some of the flights to international destinations are only seasonal (Paris, Zurich, Munich, Frankfurt), but there are also direct flights to several destinations in Africa and Asia. The busiest route from the airport is the connection to Johannesburg, which processes more than 8 million passengers annually. It also has direct flights to other main regions such as Durban and Port Elizabeth, as well as flights to smaller centres in South Africa. The total aircraft traffic movement is some 88 000 per annum. The cargo terminal also has the capacity to move 42 000 tonnes of cargo annually (WB, 2009 & 2012; ACSA, 2016).
3) King Shaka (Durban), located in KwaZulu-Natal: King Shaka Airport is the third busiest airport in South Africa, representing 13 per cent of all passenger movement in South Africa. Annually, the airport records 4.6 million passengers and a total of 52 000 aircraft traffic movements; the majority of which are domestic services. The cargo terminal has a capacity for 150 000 tonnes per year and long-term expansion could see the cargo terminal expand to a capacity for 1 million tonnes of cargo annually. It is estimated that KwaZulu-Natal produces some 4 000 tonnes of air cargo yearly, which is currently transported by road to Johannesburg. The airport also has the advantage of sea-level operation, as opposed to Johannesburg's high altitude, and is also near the Durban port, the busiest container seaport in the southern hemisphere (WB, 2009 & 2012; ACSA, 2016).
4) Port Elizabeth, located in the Eastern Cape: Port Elizabeth Airport is located some three kilometre from the city's central business district and earned the name of ‘10-minute airport’ because it is less than 10 minutes’ drive from most major areas of the city. Annually, the airport records 1.4 million passengers and 57 000 aircraft traffic movements (WB, 2009 & 2012; ACSA, 2016).
5) East London, located in the Eastern Cape: East London's airport is a small, but bustling airport that plays an important role in the growing economy of the Eastern Cape. Every day it welcomes between 20 and 30 flights, which brings 680 000 passengers to East London each year. The airport also records 29 400 aircraft traffic movements per annum (WB, 2009 & 2012; ACSA, 2016).
6) George, located in the Western Cape: George Airport is a small airport located in the heart of the Garden Route in the Southern Cape. George is a popular holiday and conference centre, and the administrative and commercial hub of the Garden Route. George Airport has scheduled flights to Cape Town, Durban and Johannesburg. Annually, the airport records 590 000 passengers and 34 000 aircraft traffic movements (WB, 2009 & 2012; ACSA, 2016).
7) Kimberley, located in the Northern Cape: Kimberley Airport lies at the heart of the Northern Cape, in the city most famous for the ‘Big Hole’, a landmark carved into the earth by early diamond prospectors. Kimberley Airport also dispatches a remarkable range of goods, everything from game trophies to industrial equipment. The airport lies about six kilometre south of Kimberley. Annually, the

airport records 146 000 passengers and 11 000 aircraft traffic movements (WB, 2009 & 2012; ACSA, 2016).

8) Upington, located in the Northern Cape: Upington Airport is located in the Northern Cape and has one of the longest runways in the world. The airport serves as an international hub and most flights are non-scheduled. Many major car manufacturers also bring their cars and commercial vehicles to Upington to test them in the hot, dry and sunny conditions. These cars are flown into and out of the airport using chartered planes. Annually, the airport records 53 500 passengers and 7 000 aircraft traffic movements (WB, 2009 & 2012; ACSA, 2016).
9) Bloemfontein (Bram Fischer), located in the Free State: The Bram Fischer Airport is an important gateway to the Free State, a land-locked province. At the heart of the economy in the region, the airport offers a world-class service, catering for some 395 000 passengers and 19 500 air traffic movements annually. The airport fulfils the role of an economic hub, which links Bloemfontein, the industrial area of Botshabelo and Maseru in Lesotho, facilitating growth and development in the Free State (WB, 2009 & 2012; ACSA, 2016).

The details pertaining to the information (passenger, aircraft and cargo movement) described above are illustrated in section 8.2.3 under Table 8.6.

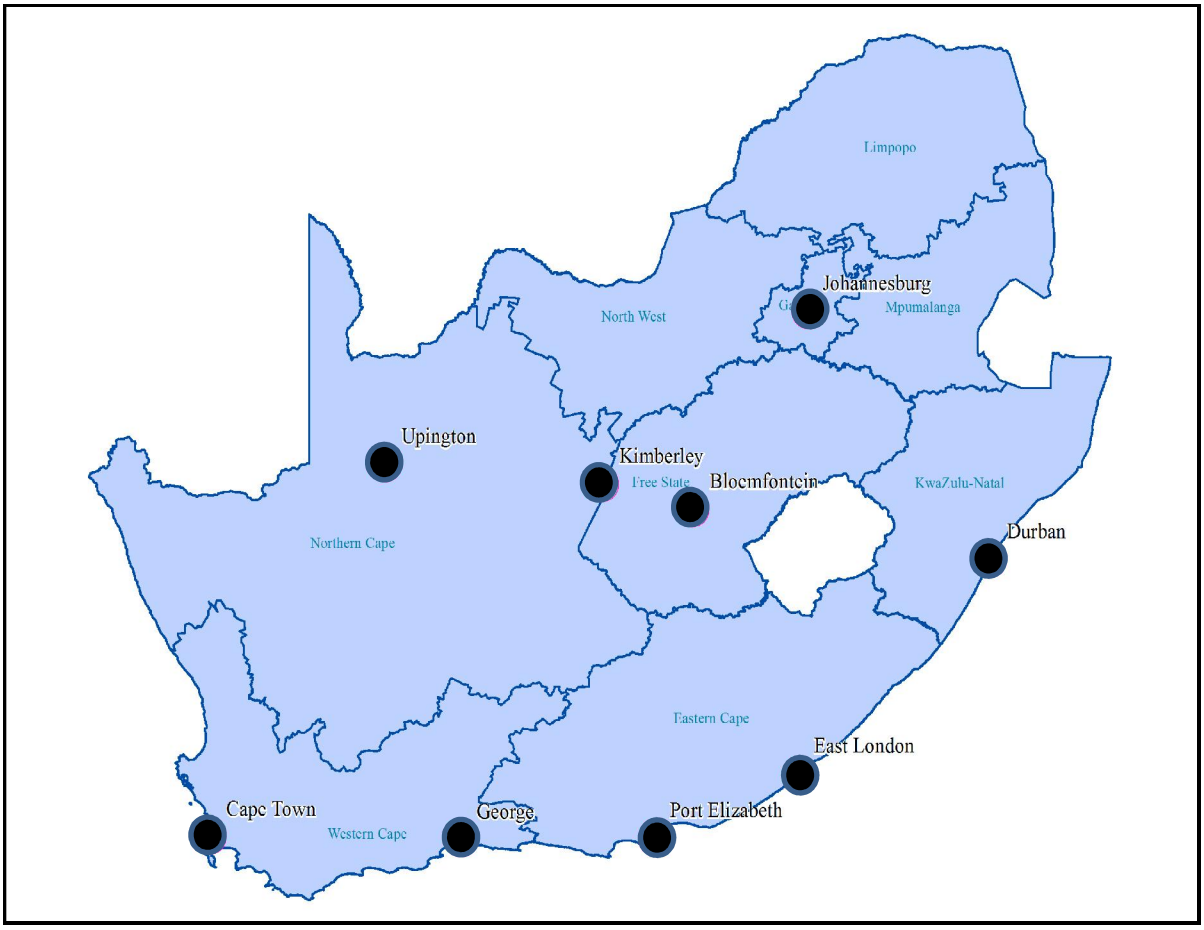


Figure 7-3 Major South African airports Source: Own compilation

7.3.3 Road network

South Africa's total road network (surfaced and gravel), the longest network of roads of any African country, is in the proximity of 750 000 kilometre, of which 618 000 kilometre are proclaimed and 132 000 kilometre un-proclaimed (South Africa, 2016). According to the NDoT, the country's network of national roads covers 21 400 kilometre, of which 19 per cent (3 120 kilometre) are toll roads; 180 000 kilometre provincial roads; 61 500 kilometre metropolitan roads; and 345 000-kilometre municipal roads (South Africa, 2016).

National routes in South Africa are a class of roads and freeways which connect major cities and towns. They form the highest category in the South African route numbering scheme, and are designated with route numbers denoted with the letter ‘N’, from N1 to N18. The SANRAL is responsible for the design, financing, maintenance, operation and rehabilitation of South Africa’s national roads (South Africa, 2014). There are 15 declared national routes, which are illustrated in Figure 7.4 and Table 7.2 below.

Table 7.2 South African national road network

Category	National roads connecting cities and towns
N1	Stretching Cape Town/ Worcester/ Beaufort West/ Colesberg/ Bloemfontein/ Kroonstad/ Johannesburg/ Roodepoort/ Pretoria/ Polokwane/ Musina/ Beit Bridge/ Harare
N2	Stretching Cape Town/ Somerset West/ George/ Port Elizabeth/ King William's Town/ East London/ Mthatha/ Kokstad/ Port Shepstone/ Durban/ KwaDukuza/ Empangeni/ eMkhondo/ Ermelo
N3	Stretching Durban/ Pietermaritzburg/ Harrismith/ Johannesburg
N4	Stretching Lobatse/ Skilpadshek/ Zeerust/ Rustenburg/ Pretoria/ eMalahleni/ Nelspruit/ Komatipoort/ Maputo
N5	Stretching Winburg/ Bethlehem/ Harrismith
N6	Stretching East London/ Queenstown/ Aliwal North/ Bloemfontein
N7	Stretching Cape Town/ Clanwilliam/ Springbok/ Vioolsdrif/ Keetmanshoop
N8	Stretching Groblershoop/ Kimberley/ Bloemfontein/ Ladybrand/ Maseru
N9	Stretching George/ Graaff-Reinet/ Middelburg (EC)/ Colesberg
N10	Stretching Port Elizabeth/ Cradock/ Middelburg (EC)/ De Aar/ Prieska/ Upington/ Nakop/ Keetmanshoop
N11	Stretching Ladysmith/ Newcastle/ Volksrust/ Ermelo/ Middelburg (MP)/ Mokopane/ Groblersbrug/ Francistown
N12	Stretching George/ Beaufort West/ Kimberley/ Klerksdorp/ Potchefstroom/ Johannesburg/ eMalahleni
N14	Stretching Springbok/ Upington/ Vryburg/ Krugersdorp/ Pretoria
N17	Stretching Johannesburg/ Springs/ Ermelo/ Oshoek/ Mbabane
N18	Stretching Warrenton/ Vryburg/ Mahikeng/ Ramatlabama/ Lobatse

Source: NDoT (2016)

Figure 7-4 South African national road network Source: NDoT (2016)

7.3.4 Rail network

South Africa has an extensive rail network connecting with networks in the sub-Saharan region, with its rail infrastructure representing about 80 per cent of Africa's total. The country's rail infrastructure connects the city regions, cities and ports with the rest of South Africa, and its focus is to provide freight logistics solutions designed for industry-based business segments, mining, and heavy and light manufacturing. South African rail resides under two entities: 1) Transnet, which is a focused, freight-transport logistics entity operating also freight rail, with the exception of ports; and 2) PRASA, focusing on the delivery of commuter rail services within metropolitan regions, long-distance (inter-city) passenger commuting and long-distance bus services within, to and from the borders of South Africa (South Africa, 2015).

7.3.4.1 Freight rail

Transnet Freight Rail's (TFR, 2012 & 2014) core network is comprised of 18 sections which are rolled up into five predominant systems. The five systems are:

1) Gauteng to Durban system – This is predominately a general freight route transferring containers, fuel and other general freight.

2) North-eastern system – This is predominately a general freight route transferring agricultural products and fuel.
3) Coal system – Heavy haul feeder lines from the Mpumalanga and Lephalale areas linking different domestic destinations and Richards Bay; predominately exports coal.
4) Export system – Heavy haul lines linking the Northern Cape with Saldanha Bay and Port Elizabeth/Ngqura; predominately exports iron ore to Saldanha Bay and manganese to Port Elizabeth/Ngqura.
5) Gauteng to Cape Town system – This is a general freight route linking the Gauteng, Free State and Western Cape provinces; predominately transferring containers, and automotive and general freight.

The five predominant systems which constitute the general freight, as well as the heavy-haul freight rail core, illustrated in Figure 7.5, emphasise two important functionalities:

1) General freight, which is the largest rail network in southern Africa, covering over 10 500 route-kilometre (excluding heavy-haul lines which cover over 2 300 route-kilometre) of railway and moving over 100 million tonnes of general freight annually (Kuys, 2011)
2) Heavy-haul freight, which serves the following:
   a. Coal: South Africa's 'black gold' is a vital export commodity; starting at the Mpumalanga coal-rich mines, the 580-kilometre line stretches from the Highveld through rural KwaZulu-Natal to Richards Bay; the second largest coal railway in the world, it delivers more than 80 million tonnes of coal annually (Kuys, 2011).
   b. Iron ore: South Africa's iron ore resources, as well as the export of iron, are ranked in the top 10 largest in the world. Iron is transported on a dedicated iron ore line from the Northern Cape to Saldanha Bay; stretching over 800-kilometre, the line delivers more than 60 million tonnes of iron annually (Bonga, 2005; Kuys, 2011; Edinger, 2014).
   c. Manganese: South Africa's largest and most economical important deposits are located in the Northern Cape, and transported over a distance of more than 1 000 kilometre to the Port of Ngqura; the line delivers more than 5 million tonnes of manganese annually (Bonga, 2005; Kuys, 2011; Transnet, 2012 & 2014; Edinger, 2014).

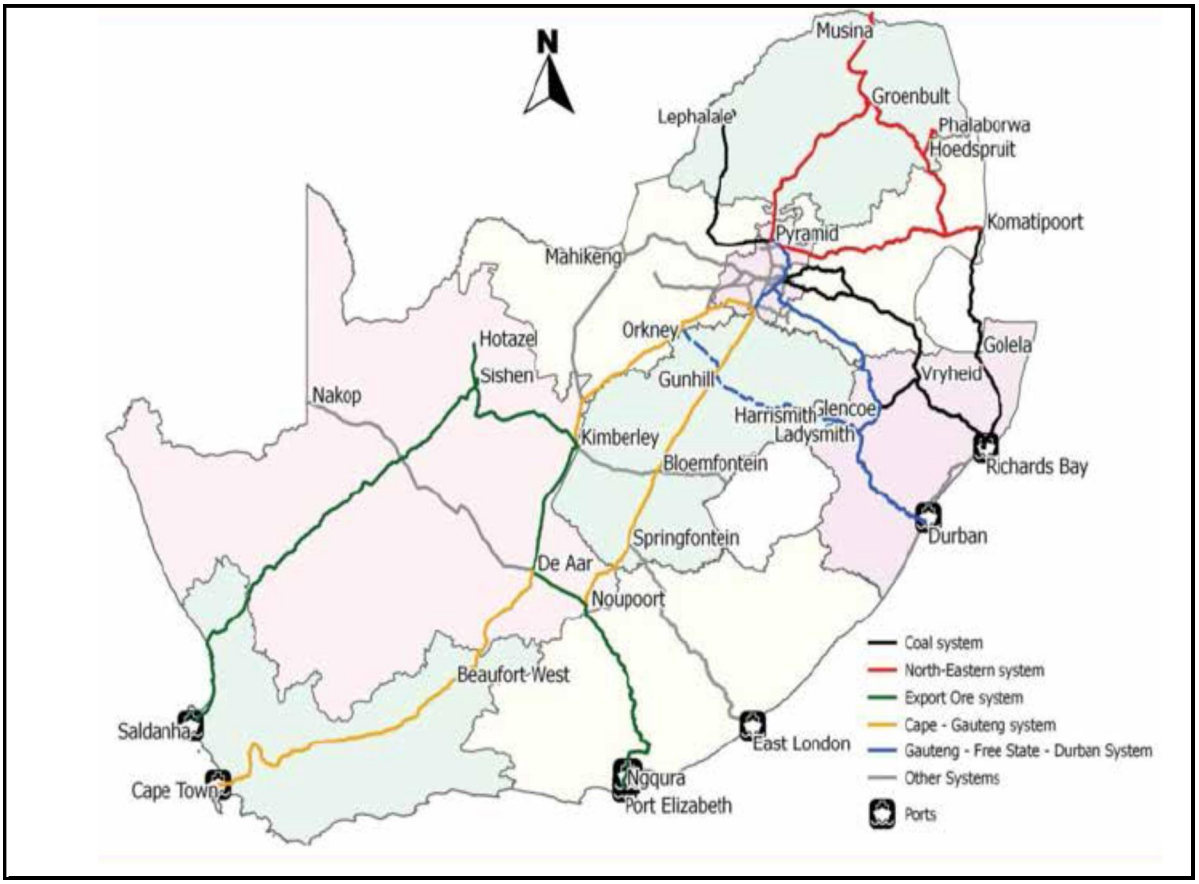


Figure 7-5 Transnet Freight Rail (TFR) core network Source: Transnet (2014)

7.3.4.2 Commuter rail

The commuter rail service, illustrated in Figure 7.6, is comprised of two predominant systems:

1) Metrorail – An operator of commuter rail services in the major urban areas (metropolitan regions) of South Africa, transferring in the proximity of 525 million passengers annually, i.e. an average of 1.7 million passengers per weekday. The Metrorail system comprises over 450 stations with 2 200 kilometre of track (Transnet, 2012 & 2014).
2) Main Line Passenger Service – An operator of facilities, designed to transfer passengers commuting long-distance (inter-city); operating various routes across South Africa; carrying approximately 1 million passengers annually over a distance of 18 600 route-kilometre (Transnet, 2012 & 2014).

Figure 7-6 Main Line Passenger Service across South Africa Source: Transnet (2014)

It is clear that South Africa has a modern and well-developed multimodal transport network system which impacts on the nature and extent of economic space development. Historically, the South African transport network systems, according to Botha (1966), reinforced fragmented spatial development, which, according to Kleynhans (2007), required reconstruction actions. Therefore, it is not surprising that various spheres of government placed strong emphasis on corridors as a mechanism to address spatial fragmentation and the lack of appropriate economic space development (South Africa, 2011, 2013 & 2014). This is evident, considering the 12 public entities mentioned in the introductory paragraph which were established to respond and deliver on economic needs through a well-constructed, integrated transportation system. This aligns with Krynauw's (2000) statement that the successful development of corridors and, ultimately, economic space development are directly related to the strength of a well-developed, multi-modal transport system.

7.4 Spatial Planning

In general, spatial planning is dedicated to establishing guiding principles for the public sector to influence the future distribution of activities, whether social or economic, in space. It is undertaken with the aim of creating a more rational balance for development, with the need to protect the environment,

and achieve social and economic growth. Furthermore, spatial planning embraces measures to coordinate the spatial impacts of other sectoral policies and to achieve a more even distribution of economic development opportunities between regions that would otherwise be created by market forces, i.e. spatial planning encompasses elements at all levels of geography. Therefore, the aim of spatial planning is to direct development initiatives towards common objectives – the common objective for South Africa is the implementation of the NDP (see section 7.4.1). In essence, it can be argued that spatial planning encompasses common principles to be applied to different planning systems to provide guidance for decision-making proposals to achieve social and economic prosperity. Planning systems, in this instance, refer to policies and legislation.

Historically, as illustrated in Diagram 7.2, spatial planning in South Africa, which aligns with the notions of Acemoglu (2012) and Hendler (2015) of a dual economy system (see section 7.2), can be summarised across five distinct periods: 1) the colonial and early development period (1882–1910); 2) the laissez-faire growth and development period (1910–1950); 3) the land use control and Apartheid restructuring period (1950–1980); 4) the Apartheid vision in decay period (1980–1994); and 5) the post-Apartheid transformation period (1994 to the present). In the view of Drewes *et al*. (2013), it is evident that national spatial planning during the 1970s until the 1990s was primarily driven by industrial development, i.e. there was a definite drive towards economic growth. However, according to him, a shift in emphasis took place in the early 1990s towards a balanced approach, whereby a people-centred approach replaced the previous 'fordist' approach to development. Therefore, in contrast to the main goals of economic growth and separate development, which were the previous regime's approach towards spatial planning, the period between 1950 and 1994 left South Africa with spatial divergence, which extended between all the major economic centres and regions.

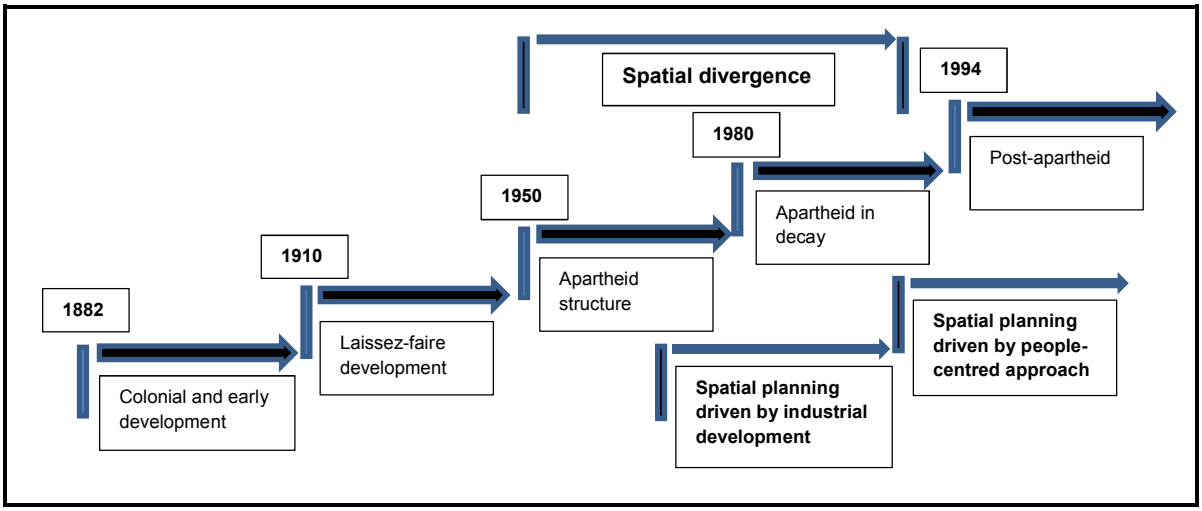


Diagram 7-2 Historic spatial planning in South Africa Source: Own compilation

However, since 1994, the objective of the newly elected South African government has been to achieve a high economic growth rate in the country through the 'geographical expression' of spatial planning on social and political issues. Therefore, since 1994, various initiatives have been introduced to reform and improve the policy and legislative frameworks that regulate spatial planning in South Africa (Drewes *et al*., 2013; SACN, 2015). The South African government has employed various economic development programmes and Acts of Parliament since 1994, which included the RDP; the White Paper on Local Government (South Africa, 1998) which was legislated in the Municipal Structures Act, 1998 (Act 117 of 1998) and the Municipal Systems Act, 2000 (Act 32 of 2000); the Growth Employment and Redistribution Programme (GEAR); the Accelerated and Shared Growth Initiative of South Africa (AsgiSA), as well as the NGP (Van Aardt *et al*., 2011). However, according to Van Aardt *et al*. (2011), most of these programmes failed to achieve the required economic growth the government was hoping for and, furthermore, they also failed to establish a comprehensive, integrated planning framework that could guide economic development.

Although spatial planning guides the interface between planning systems, one of the problems stemming from such an interface relates to policies and legislative framework being either incomplete or not aligned (Drewes *et al*., 2013). Although pre-democracy South Africa had separate planning legislation, after 1994, in spite of reform in government structures, existing planning laws and mechanisms remained largely unchanged (Drewes *et al*., 2013). However, at a policy level, the White Paper on Local Government (South Africa, 1998), placing emphasis on integrated development planning, set the stage for a new paradigm shift. In 2001, the White Paper (South Africa, 2001) on Spatial Planning and Land Use Management was introduced with the aim of producing a legislative and policy framework that would enable government to formulate policies, plans and strategies to address, confront and resolve the spatial and economic challenges facing the country. The most dramatic effect of the White Paper was that it rationalised the existing plethora of planning laws into one national system, resulting in national government having the overall responsibility for spatial planning, land use management and land

development functions. One of the most important elements in the 2001 White Paper was to prescribe national spatial planning frameworks around particular programmes aligning with national priorities. The NIP (see section 7.4.2) and IPAP (see section 7.4.3) highlights specific priority programmes under the concept, 'geographical expression'. However, national spatial planning frameworks were not considered a national plan, but rather policy and legislation frameworks for sustainable and equitable planning. It was in this context (South Africa, 2013) that further reform of the planning system was required. Firstly, the importance of forward planning was recognised and, secondly, reform of the policy and legislative systems regulating planning was required. In summary, the White Paper on Spatial Planning and Land Use Management (South Africa, 2001), which was introduced in 2001, established the foundation for the planning principles contained in today's planning policies and legislation (SACN, 2015) meant to initiate economic growth.

In an assessment by Schoeman (2015), the various spatial frameworks are considered the most current and important, from an alignment and integration perspective, by the different spheres of government in the domain of spatial planning. This is classified and summarised in Table 7.3. The classification should be considered against the background that the Constitution of South Africa provides for three spheres of government, namely national, provincial and local, each with certain legislative responsibilities. *National government* is responsible for policy formulation, the setting of national standards, and the establishment and funding of priority programmes; *provincial government* is responsible for delivering province-wide services, and the monitoring and regulation of municipal planning, implementation processes and the building of local capacity; and *local government* is responsible for the promotion of social and economic development through integrated development planning, local economic development and needs-driven infrastructure provision (South Africa, 2001).

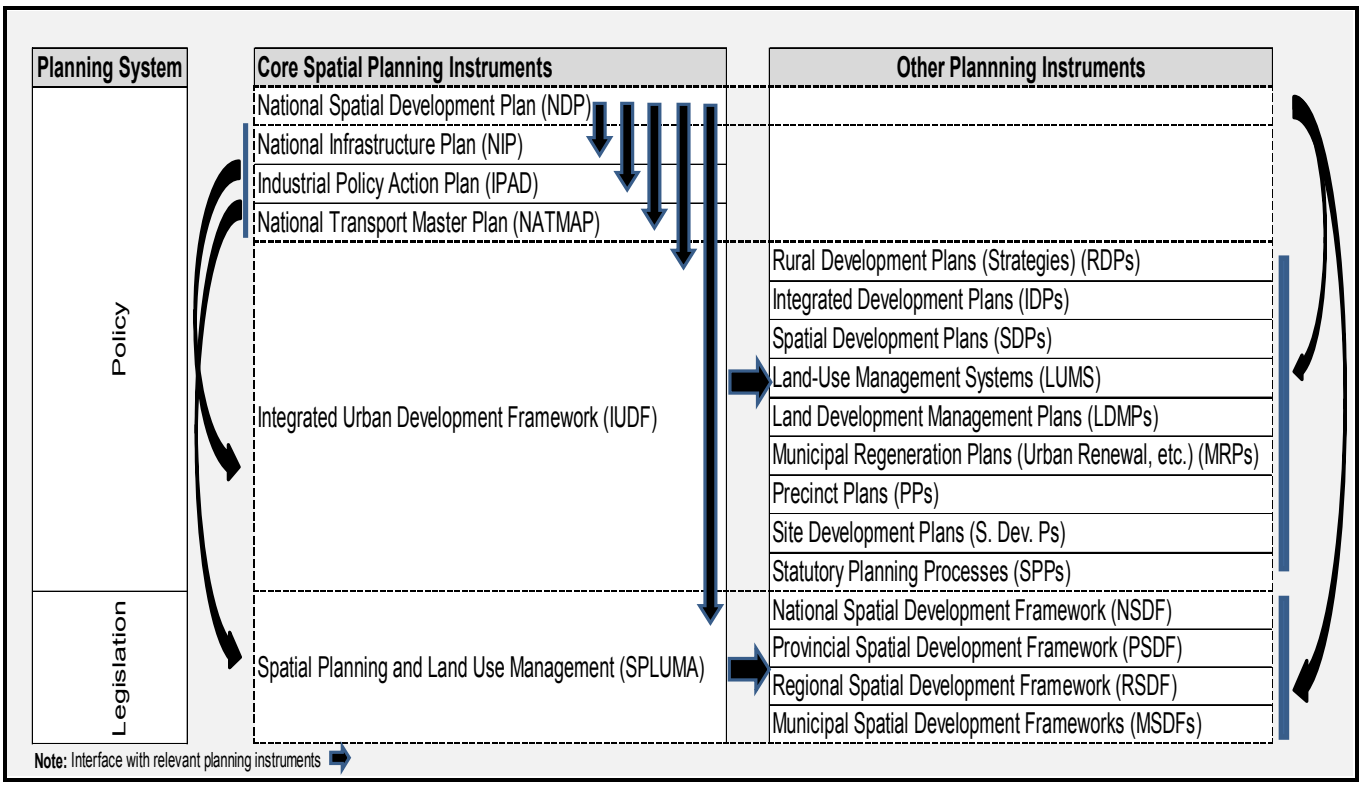
Table 7-3 Spatial planning instruments formulated and managed by different spheres of government

Spatial planning	National	Provincial	Local
National Spatial Development Plan (NDP)	x		
National Spatial Development Framework (NSDF)	x		
National Infrastructure Plan (NIP)	x		
Industrial Policy Action Plan (IPAD)	x		
National Transport Master Plan (NATMAP)	x		
Provincial Spatial Development Framework (PSDF)	x	x	
Spatial Planning and Land Use Management (SPLUMA)	x	x	x
Regional Spatial Development Framework (RSDF)		x	x
Rural Development Plans (Strategies) (RDPs)		x	x
Integrated Development Plans (IDPs)		x	x
Integrated Urban Development Framework (IUDF)		x	x
Spatial Development Plans (SDPs)		x	x
Municipal Spatial Development Frameworks (MSDFs)			x
Land-Use Management Systems (LUMS)			x
Land Development Management Plans (LDMPs)			x
Municipal Regeneration Plans (Urban Renewal, etc.) (MRPs)			x
Precinct Plans (PPs)			x
Site Development Plans (S. Dev. Ps)			x
Statutory Planning Processes (SPPs)			x

Source: Schoeman (2015)

Although many of these frameworks are standing on the periphery of the various planning systems, only a few are at the core when considering strategies about how to best manage the country's ability to achieve social and economic transformation. Considering that the research is from a national perspective, the various spatial planning instruments regarded as being at the core are further discussed in the subsequent sections. Table 7.4 illustrates the planning instruments considered to be at the core, with specific reference to other planning instruments that these core planning instruments strongly interface with.

Table 7-4 Core Spatial Planning Instruments



Source: Own compilation

In brief, spatial policies refer to the basic spatial planning principles that are formulated and enforced, by which the government seeks to achieve socio-economic prosperity. On the other hand, spatial legislation refers to the support of policy frameworks to promote justifiable economic and social development, i.e. legislation creates the interface required to promote the various spatial development frameworks promulgated at a national, provincial and local level. In this regard, the reasons for selecting the various spatial planning instruments, illustrated in Table 7.4, as core are: 1) the National Development Plan (NDP), which emphasises the beginning of a new focus on strategic spatial planning for South Africa; 2) the National Infrastructure Plan (NIP), which envisions a long-term planning framework for investment in major strategic infrastructure projects as incorporated and promoted in the NDP; 3) the Industrial Policy Action Plan (IPAD), which introduces Specific Economic Zones (SEZs) as a tool to assist in the economic development of regions; 4) the National Transport Master Plan (NATMAP), which envisions a dynamic, long-term, sustainable land-use and multimodal (road, rail, air and sea) transportation systems framework for the development of network infrastructure facilities; 5) the Integrated Urban Development Framework (IUDF), which unlocks development synergies that emanate from coordinated investments in cities, thereby ensuring a new approach for South African cities and towns; and 6) the Spatial Planning and Land Use Management (SPLUMA), which brings together through the development of spatial development frameworks the collective vision of government, businesses, and civil society to promote social and economic inclusion.

7.4.1 National Development Plan (NDP)

The main purpose of the National Development Plan (NDP) (South Africa, 2013) is to eliminate poverty and reduce inequality by growing an inclusive economy. This is evident considering that the National Development Plan (NDP) proclaims, “South Africa needs an economy that is more inclusive, more dynamic and in which the fruits of growth are shared more equitably”, which, in essence, refers to initiating spatial transformation. Responding systematically to entrenched spatial patterns that exacerbate socio-economic inefficiency was chosen as a catalytic intervention to achieve spatial transformation. The National Development Plan (NDP) makes the argument that the transformation of national space economy needs to be understood against two important elements: 1) infrastructural networks becoming increasingly integrated, which aligns with the NATMAP vision of providing an integrated transport system to promote economic transformation (see section 7.4.4); and 2) urban growth, which aligns with the IUDF vision of unlocking development synergies (see section 7.4.5). All of this requires a strategic response, including a reorientation of attention to the growth of cities or the lag thereof. According to the National Development Plan (NDP), South Africa's economic activities are distributed across four main metropolitan regions, as well as a network of cities, large towns and service centres, all linked by established networks of connecting infrastructure. The National Development Plan (NDP) synthesises that the Gauteng city-region has reinforced its national dominance in attracting the bulk of economic activities (South Africa, 2013). This is also evident considering the NIP trajectory of economic growth (see section 7.4.2). The coastal city-regions, on the other hand, have not performed so well, especially in terms of job creation, largely because the manufacturing industry has failed to gain traction, despite the apparent advantages of its location. The performance of smaller cities has also been uneven, as they only depend on their dominant industries. Many small towns and rural areas have stagnated, or declined as agriculture and mining have gone through structural changes. This lack of, or uneven performance of cities, according to Stern (1985) and Bloch (1989), is based on the distance from strong economic cores, such as a city-region. In their view, identifying growth points away from a national or regional economic core has proven fruitless. Furthermore, according to the National Development Plan (NDP), South Africa has a relatively good core network of national infrastructure. The challenge is to maintain and expand on this infrastructure to address the demands of a growing economy. When considering the NATMAP vision, South Africa needs to invest in a strong network of infrastructure designed to support and meet the country's medium and long-term socio-economic objectives. The National Development Plan (NDP) (South Africa, 2013) highlights the notion that interconnected interventions such as economic solutions and infrastructure investment are needed to organise spatial transformation. One such intervention is the establishment of development corridors on a transnational (cross-border), as well as national scale.

The notion of development corridors as a planning instrument to guide economic space development on a national scale is discussed in detail in section 7.5. Furthermore, the notion to pursue for deeper transnational integration is also briefly mentioned and discussed in section 7.5.

7.4.2 National Infrastructure Plan (NIP)

The National Infrastructure Plan (NIP) (South Africa, 2012) was established in 2012, in response to the slow pace of infrastructure development, weak implementation capacity and the lack of alignment with national priorities. The NIP aims to transform the South African economic landscape while simultaneously supporting the integration of African economies. The Presidential Infrastructure Coordinating Commission proposed a 20-year planning framework for investment in major Strategic Infrastructure Projects (SIPs) and is legislated, in terms of the Infrastructure Development Act, 2014 (Act 23 of 2014). The NIP contains 18 SIPs covering social and economic infrastructure across the country that can fast-track development and growth. It is also anticipated that the investment in the construction of ports, roads, railway systems and other infrastructure will contribute to faster economic growth.

Already mentioned, the NDP incorporates the National Infrastructure Plan (NIP), thereby supporting the series of ambitious and far-reaching SIPs envisaged to transform South Africa's economic landscape. The identified projects will provide new infrastructure, as well as assisting in upgrading existing infrastructure. Furthermore, it is also anticipated that the NIP will play an important role in facilitating the regional integration of African co-operation and economic development on the African continent.

Table 7.5 provides a list of SIPs which were approved by the Presidential Infrastructure Coordinating Commission. Each project was identified through spatial analysis of infrastructure gaps, population movement and economic performance that enabled spatial targeting for investment opportunities.

Table 7-5 Strategic Infrastructure Projects

SIP	Strategic Infrastructure Projects	Project
SIP 1	Unlocking the nothern mineral belt with Waterberg as catalyst	Investment in rail, water pipelines, energy generation and transmission infrastructure to tap Limpopo's rich mineral reserves.
SIP 2	Durban-Free State-Gauteng logistics and industrial corridor	Linking the industrial hubs in Durban, the Free State and Gauteng, and improving access to Durban's import/export facilities.
SIP 3	South-eastern node and corridor development	Upgrade of port and rail capacity, construction of a new dam in Umzimvubu in the Eastern Cape, construction of rail infrastructure to transport manganese from the Northern Cape to Port Elizabeth, construction of a manganese sinter facility in the Northern Cape and a smelter in the Eastern Cape.
SIP 4	Unlocking the economic opportunities in the North West province	Acceleration of identified investments in roads, rail, bulk water and water treatment and transmission infrastructure; further development of the mining, agriculture and tourism sectors in the province.
SIP 5	Saldanha-Northern Cape development corridor	Expansion of rail and port infrastructure in the Saldanha area; construction of industrial capacity at the back of these ports (including industrial development zone); strengthening maritime support for the gas and oil activities along the West Coast; expansion of iron ore mining production.
SIP 6	Integrated municipal infrastructure project	Addressing all maintenance backlogs and upgrades required in water, electricity and sanitation bulk infrastructure.
SIP 7	Integrated urban space and public transport programme	Construction/expansion of public transport, housing, economic and social infrastructure.
SIP 8	Green energy	Supporting sustainable green energy initiatives nationally using options envisaged in the integrated resource plan; supporting biofuel production.
SIP 9	Electricity generation	Accelerating construction of power plants to meet energy needs identified in the integrated resource plan.
SIP 10	Electricity transmission and distribution for all	Expansion of the transmission and distribution network.
SIP 11	Agri-logistics and rural infrastructure	Investing in infrastructure such as storage facilities, transport links to main networks, fencing of farms, irrigation schemes to poor areas, agricultural colleges, processing facilities (including abattoirs) and rural tourism.
SIP 12	Revitalisation of public hospitals and other health facilities	Building and refurbishing hospitals, public health facilities and nursing colleges. Extensive capital expenditure to prepare the public healthcare system to meet the further requirements of the National Health Insurance scheme.
SIP 13	National school build programme	Replacing inappropriate school structures and addressing basic service backlogs. Provision of basic services under the Accelerated School Infrastructure Delivery Initiative.
SIP 14	Higher education infrastructure	Construction of lecture rooms, student accommodation, libraries and laboratories, and improving ICT connectivity. Development of university towns with a combination of facilities, ranging from residences and retail to recreation and transport.
SIP 15	Expanding e-access to communication technology	Enabling the Department of Communications' target of 100% broadband penetration by 2020. The private sector is focusing mainly on urban areas, while government will invest in rural and township areas. It will also invest in e-government and school and health connectivity.
SIP 16	SKA and Meerkat	Radio-telescope installations.
SIP 17	Rgional integration	Investment in mutually beneficial projects in the Free Trade Area, encompassing East, Central and southern Africa.
SIP 18	Water and sanitation master plan	Addressing backlogs in water and sanitation; maintenance of water and sanitation infrastructure.

Source: National Treasury (2012)

It is clear that each project is focused on specific geographical areas promoting specific geographic expression, i.e. it is a responsible and not an arrogant government that initiates priorities that will envisage spatial transformation. Furthermore, it is also clear that, from the existing projects, three relate directly to development corridors, which are discussed in more detail in section 7.5.

Lastly, the National Infrastructure Plan (NIP), in the spatial analysis of infrastructure gaps, population movement and economic performance, made two important predictions: 1) the expected increased urbanisation to economic centres (illustrated in Figure 7.7) and 2) the anticipated development trajectory of economic growth (illustrated in Figure 7.8). According to the National Infrastructure Plan (NIP), the population migration will result in placing more constraints on major economic nodes and the anticipated economic growth will continue around the major economic hubs of Johannesburg, Cape Town and Durban (eThekwini). This necessitates the adoption by government of an approach that will support a balanced economic growth across the country, which emphasises the notion of development corridors (discussed in detail in Chapter 5) as an approach to a confluence of regional economic integration and inclusive growth.

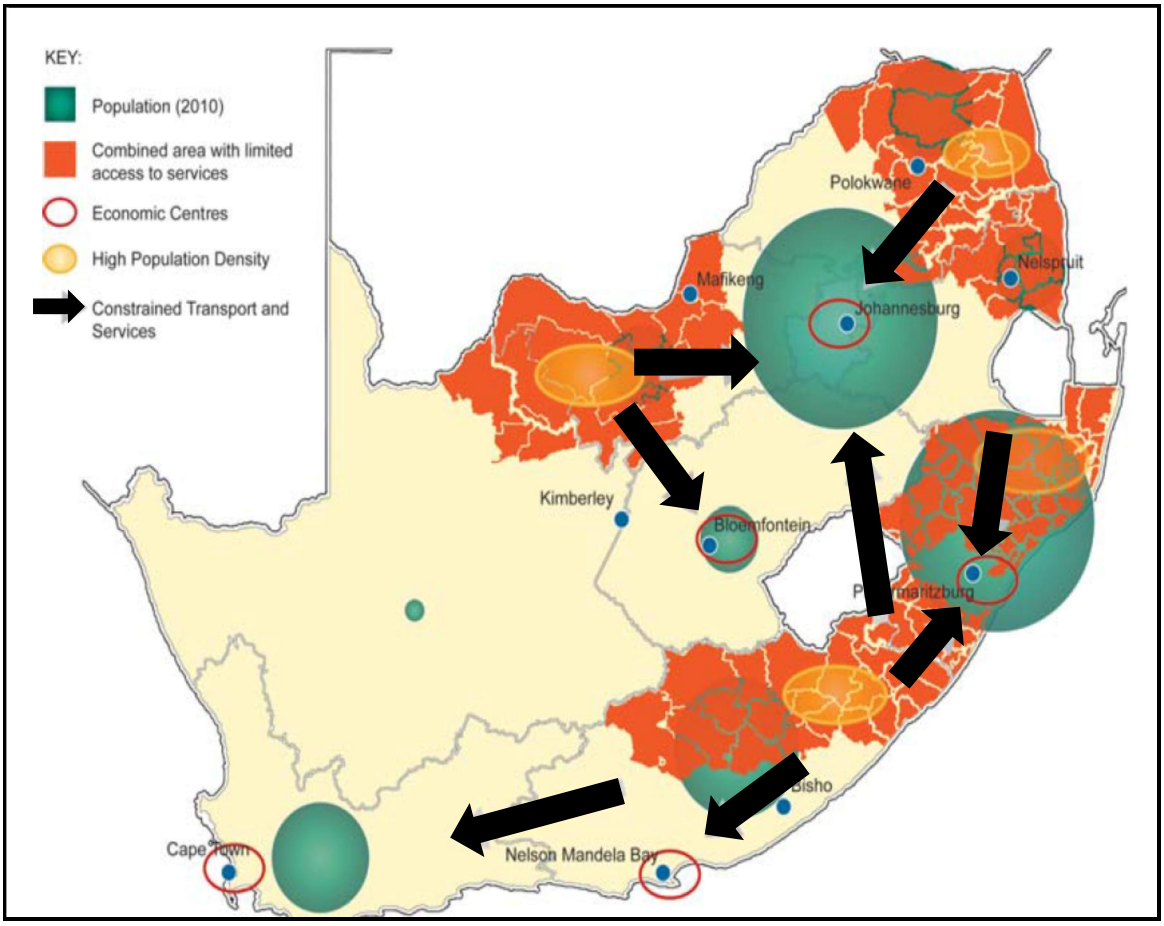


Figure 7-7 Projected expected increased urbanisation Source: South Africa (2012)

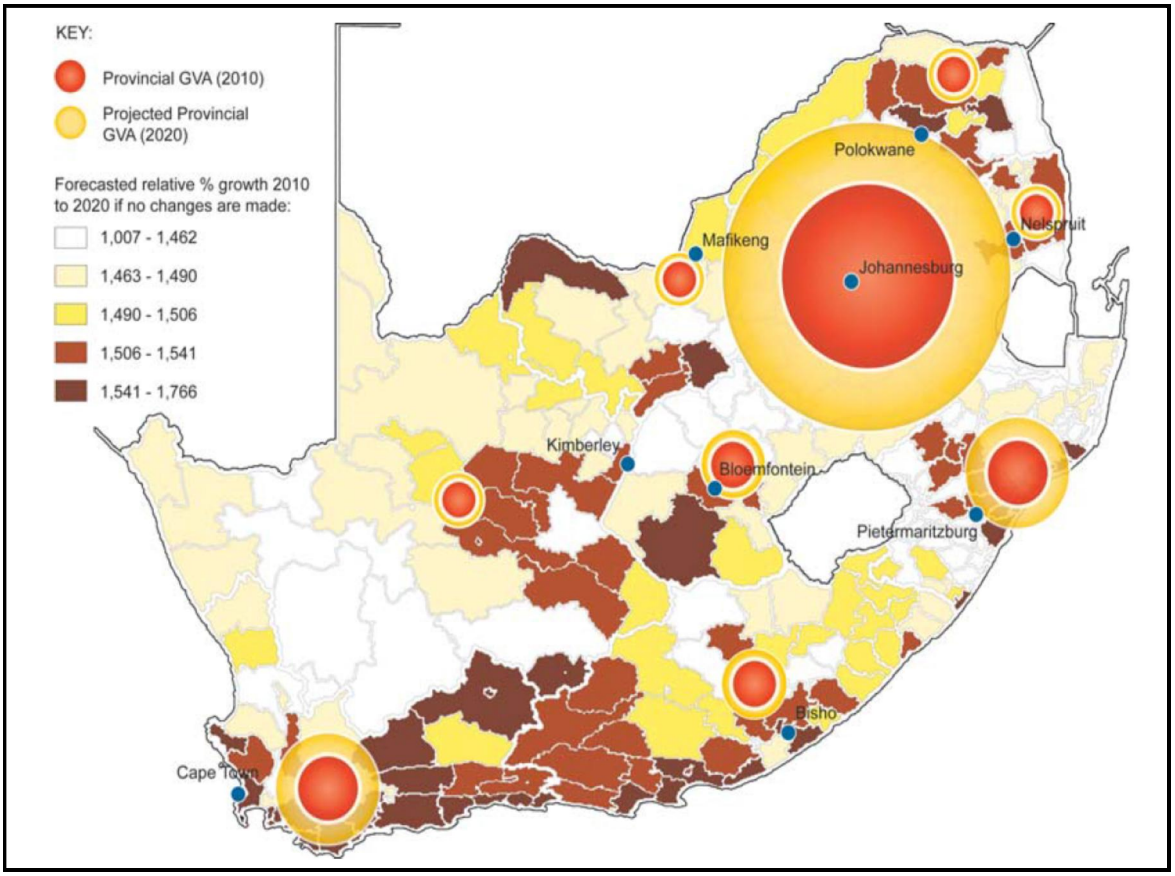


Figure 7-8 Anticipated development trajectory of economic growth

Source: South Africa (2012)

7.4.3 Industrial Policy Action Plan (IPAD)

Industrial decentralisation is particularly challenging in the South African landscape, considering the deep-seated spatial distortions inherited from the Apartheid period. In this regard, the Industrial Policy Action Plan (IPAP) was introduced to differentiate economic and industrial development related to regions to promote economic growth. The key consideration identified by Industrial Policy Action Plan (IPAD) was to strengthen the instruments which would enable appropriate and viable economic and industrial decentralisation to take firm root in the previously under-served regions, connecting them into the wider national economy to discover potential new investment opportunities. In this regard, national government introduced SEZs as a tool to assist in the economic development of regions (South Africa, 2010 & 2016). SEZs were created to support sustained economic growth of the manufacturing sector, based on the efficiencies stemming from 1) proximity to markets and ports; 2) efficient supply and logistics chains; 3) agglomeration and clusters; and 4) supportive economic infrastructure (South Africa, 2016). As illustrated in Figure 7.9, four SEZs were established: 1) the Coega Industrial Development Zone (IDZ), situated in the Nelson Mandela Bay region (in Port Elizabeth), which was designated in 2001 to become South Africa's first IDZ. It is strategically located on the east-west trade route to service global, as well as African markets. The zone leverages the public sector to attract foreign and domestic

investments with an export orientation in the manufacturing sector. The zone mainly attracts investments in the agro-processing; automotive; aqua-culture; energy; metals; logistics and business process services sectors. It also advances socio-economic development in the Eastern Cape region through skills development, technology transfer and job creation; 2) the East London IDZ, part of the Buffalo City Metropolitan area, which was established in 2003 as part of the South African government's initiative to improve industrial competitiveness and economic growth in the country. The zone has become a prime industrial park in South Africa, renowned for its customised solutions for various industries, including automotive, agro-processing and aqua-culture. The zone's location provides investors with connections to major markets, locally, as well as globally; 3) the Richards Bay IDZ, situated in Kwazulu-Natal close to the Durban (eThekwini) city region, which is a purpose-built zone securing an industrial estate on the north-eastern South African coast. The zone links the province's two major ports, Durban (eThekwini) and Richards Bay, and connects with Maputo in Mozambique and, ultimately, areas of East Africa. It is linked to the international sea port of Richards Bay, tailored for manufacturing, and storage of minerals and products to boost beneficiation, investment, economic growth and, most importantly, the development of skills and employment. The zone aims to encourage international competitiveness and the attraction of export-orientated manufacturing investment opportunities; and 4) the Saldanha Bay IDZ, which was launched in 2013 to serve as the primary oil, gas and marine repair engineering and logistics services complex in Africa, servicing the needs of the upstream oil exploration industry and production service companies, operating in the oil and gas fields off Sub-Saharan Africa. The zone includes logistics, repairs and maintenance, as well as fabrication activities (South Africa, 2010; De Lange, 2012; South Africa, 2016).

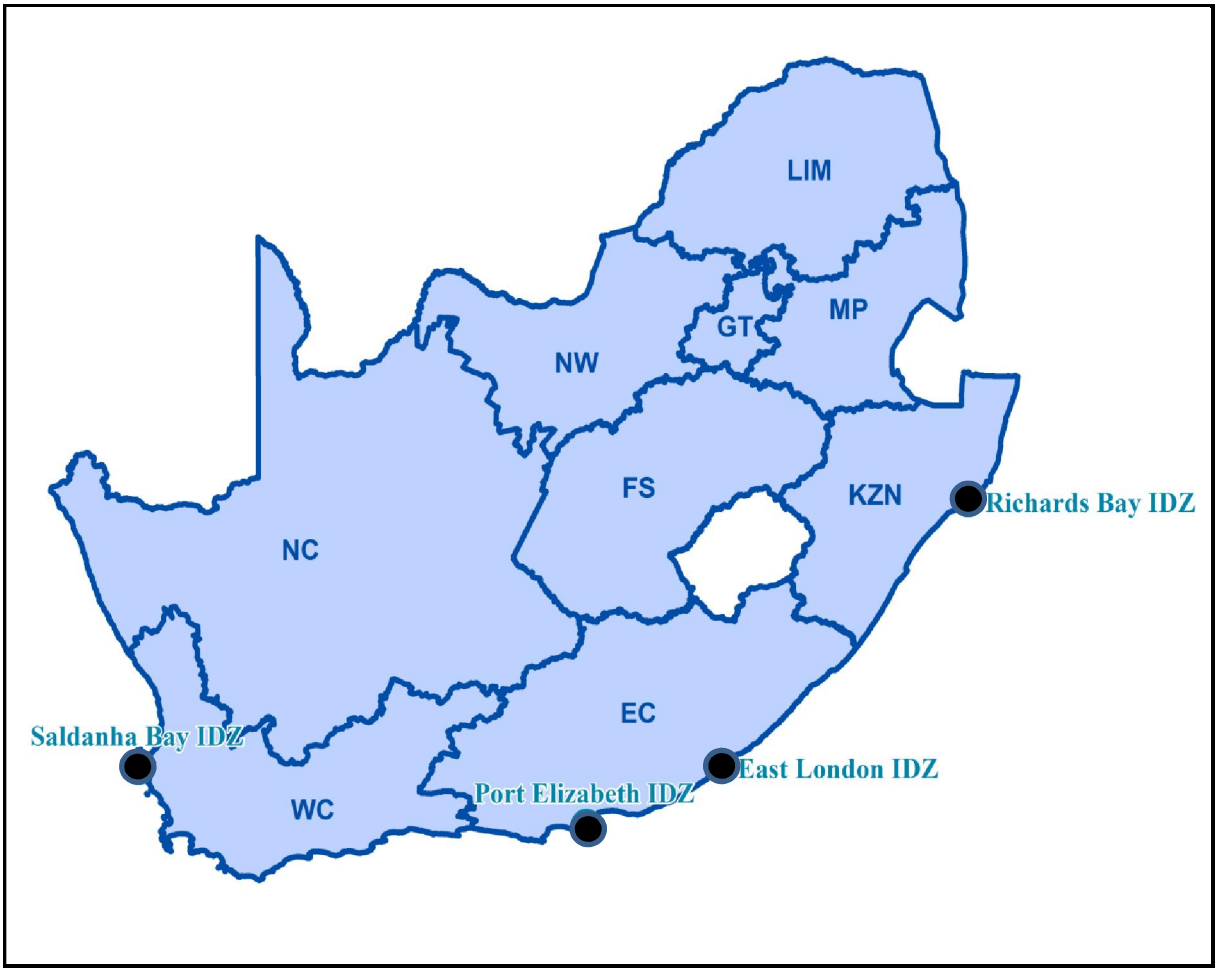


Figure 7-9 Strategic economic zones Source: Own compilation

A key initiative linked to Industrial Policy Action Plan (IPAD) as an outflow from the IDZ, is government's Industrial Parks Programme (IPP), spearheaded by the Department of Trade and Industry (DTI). DTI prioritised various state-owned industrial parks (see Table 7.6 and Figure 7.10) as part of creating investment opportunities to promote economic growth (South Africa, 2017). According to DTI, the initiative will go a long way in accelerating economic development in especially the lagging regions of the country. In DTI's view, industrial parks will contribute towards economic growth, job creation and diversification of economic activity, as well as attracting investment opportunities. DTI strongly believes that industrial parks will enable regions to build, strengthen and develop their strategic industrial capabilities (South Africa, 2017).

Table 7-6 State-owned industrial parks

Industrial Parks		Place	Province
1	Seshego	Polokwane	Limpopo
2	Nkowankowa	Tzaneen	Limpopo
3	Queenstown	Queenstown	Eastern Cape
4	Vulindlela	Mthatha	Eastern Cape
5	Isithebe	Durban/Richards Bay	KwaZulu-Natal
6	Botshabelo	Thaba Nchu/Bloemfontein	Free State
7	Phuthaditjhaba	Harrismith	Free State
8	Bodirelo	Mogwase	North West
9	Babelegi	Hammanskraal	North West
10	Garankuwa	Pretoria	Gauteng
11	Ekandustria	Bronkhorstspruit	Gauteng

Source: Own compilation

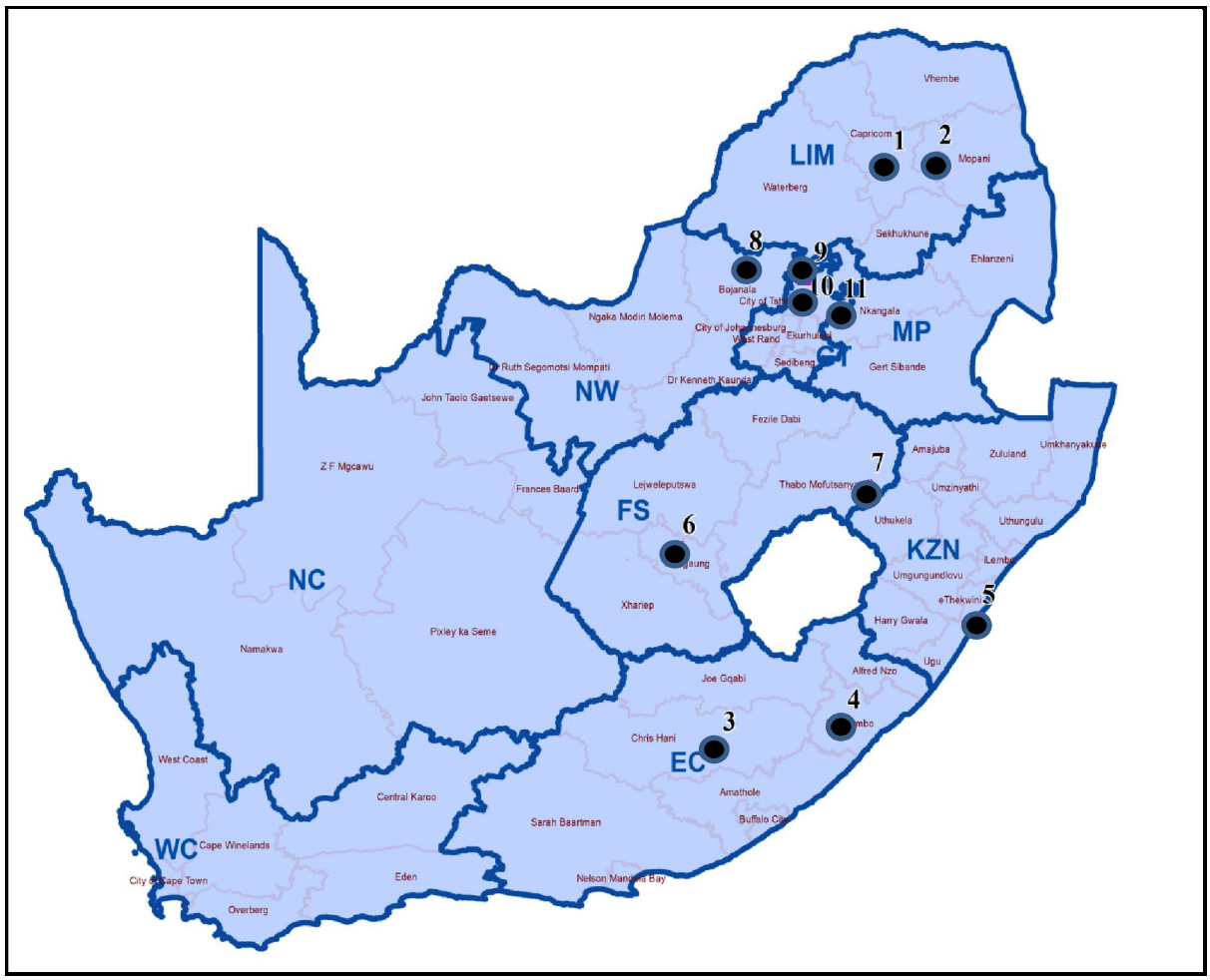


Figure 7-10 State-owned industrial parks Source: Own compilation

Note: Map should be read along with Figure 7.6

It is through initiatives like IDZs and IPP that Industrial Policy Action Plan (IPAD) hopes to expand the scope and depth of all the interlocking (cross-cutting and sector-specific) programmes, putting forward combined efforts to secure collaborative efforts that will redirect and support the manufacturing sectors, in order to marshal resources for increasing investment in the economy.

7.4.4 National Transport Master Plan (NATMAP)

As far back as 1999, the NDoT launched the 'Action Agenda' to give effect to the 'strategic framework', spelling out how the country could meet transport requirements in a sustainable way, but also expressing the view that transport is an enabling industry to meet other pressing national and social objectives. The department opted for two important approaches: 1) a 'strategic network' consisting of densely developed nodes and interconnecting corridors; and 2) a 'supporting network' that feeds into and distributes from the strategic network, but also connects to areas outside the core network. An outflow from the 'Action Agenda' was the promulgation of an important piece of legislation, namely the National Land Transport Transition Act, 2000 (Act 22 of 2000), which relates directly to interconnecting corridors and transport systems (South Africa, 1999). The two key legislative issues in the National Land Transport Transition Act impacting directly on corridors and transport systems are:

1) Functions must be integrated, in relation to economic planning and the development of corridors. This notion aligns with the NDP (see section 7.4.1) and the NIP (see section 7.4.2), promoting the economic vision of regional integration at a trans and national level through the establishment of development corridors as a key instrument to enable economic transformation.
2) Transport plans must be developed so as to enhance the effective functioning of regions. This notion aligns with the development of a sustainable multimodal (road, rail, air and sea) transportation system that expresses transportation as an enabler to meet national objectives.

The second notion, which envisions the development of a dynamic, long-term, sustainable land use and multimodal (road, rail, air and sea) transportation systems framework for the development of network infrastructure facilities resulted in the approval of the National Transport Master Plan (NATMAP) by the South African government in 2011 (Schoeman, 2013). The National Transport Master Plan (NATMAP) is a demand-responsive planning instrument responding to national, provincial, municipal and regional demand forecasting, which is an important contribution to national planning formulation processes. The following elements are considered important contributors:

1) Analysis of land use, economic activity and population
2) Analysis of current movement infrastructure
3) Modelling of scenarios and demand projections.

Importantly, the National Transport Master Plan (NATMAP) also contains information on strategic movement infrastructure elements that include identifying current and potential linkages between different nodes and regions distributed across the country. This aligns with the IUDF's (see section 7.4.5) vision of developing urban nodes that provide economic and social investment opportunities.

In summary, according to Schoeman (2013), viewing National Transport Master Plan (NATMAP) in its totality provides a holistic and integrated plan that not only promotes a sustainable transportation system, but also economic transformation through the creation of an integrated, multimodal transport system. The importance of this notion is discussed and explained in detail in Chapter 5 under section 5.5.

7.4.5 Integrated Urban Development Framework (IUDF)

The Integrated Urban Development Framework (IUDF) (South Africa, 2014) is designed to unlock the development synergy that emanates from coordinated investments in places, ensuring a new approach for South African cities and towns. The Integrated Urban Development Framework (IUDF) is specifically aimed at developing urban nodes. The basic principles of economic space development are theorised in Chapter 4, which should be considered the basis of the Integrated Urban Development Framework (IUDF's) aim to develop urban nodes. The framework has a vision of spatially and economically integrated centres which provide economic and social opportunities. Therefore, the IUDF is an extension of the various themes contained in the NDP, transforming the national space economy by providing a new approach to urban investment.

It is clear that the Integrated Urban Development Framework (IUDF) (South Africa, 2014) recognises that the country has different types of cities and towns, which have different roles and requirements (this is explained in detail in section 7.2). Therefore, to achieve the transformative vision of spatial transformation as a strategic approach, the Integrated Urban Development Framework (IUDF) advocates the following key themes:

1) Integrated spatial planning, which is essential for coherent development, stimulating a more rational, structured use of urban space, thereby guiding specific investments to build a sustainable economy.
2) Integrated transport and mobility, which are vital components of economic infrastructure investment, supporting social and economic development through urban linkages.
3) Integrated and sustainable human settlements, which are crucial for redressing Apartheid geography and the restructuring of cities.
4) Integrated urban infrastructure, which must be extensive and strong enough to meet industrial and commercial needs, and should be planned in such a way that it supports the development of an efficient and equitable urban form facilitating access to social and economic opportunities.

5) Efficient land governance and management, where municipalities and private investors have a vested interest in land value, which contributes to the growth of inclusive and multifunctional urban spaces.
6) Inclusive economic development, which is the backbone of national economic policy, emphasising the potential of new economies through innovation, investments and spatial development.
7) Empowered active communities which bring together a critical mass of social and economic diversity, as well as the active citizens advocated by the NDP, empowering communities to transform the quality of urban spaces.
8) Effective urban governance to manage the intergovernmental dynamics within cities, in relation to provinces and other municipalities, fulfilling the developmental and growth mandate resulting in inclusive and resilient urban spaces.

In summary, the Integrated Urban Development Framework (IUDF) illustrates different options for more effective and efficient urban space development, contributing to the NDP's aim for cities to be the country's economic drivers through improved spatial transformation and inclusion. Rooted in the NDP, the Integrated Urban Development Framework (IUDF) supports the country's need for inclusive economic growth. Furthermore, the Integrated Urban Development Framework (IUDF) also creates an interface with the various planning instruments promulgated at a local level (see Tables 7.3 and 7.4).

7.4.6 Spatial Planning and Land Use Management Act (SPLUMA)

According to the SACN (2015), until the promulgation of Spatial Planning Land Use Management Act (SPLUMA), the national system proposed in the 2001 White Paper and detailed in subsequent spatial policy was not included in any new legislation governing spatial planning. The Development Facilitation Act, 1995 (Act 67 of 1995) pre-dating the 2001 White Paper, which has since been repealed, was the only post-1994 piece of legislation that dealt with spatial development principles. The Spatial Planning Land Use Management Act (SPLUMA) was developed to legislate for a single, integrated planning system for the entire country. Therefore, prior to the Spatial Planning Land Use Management Act (SPLUMA), spatial planning was fragmented with no alignment of authorisation processes between the different spheres of government. In 2013, the Spatial Planning and Land Use Management Act, 2013 (Act 16 of 2013) was published bringing into effect fundamental changes in spatial planning. Considered most important was providing for the development of respective Spatial Development Frameworks (SDFs) by all spheres of government, thereby promoting social and economic inclusion. This aligns with the NDP proposal that the development of spatial frameworks involve government, businesses and civil society to create a collective vision (Drewes *et al*., 2013). The aim of developing SDFs is to ensure that all plans and programmes are coordinated, consistent and in harmony with each other, i.e. SDFs will give specific and definite geographical expression to influence the space economy of South Africa. The Act promotes four different SDFs (see Table 7.4) with specific outcomes:

1) A national SDF, which contributes to and gives spatial expression to the national development policy and plans emanating from various sectors of national government.
2) A provincial SDF, which contributes to and expresses provincial development policy, as well as integrating, and spatially expressing policies and plans emanating from the various sectors of the provincial and national spheres of government.
3) A municipal SDF, which assists with integrating, coordinating, aligning, and expressing development policies and plans emanating from the various sectors of the spheres of government.
4) A regional SDF, which outlines specific arrangements for prioritising, mobilising, sequencing, and implementing public and private infrastructural and development investment and spatially structured areas identified in the different spatial development frameworks.

The introduction of the Spatial Planning Land Use Management Act (SPLUMA) is set to aid effective and efficient planning affecting spatial transformation. According to Turok (2014), although there is no agreed definition for spatial transformation, it is often referred to as 'major urban change or restructuring'. Therefore, urban restructuring implies that cities are being tasked with driving spatial transformation. This transformation should meet the need for inclusivity, mobility and access to economic development investments which will drive local and national growth prospects, transforming space in a manner that is economically sustainable (SACN, 2015). This aligns with the aim of the NDP, which is to break down the legacy of spatial divergence through a coherent approach to spatial development backed by strong investment, and the identification of viable and sustainable opportunities. These opportunities are discussed in Chapter 9 and illustrated in Figure 9.1.

The NDP on spatial development promotes spatial perspectives that set out the opportunities and choices available, in order to lay the basis for aligning investment and economic development initiatives. In addition, regional development is an imperative to promote sustainable economic growth. Increased exports to SADC alone can generate additional economic growth arising from South Africa's position as a financial, logistics and services hub. These opportunities can strengthen economic development in and between neighbouring countries. South Africa cannot succeed with regional development without strong partnerships with other countries on the continent (South Africa, 2010).

It is clear that South Africa created a comprehensive spatial planning system to deal with and promote inclusive economic development. However, it also seems that these structures only serve the vested interest of the government and not the entrepreneurial playing fields. Furthermore, as stated by Wessels (2016), it seems that the NDP created an interface across the various planning instruments to promote economic inclusion through the facilitation of growth, which, in effect, constrained economic growth and did not necessarily promote economic inclusion. This was eloquently summarised by Drewes *et al*. (2013), who stated that national space had been left open for interpretation, in terms of economic growth and development, which had led to a lack of execution of the well-intentional spatial guiding instruments

promulgated at the various levels of government. However, one commonality rooted in each of the core frameworks is the notion that economic growth is dependent on cities as renewed economic dynamism (see Chapter 4). According to each framework, cities should pave the way towards economic growth and development to promote economic inclusion and spatial transformation.

7.5 Development Corridors

In Brunner's (2013) view, corridors do not stand alone and their role in economic space development can only be comprehended in terms of the network effects that they induce, whereby new opportunities are created to participate in global trade and to foster market integration. He points out that the dynamic interaction between corridors creates patterns of economic development based on combined elements of the NEG. Furthermore, according to him, what corridors can achieve for economic development and integration depends, firstly, on the characteristics that the specific existing economic networks in which the corridors are embedded personify, and, secondly, on the characteristics that the corridor development intends to introduce or strengthen. Mulenga (2013), supporting Brunner's view, stated that to capture the full benefits of corridors, they should be viewed as engines of economic space development in themselves and not only as conduits for growth. Therefore, for the purpose of the research, corridor initiatives relating to the southern African and South African context, which are being highlighted and promoted through the NDP and NIP, are discussed to show that, although these corridors were established primarily with a political and economic vision in mind, there is no standard picture of what development corridors are and what they can achieve, especially as an integrated framework to restructure economic spaces.

According to the UN (2009) and reiterated by the ADB (2010), remoteness from major world markets is the principal reason why many African countries have been unsuccessful in mitigating strong economic development. Most African countries are developing countries with similar economic structures and limited resources. The trade opportunities between these countries and world markets are insignificant and, in most cases, the transport infrastructure is weak and offers no advantage to economic development. Therefore, under the auspices of the UN (2009) and the ADB (2010), African countries have embarked on promoting various action plans whereby the special need to develop economic opportunities is addressed, in the hope of stimulating intra-regional and global trade. Various regional development corridors have been established to provide important connections between economic nodes or hubs that are usually centred in major urban areas to address this need. In order to create free trade initiatives, nine regional development corridors (illustrated in Figure 7.11) were established, each with a political and economic vision to pursue the deeper regional integration programmes established under the COMESA, the EAC and the SADC free trade initiative (UN, 2009; ADB, 2010). The nine development regional corridors established are: 1) the Northern corridor; 2) the Central corridor; 3) the

Dar es Salaam corridor; 4) the Walvis Bay corridor; 5) the Maputo corridor; 6) the Beira corridor; 7) the North-South corridor; 8) the Lobito-Benguela corridor; and 9) the Nacala corridor.

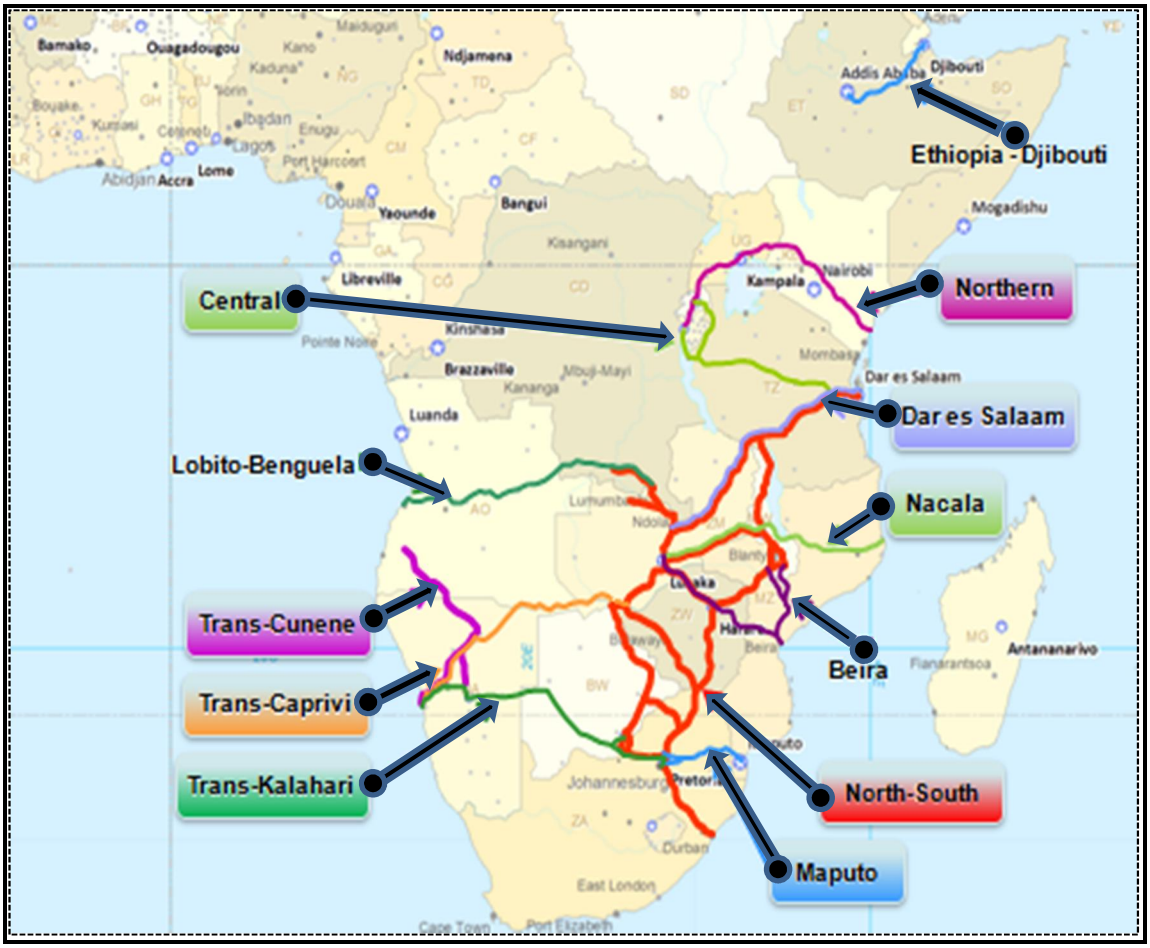


Figure 7-11 Southern African development corridor initiatives

Source: UN (2009); ADB (2010)

These corridors were established to provide a framework for economic collaboration among countries promoting internal and external trade. Furthermore, these corridors were established as a strategic link with landlocked countries to unlock foreign trade opportunities. Each corridor is multimodal-, encompassing road, rail, seaport, airport and inland waterways. Of the selected southern African corridor initiatives, three are directly linked to South Africa. The three corridors are:

1) *Walvis Bay corridor* – The Walvis Bay corridor encompasses four major economic development corridors extending from the port of Walvis Bay, namely the Trans-Kalahari, the Trans-Caprivi, the Trans-Cunene and the Trans-Oranje corridors. These corridors reach Angola, Botswana, Democratic Republic of the Congo, South Africa, Zambia and Zimbabwe. Of the four corridors, only the Trans-Kalahari corridor links with South Africa. The Trans-Kalahari corridor extends from Walvis Bay to Botswana through the communities of Swakopmund, Usakos, Karibib, Okahandja, Windhoek and

Gobabis. From Botswana, it extends to Johannesburg/Pretoria, linking up with the Maputo corridor connecting the port of Walvis Bay on the east coast to the port of Maputo on the west coast (Jorgensen, 2000; Schutte, 2003; Brundige *et al*., 2011; Mommen, 2011; Bowland *et al*., 2012; Giersing *et al*., 2013; Van Zyl, 2013).

2) *Maputo corridor* – The Maputo corridor links the Gauteng region in South Africa with the Maputo region in Mozambique. The corridor also unlocks the regions of Mpumalanga and Limpopo in South Africa, and is one of the most important examples of contemporary, bilateral co-operation between the countries of Mozambique and South Africa. Promoted as a transnational development corridor, the corridor became a reality as a result of coinciding developments of core infrastructure, which included the upgrading of the Maputo port and the upgrading of the N4 highway, stretching from Pretoria to Maputo (Jorgensen, 2000; Schutte, 2003; Brundige and *et al*., 2011; Mommen, 2011; Bowland *et al*., 2012; Giersing *et al*., 2013; Van Zyl, 2013).
3) *North-South corridor* – The North-South corridor traverses eight countries covering two existing corridors, namely the Durban corridor and the Dar es Salaam corridor, which link the port of Durban in southern Africa to the East African port of Dar es Salaam. The corridor has a holistic and sub regional approach, with the following objectives: to facilitate cross-border trade; to reduce transport delays and costs; to promote transit and transport regulations; and to support landlocked countries in gaining easier access to international markets (Jorgensen, 2000; Schutte, 2003; Brundige *et al*., 2011; Mommen, 2011; Bowland *et al*., 2012; Giersing *et al*., 2013; Van Zyl, 2013).

South Africa responded to the economical vision of regional integration with the establishment of a 20-year planning framework (the aim of the NIP is to transform the South African economic landscape, see section 7.4.2) to create investment opportunities within major strategic infrastructure projects (South Africa, 2012). The projects are mainly focused on creating development corridors, which are incorporated in the NDP as spatial themes and in the NIP as key infrastructure projects. The NDP (South Africa, 2013) highlighted that, in the South African landscape, city regions and cities are considered economic nodes or hubs which represent the core cylinder of national agglomeration economies and, when combined, they support the notion of an economic network extending between them (illustrated in more detail in Chapter 8, see section 8.2). In support of this political and economic vision to pursue greater regional integration, South Africa identified three development corridors (illustrated in Figure 7.12), which were established through a process of analysing infrastructure gaps and potential economic investment areas. The development corridors (South Africa, 2012 & 2013) are:

1) *Durban—Free State—Gauteng corridor* – The Durban—Free State—Gauteng corridor has been earmarked by the government as an important infrastructural project to boost economic development. This is not surprising, considering that it is one of the busiest routes in the country, transporting some 30 million tonnes of freight per annum. The corridor forms part of the government's 2050 vision and is considered to be the backbone of South Africa's freight

transportation network, vital in facilitating economic growth for the country and the southern African region. The corridor encompasses the following elements: the port of Durban; Durban—Gauteng road; Durban—Gauteng rail; and logistics hubs. It is envisioned that these elements will ensure that the country's economy remains competitive in global markets. The port of Durban alone provides connectivity to about 53 international destinations, as well as access to local distribution networks, thereby connecting the major economic centres of Gauteng and Durban regions, making it an important corridor for international trade. The Free State government, on the other hand, is of the opinion that the Durban—Free State–Gauteng corridor is intended to promote not only better transport of goods between the end points, but also economic development in the towns and rural areas located in proximity of the corridor. The town of Harrismith, situated at the intersection of the N3 and N5 highways, is ideally positioned to establish a logistical hub. The intention is to create an inland port at Harrismith that can handle cargo containers and, at the same time, be able to shift cargo from road to rail. The corridor is the busiest freight corridor in the country and the focus is on improving efficiency and effectiveness of freight operations along the corridor, ensuring that capacity is provided ahead of demand. It is the government's intention to achieve these objectives in a manner that optimises socio-economic development along the corridor.

2) *South-Eastern corridor* – The South-Eastern corridor will improve the industrial and agricultural development, and export capacity of the Eastern Cape region, expanding the region's economic and logistics linkages with the Northern Cape and KwaZulu-Natal regions. The corridor will strengthen economic development in Port Elizabeth through rail capacity stretching from the Northern Cape and the N2 Wild Coast Highway, thereby improving access into KwaZulu-Natal.
3) *Saldanha—Northern Cape corridor* – The Saldanha—Northern Cape corridor was launched in 2012, with the aim of ensuring that the Saldanha—Northern Cape region becomes a value-adding centre to economic development, rather than simply being a transit corridor for iron ore. This will entail developing the back-of-port industrial capacity, strengthening maritime support capacity to create economic opportunities for gas and oil activities along the African west coast, and the expansion of iron ore mining production and beneficiation. The Saldanha port infrastructure and operations will be expanded to increase South Africa's iron ore export capacity. This proposed port expansion forms part of an overall project to increase the throughput capacity of the Sishen - Saldanha iron ore from 60 to 88 million tonnes annually. This is motivated by South Africa's aspirations to remain a strong competitor in the iron ore export industry, and position the country to reap the benefits from increasing global market share and revenue generated from iron ore exports. The corridor will encompass three elements: mine-side ore loading; iron ore rail transport; and a port iron ore terminal. Current iron ore exports contribute about R70 billion to South Africa's gross domestic profit. The proposed expansion will provide an increase in iron ore exports of some 40 per cent, compared to current exports. Therefore, a substantial increase in revenue from iron ore exports would be achieved through this proposed corridor.

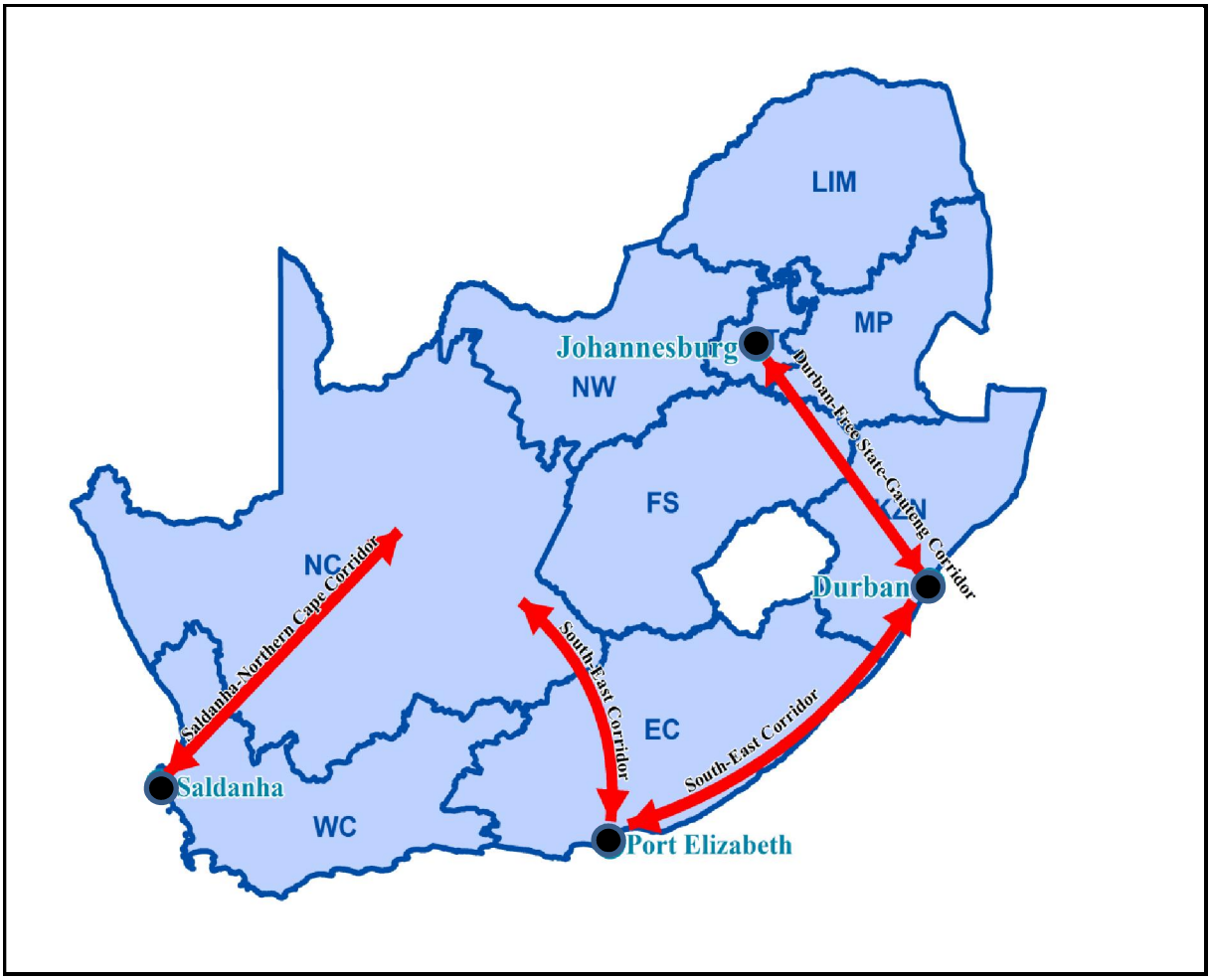


Figure 7-12 South African development corridor initiatives

Source: Own compilation

In the South African context, it is clear that corridor development as an economic vision to pursue greater regional integration is primarily politically driven. According to the various SDFs (South Africa, 2012), corridors are primarily defined as areas of high-density, urban development centred around economic activities and development routes, and are characterised by dynamic, mutually supporting relationships between land uses and movement systems. In essence, this concentration of high-density urban development improves access to investment opportunities, thereby offering a means to integrate service provision, and economic and social needs at a trans and national level. This notion is best summarised by Haggett's (1983) view stating that corridors are usually characterised by a combination of strip and nodal development. Strip development generally compromises mixed uses (commercial, industrial and residential) and is located along portions of development corridors, while nodes are characterised by the clustering of economic activities at points of maximum accessibility. This notion of Haggett is supported by the concept of a development corridor (see section 5.2), postulated by scholars such as Friedmann (1972), Tuppen (1977), Geyer (1988), Andersen *et al*. (1998), Arvis *et al*. (2011), Buiten *et al*. (2011), Henning *et al*. (2012), Srivastava (2012) and Brunner (2013), arguing that a link

between nodes provides access to different levels of economic opportunities, and the intensity of economic development at nodes varies in size and dominance. Furthermore, nodal development and economic space development, as described in chapters 3 and 4, respectively, are synonyms of the concept of linkage, explaining the variety of accessibility between nodes; and nodes, explaining the agglomeration of economic activities at different localities, both pursuing the notion of certain cities or regions being selected as preferred locations to support economic development. This supports the fact that, in the South African context, when considering the NDP, NIP, IPAD, NATMAP, IUDF and SPLUMA, there are strong indications that functional relationships between urban centres do play a decisive role in the establishment of development corridors as a planning instrument to enhance economic space development.

7.6 Summary and Conclusion

It is very clear that the main agglomeration of economies for South Africa resides within its *city regions* and *cities*, which also establishes an interconnected network of settlements and functional economic regions. Furthermore, it is also evident that South Africa possesses a well-developed transportation network, which is considered an essential ingredient for not only promoting economic development, but also for establishing a functional, interconnected network which addresses mobility, accessibility and integration. Although South Africa has created comprehensive planning frameworks, it seems that they only serve the vested interest of political considerations and not entrepreneurial interest. Furthermore, it is also evident that the NDP, NIP, IPAD, NATMAP, IUDF and SPLUMA are considered the most critical planning frameworks in achieving spatial transformation and economic development. The various levels of spatial planning frameworks, stretching from national, provincial, regional and local levels, determine the desired spatial structure for South Africa and are the mechanisms through which spatial transformation and economic development are to be interpreted to create investment opportunities. However, despite the challenges faced, in relation to inter-government and intersector alignment, the NDP, NIP, IPAD, NATMAP, IUDF and SPLUMA offer the greatest opportunity to effect spatial transformation and economic development. These planning frameworks provide a common vision relating to spatial development, whether it is at a national, provincial, regional or local level. The reasons being are that they provide the means by which diverse sector requirements are captured and coordinated; they are where the normative principles can be interpreted, in relation to spatial challenges; and they provide the opportunity to ensure that capital budgeting is directed towards desired investment opportunities. The central role of these planning frameworks in strategic spatial planning, sector alignment and spatial targeting of government investment means that spatial transformation will be more explicit, in terms of its geographical application, i.e. stronger focus will be placed on areas where sufficient agglomeration economies exist, which concurs with Drewes (2015) suggestion that economic space development is the outcome of selecting certain cities or regions as preferred locations to create investment opportunities. However, this stronger focus requires reconstruction actions and, in this

regard, South Africa has responded by placing strong emphasis on development corridors as the key mechanism to not only address spatial transformation, but also to drive economic space development. In retrospect to the response, it is evident that no explicit, integrated spatial planning framework to guide economic space development exists. What is clear is the fact that government departments promote their own policies and programmes to address economic development. On a positivism note, the NDP, NIP, IPAD, NATMAP, IUDF and SPLUMA do offer the opportunity to effect spatial transformation and economic development. However, these frameworks require a model to serve as an interface whereby spatial planning policies and legislation can be integrated to collectively guide economic space development.

Therefore, the importance of the chapter is to contextualise the background against which the Spatial Corridor Model (SCM) (being discussed and illustrated in detail in Chapter 8) will be constructed, with the purpose of being used as a strategic and supporting instrument to explicitly guide economic space development within the South African economic landscape.

Chapter 8 Spatial Corridor Model (SCM)

8.1 Introduction

In chapters 1 and 2, reference is made to the construction of a Spatial Corridor Model (SCM) as the main research design. The research method as explained in detail in Chapter 2 supports the research design by integrating measurements and approaches to produce a more generalised theoretical framework. The creation of the theoretical framework considers three key functional output levels: 1) to establish the spatial distribution of settlements, according to functional typologies which represent the economic dominance settlements exert, relative to one another, thereby defining a primary network of functional urban centres within the country; 2) to establish the relative economic advantage (how gravity correlates with the size of the economy) of the primary network of functional urban centres' strength based on proximity, relative to one another; and 3) to establish the integrated and supporting networks of development axes, creating potential corridor development zones upon which a national spatial framework guiding economic space development within the country can be built.

Diagram 8.1 shows a graphic outline illustrating the chronological process for each output level when constructing the Spatial Corridor Model (SCM). Each of the functional output levels is subjected to a chronological, step-by-step process constituting own measurements and approaches, resulting in a specific outcome. Each outcome constitutes the input for the following functional output level, e.g. establishing the primary functional network of economic regions becomes the input to establish the strength of each region's economic contribution based on proximity to one another. The details pertaining to each output level, chronological process and outcome are described and illustrated in detail in the subsequent sections of the chapter.

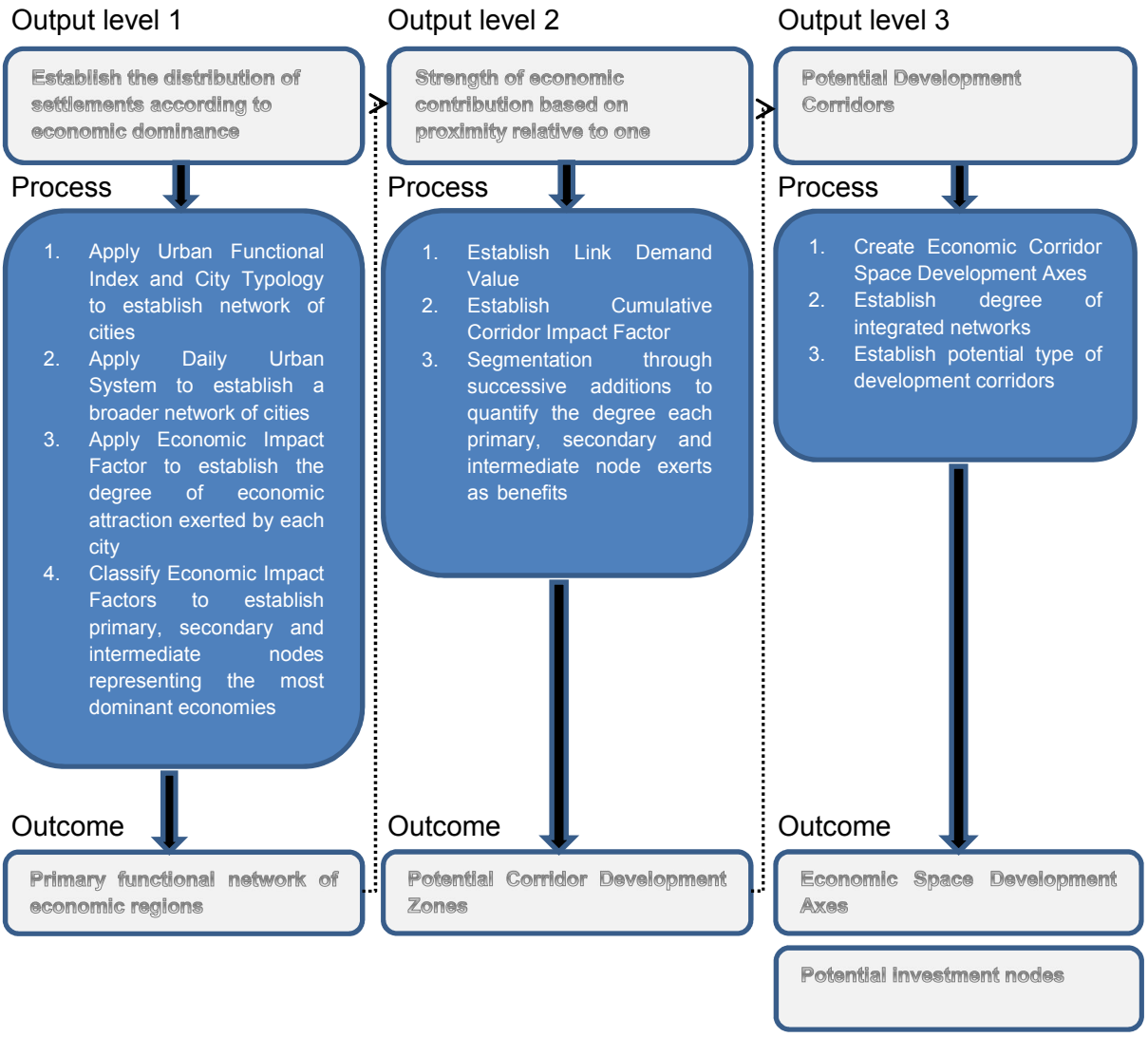


Diagram 8-1 Spatial Corridor Model Source: Own compilation

8.2 Primary Networks of Functional Urban Centres

Almost 68 per cent of South Africa's population reside within *city regions, cities* and large *towns*. Of the 68 per cent, it was calculated using the 2011 census data, that 42 per cent resided within the four *city regions*, namely Gauteng, Cape Town, Durban (eThekwini) and Port Elizabeth (Nelson Mandela Bay); 7 per cent resided within *cities* and some 14 per cent in several large *service towns* (Van Huyssteen *et al*., 2014). Due to the wide applications by the National Planning Commission (NPC) in the National Spatial Diagnostics Report (stepsa.org); the Department of Rural Development and Land Reform (DRDLR) in understanding development dynamics; Statistics South Africa (Stats SA) in analysing household survey data; and the Department of Co-operative Government (DCOG) in the development of the latest Urban Development Framework, the settlement typology has been used as a key input to profile the growth of towns, as well as the extent of change in population dynamics within towns and cities (SACN, 2016; Van Huyssteen *et al*., 2013).

The spatial distribution of cities, towns and settlements, according to the typology, is set to represent the functional role that cities and towns play in their regional contexts, not a mere hierarchical calculation of population and/or economic production or services. The hierarchical calculation, as explained in detail in Chapter 3, refers to the matrix of urban centres whereby economic spaces are organised, while the functional role of cities, as explained in detail in Chapter 4, refers to cities as sites of renewed economic dynamism, i.e. cities are the key ingredient to structure economic space development.

Findings illustrate the important role that these populated places, and especially *city regions* and *city* areas play as economic engines and job baskets within South Africa. An estimated 57 per cent of the formal economy alone is being generated in the *city regions* and when adding the network of *cities* and major *towns,* more than 80 per cent (see Table 8.2) of the total South African economy is generated. These cities function as highly concentrated command points, i.e. key locations for economic activities and specialised services, sites for production and innovation; and as markets for products and innovation produced. Furthermore, the profiles have been used successfully in the analyses of urban and settlement growth, and the changing demographic and economic profiles in South Africa, which emphasise the important role towns, cities and settlements play in the country's economic development (Van Huyssteen *et al*., 2009, 2013 & 2014; Spocter *et al*., 2010; CSIR, 2013). Table 8.1 provides an overview of population and economic activity (using GVA as an indicator) for the various categories of settlements.

Table 8-1 Comparative analyses of population and economic activity in South Africa

Functional Settlement Type (CSIR/SACN 2013v2)	Area_Km	% of National Area	Population 2011	% of National Population	Service Economy (Service Sector GVA (xR1000))	Economic Activity (*Total GVA (xR1000))	Contribu-tion to Formal Nat Econ Activity
CityRegions	20 575	1.65%	21 856 192	42.22%	758 652	1 185 948	56.77%
Cities	8 225	0.66%	3 876 064	7.49%	102 574	178 276	8.53%
TOTAL CITIES	28 800	2.30%	25 732 256	49.70%	861 226	1 364 224	65.30%
Regional Centres	18 079	1.45%	7 313 730	14.13%	141 580	229 697	10.99%
ServiceTowns	7 232	0.58%	2 720 372	5.25%	47 847	87 232	4.18%
TOTAL MAJOR TOWNS	25 311	2.02%	10 034 102	19.38%	189 427	316 929	15.17%
Local or Niche Towns	29 756	2.38%	4 327 891	8.36%	69 102	121 169	5.80%
Rural Nodes in High density areas	928	0.07%	191 123	0.37%	2 537	4 850	0.23%
TOTAL SMALL TOWNS	30 684	2.45%	4 519 014	8.73%	71 639	126 019	6.03%
High Density Settlements	59 276	4.74%	6 081 912	11.75%	40 074	73 587	3.52%
Sparse Rural Areas	1 070 931	85.66%	3 036 010	5.86%	51 830	184 994	8.86%
Dense Rural Areas	35 258	2.82%	2 366 803	4.57%	13 921	23 351	1.12%
TOTAL REST OF SA	1 165 465	93.22%	11 484 725	22.18%	105 826	281 932	13.50%
NATIONAL TOTALS	1250260	100.00%	51770097	100%	1228117	2089104	100%

** GVA Total excludes Construction sector*

SOURCE: CSIR GAP 2013 based on StatsSA Census 1996,2001,2011; SACN/CSIR Settlement Typology 2013v2, CSIR TAT (Temporal Analyses Tool) 2013

2011 Population in cities,towns & Settlements 89.56%

2011 Population in cities & towns 77.82%

Source: Van Huyssteen (2013)

Establishing the primary networks of functional urban centres for South Africa is based on four key steps: 1) to establish a general functional network of cities; 2) to refine the classification of the functional network of cities into broader economic regional nodes; 3) to establish the degree of economic attraction or economic output levels exerted by each economic regional node, in relation to one another; and 4) to establish a primary network of urban centres which measures the most dominant agglomeration of economies within the country.

8.2.1 Functional network of cities

The first step mainly focuses on the UFI, as well as the city typology of the CSIR to establish the broader or general functional network of cities within the country. The purpose of the UFI is twofold: 1) to determine the economic weight of urban settlements relative to one another; and 2) to distinguish between the sizes of the commercial, service and industrial components of urban economies.

Furthermore, one of the potential uses of the UFI is to determine the relative economic dominance of cities in an urban network, as was done in the CSIR's urban classification and in the South African NDP for 2030. The CSIR settlement typology was primarily developed to describe the role and character of the different settlement types, and to illustrate the relationships and flows between the different spaces, as well as the relationships between urban centres and their hinterlands and the broader global economy. The variables used for classification include concentration or population density, settlement size and the relations between places, using accessibility measures. Flows and linkages between settlements also played an important role in both the classification and definition of settlement areas. Therefore, both the UFI and the city typology of the CSIR were subsequently used to measure economic agglomeration, i.e. the relative strength of commercial and industrial clustering as a means of determining the potential strength of economic space development within the country. However, it is important to note that the places of the biggest and most well-known cities, towns and settlements (see Table 8.1) include their functional surroundings (not reflected as administrative areas) to enable understanding of formal economic activities and the extent of population in the area. This also refers to the functional role of cities, towns and settlements in providing access to services and opportunities.

In the South African context, urban evolution resulted in nested patterns of higher and lower-order centres (see Chapter 3). The latter allowed for the delimitation of functional areas in national space, based on economic catchment areas of higher-order centres, which, in turn, determined the outcomes of agglomeration economies in the form of *city regions, cities* and *large towns* (see Chapter 4). The resulting current or emerging polycentric structural composition of *city regions, cities* and *large towns* and the potential flows of economic activities between these centres confirm the notion of urban agglomeration where functional and locational relationships will provide greater diversity, creativity and freedom for growth and development. This supports the notion of cities being considered a key ingredient to structure economic space development, as explained in Chapter 4.

Table 8.2 and Figure 8.1 illustrate the network of cities generating more than 80 per cent of the country's formal economy. These places are primarily classified as *primary cities, intermediate cities* or *small cities* and *large towns*, and are divided into three functional typologies: 1) cities with a UFI value of 20 and above, considered *primary cities*, contributing more than 50 per cent towards the economy, as well as accommodating close to 40 per cent of the total population and close to 50 per cent of the total economically active population; 2) cities with a UFI value of between 5 and 20, considered *intermediate cities* or *small cities*, contributing more than 15 per cent towards the national economy, as well as accommodating close to 15 per cent of the total population and close to 15 per cent of the total economically active population; and 3) cities with a UFI value of between 2 and 5, considered *large towns*, contributing close to 10 per cent towards the national economy, as well as accommodating close to 10 per cent of the total population and close to 10 per cent of the total economically active population.

This classification, based on UFI values, defines the relative economic dominance of the cities in an urban network, which aligns with the CSIR's functional classification of urban centres within the country.

Table 8-2 Functional network of cities measuring economic agglomeration within the country

UFI	Municipality				Population		Economic active		GVA	
100,00	WC	CPT	City of Cape Town	Cape Town	3 740 025	*7,22%*	1 700 229	*9,06%*	186 199	*10,93%*
94,51	GT	JHB	Johannesburg	Johannesburg	4 434 828	*8,57%*	2 261 487	*12,05%*	233 761	*13,72%*
76,05	KN	ETH	eThekwini	Durban	3 442 362	*6,65%*	1 422 879	*7,58%*	148 555	*8,72%*
51,70	GT	TSH	City of Tshwane	Tshwane	2 921 490	*5,64%*	1 424 601	*7,59%*	156 169	*9,17%*
38,49	GT	EKU	Ekurhuleni	Ekurhuleni	3 178 470	*6,14%*	1 582 452	*8,43%*	149 601	*8,78%*
34,93	EC	NMA	Nelson Mandela Bay	Port Elizabeth	1 152 117	*2,23%*	457 386	*2,44%*	42 415	*2,49%*
25,91	FS	MAN	Mangaung	Bloemfontein	747 429	*1,44%*	292 971	*1,56%*	30 394	*1,78%*
Total					**19 616 721**	***37,89%***	**9 142 005**	***48,69%***	**947 094**	***55,59%***
19,26	EC	BUF	Buffalo City	East London	755 202	*1,46%*	285 225	*1,52%*	28 005	*1,64%*
18,97	KN	KZN225	The Msunduzi	Pietermaritzburg	618 537	*1,19%*	229 674	*1,22%*	23 152	*1,36%*
16,65	GT	GT481	Mogale City	Krugersdorp	362 421	*0,70%*	178 479	*0,95%*	16 342	*0,96%*
12,21	MP	MP322	Mbombela	Nelspruit	588 792	*1,14%*	228 237	*1,22%*	17 226	*1,01%*
11,82	LIM	LIM354	Polokwane	Polokwane	628 998	*1,21%*	230 475	*1,23%*	17 177	*1,01%*
11,23	WC	WC044	George	George	193 671	*0,37%*	79 545	*0,42%*	5 866	*0,34%*
9,12	NC	NC091	Sol Plaatjie	Kimberley	248 040	*0,48%*	92 562	*0,49%*	8 834	*0,52%*
9,02	NW	NW403	City of Matlosana	Klerksdorp	398 676	*0,77%*	158 895	*0,85%*	11 799	*0,69%*
8,32	NW	NW373	Rustenburg	Rustenburg	549 576	*1,06%*	266 472	*1,42%*	26 313	*1,54%*
8,24	WC	WC024	Stellenbosch	Stellenbosch	155 733	*0,30%*	67 134	*0,36%*	9 501	*0,56%*
7,83	GT	GT421	Emfuleni	Vereeniging/Vanderbijlpark	721 665	*1,39%*	310 095	*1,65%*	21 797	*1,28%*
7,43	FS	FS184	Matjhabeng	Welkom	406 461	*0,79%*	158 175	*0,84%*	13 027	*0,76%*
7,15	WC	WC023	Drakenstein	Drakenstein	251 262	*0,49%*	106 029	*0,56%*	8 959	*0,53%*
6,80	MP	MP312	Emalahleni	Witbank	395 463	*0,76%*	190 662	*1,02%*	21 456	*1,26%*
5,88	KN	KZN282	uMhlathuze	Richardsbay	334 458	*0,65%*	124 410	*0,66%*	13 865	*0,81%*
5,55	WC	WC043	Mossel Bay	Mossel Bay	89 427	*0,17%*	34 899	*0,19%*	5 069	*0,30%*
5,39	NW	NW402	Tlokwe City Council	Potchefstroom	162 759	*0,31%*	65 913	*0,35%*	6 161	*0,36%*
5,14	MP	MP313	Steve Tshwete	Middelburg	229 833	*0,44%*	107 067	*0,57%*	9 490	*0,56%*
5,05	WC	WC048	Knysna	Knysna	68 658	*0,13%*	29 187	*0,16%*	2 355	*0,14%*
Total					**7 159 632**	***13,83%***	**2 943 135**	***15,68%***	**266 394**	***15,64%***
4,97	KN	KZN252	Newcastle	Newcastle	363 237	*0,70%*	100 653	*0,54%*	7 430	*0,44%*
4,92	KN	KZN283	Ntambanana	Empangeni	74 337	*0,14%*	**13 074**	***0,07%***	1 027	*0,06%*
4,60	NW	NW372	Madibeng	Brits-Hartbeespoort	477 378	*0,92%*	215 214	*1,15%*	14 302	*0,84%*
4,45	LIM	LIM333	Greater Tzaneen	Tzaneen	390 093	*0,75%*	116 019	*0,62%*	5 683	*0,33%*
4,12	WC	WC025	Breede Valley	Worcester	166 824	*0,32%*	68 607	*0,37%*	4 305	*0,25%*
3,94	FS	FS201	Moqhaka	Kroonstad	160 536	*0,31%*	55 593	*0,30%*	5 529	*0,32%*
3,92	FS	FS192	Dihlabeng	Bethlehem	128 703	*0,25%*	47 496	*0,25%*	3 288	*0,19%*
3,74	EC	EC157	King Sabata Dalindyebo	Mthatha	451 713	*0,87%*	95 577	*0,51%*	7 997	*0,47%*
3,74	KN	KZN232	Emnambithi/Ladysmith	Ladysmith	237 435	*0,46%*	72 252	*0,38%*	5 677	*0,33%*
3,74	WC	WC032	Overstrand	Hermanus	80 433	*0,16%*	35 553	*0,19%*	2 578	*0,15%*
3,69	WC	WC045	Oudtshoorn	Oudtshoorn	95 934	*0,19%*	31 167	*0,17%*	2 212	*0,13%*
3,68	NC	NC083	//Khara Hais	Upington	93 495	*0,18%*	32 232	*0,17%*	3 040	*0,18%*
3,68	NW	NW383	Mafikeng	Mafikeng	291 528	*0,56%*	92 895	*0,49%*	8 619	*0,51%*
3,56	WC	WC047	Bitou	Plettenberg Bay	49 161	*0,09%*	23 598	*0,13%*	1 524	*0,09%*
3,46	GT	GT422	Midvaal	Meyerton	95 301	*0,18%*	45 954	*0,24%*	4 275	*0,25%*
3,16	MP	MP307	Govan Mbeki	Secunda	294 537	*0,57%*	134 385	*0,72%*	16 166	*0,95%*
3,08	KN	KZN292	KwaDukuza	Stanger	231 189	*0,45%*	91 176	*0,49%*	5 159	*0,30%*
3,04	KN	KZN212	Umdoni	Scottburgh-Umkomaas	78 876	*0,15%*	25 035	*0,13%*	2 215	*0,13%*
3,03	FS	FS204	Metsimaholo	Sasolburg	149 109	*0,29%*	65 205	*0,35%*	6 171	*0,36%*
2,89	LIM	LIM344	Makhado	Makhado	516 030	*1,00%*	124 473	*0,66%*	8 165	*0,48%*
2,79	EC	EC134	Lukanji	Queenstown	190 725	*0,37%*	53 262	*0,28%*	3 948	*0,23%*
2,77	WC	WC014	Saldanha Bay	Saldanha Bay	99 192	*0,19%*	44 829	*0,24%*	3 406	*0,20%*
2,74	GT	GT484	Merafong	Carletonville	197 520	*0,38%*	91 524	*0,49%*	6 586	*0,39%*
2,63	MP	MP302	Msukaligwa	Ermelo	149 376	*0,29%*	56 964	*0,30%*	3 913	*0,23%*
2,60	KN	KZN263	Abaqulusi	Vryheid	211 062	*0,41%*	42 699	*0,23%*	4 253	*0,25%*
2,59	LIM	LIM367	Mogalakwena	Mokopane	307 683	*0,59%*	78 645	*0,42%*	6 531	*0,38%*
2,32	EC	EC104	Makana	Grahamstown	80 391	*0,16%*	28 491	*0,15%*	2 143	*0,13%*
2,10	FS	FS194	Maluti a Phofung	Harrismith	335 784	*0,65%*	90 870	*0,48%*	6 891	*0,40%*
2,03	FS	FS203	Ngwathe	Parys	120 519	*0,23%*	39 555	*0,21%*	2 240	*0,13%*
2,02	NC	NC062	Nama Khoi	Springbok	47 040	*0,09%*	16 014	*0,09%*	2 507	*0,15%*
2,02	NW	NW384	Ditsobotla	Mmabatho	168 900	*0,33%*	52 434	*0,28%*	4 397	*0,26%*
Total					**6 334 041**	***12,23%***	**2 081 445**	***11,09%***	**162 177**	***9,52%***
TOTAL					**33 110 394**	***63,96%***	**14 166 585**	***75,46%***	**1 375 665**	***80,74%***

Source: South Africa (2011); GVA (2011)

Total population count: 51 770 654; Total economically active population: 18 774 132; and Total GVA: 1 703 801 billion

Note: 1) **Total population count** is defined as all usual residents, generally referred to as the *de jure* population, and the total of all persons present, referred to as the *de facto* population; 2) **Economically active population** is defined as the fraction of a population that is either employed, or actively seeking employment; 3) **Gross value added (GVA) at basic prices** is defined as output valued at basic prices less intermediate consumption valued at purchaser's prices. Therefore, the GVA is known by the price at which the output is valued. GVA is a useful way of comparing regions of different sizes of economies.

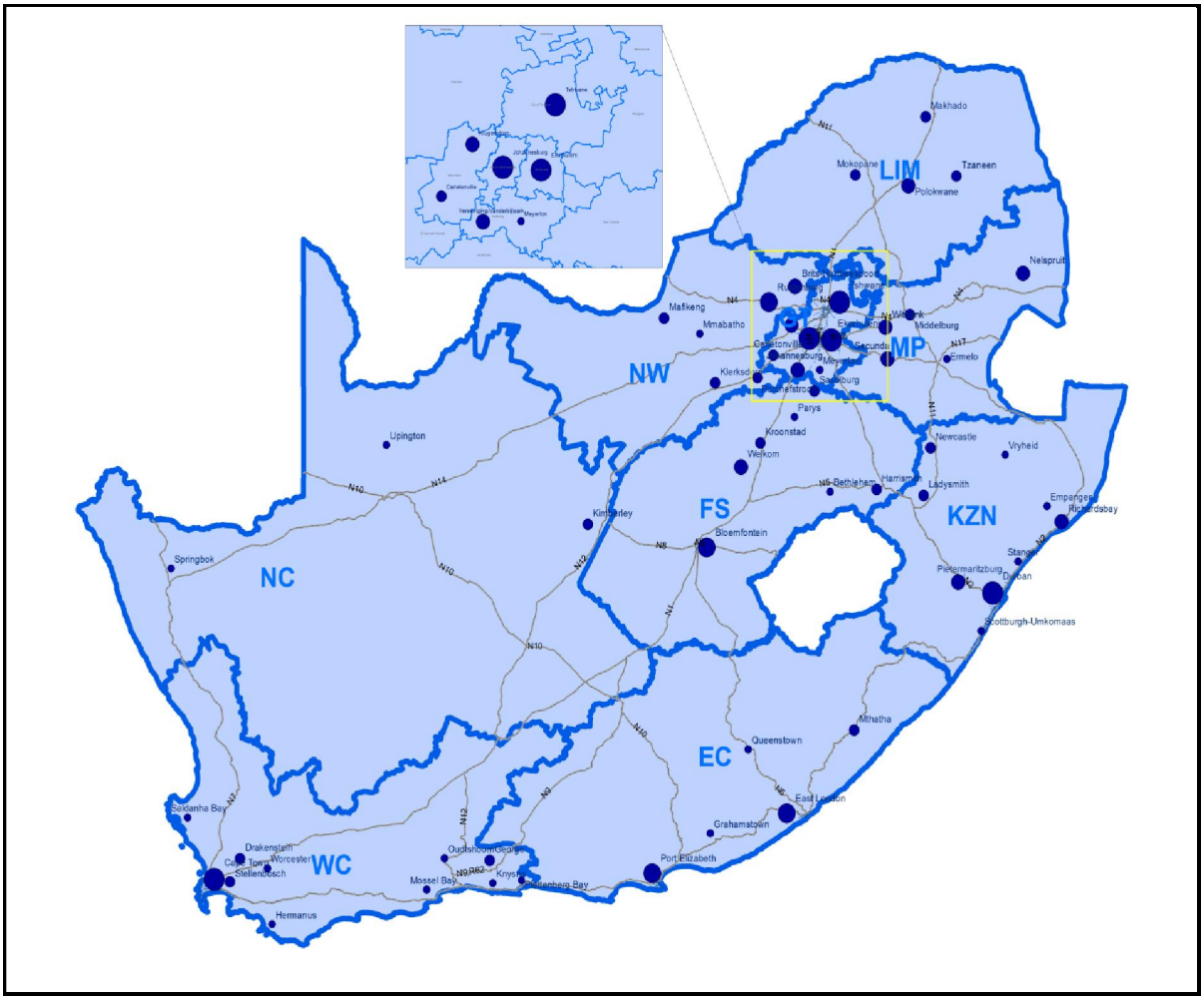


Figure 8-1 Functional network of cities measuring economic agglomeration within the country

Source: Own compilation

Although it is clear that the general network of cities, based on functional typology, represent the most dominant agglomeration of economic activities in South Africa, the clustering of this network of cities in proximity to one another creates the opportunity to also establish the sphere of influence that exists between the cities when measuring economic spillovers (see NEG under section 3.4) provided by the proximity of larger urban centres. This allows for creating a functional network of urban centres in the context of broader economic regional nodes (urban centres' relationship with their hinterland), i.e. the integration of urban centres around larger urban centres establishes a larger commuting area. (This is further discussed as urban systems in the next section.)

8.2.2 Urban systems

The second step considers a daily and weekly urban system to refine the classification of the broader network of functional urban centres established under step one. The South African settlement typology has recently been linked to the *daily* and *weekly urban system* concept advanced by Geyer Jr. and

Geyer (2015a). According to them, travelling distances to towns and cities from core city centres are used to functionally distinguish between towns and cities within a network of cities, i.e. the purpose is to quantify the relationships and flows between different settlements within a network of cities, and to distinguish between nodes within the daily and weekly commuting areas of core cities.

The concept of an urban system is not new; it was introduced by Doxiadis (1968) more than four decades ago and has remained ever since. In Friedmann's (1966) view, there is a direct relationship between the interaction of cities and the distance separating them. In simplistic terms, the locality of a settlement in relation to a dominating core city would co-determine its level of interaction with the core city, i.e. its dependence on economic spillovers provided by the larger urban centres (see section 3.4).

The daily urban system includes all settlements located within one hour's travel time from one of the core city centres which, according to Newman (2004), remains a fairly constant commuting distance. Closely associated with the daily urban system is the concept of the weekly urban system (Hall *et al*., 1980), which includes all settlements (higher and lower order) located within two hours' commuting distance from one of the core city centres.

As mentioned, daily urban systems are based on a one-hour commuting distance from a large city centre, which makes daily commuting for work or other economic or social purposes between urban settlements possible, thereby creating a direct relationship. The same applies to the weekly urban system, which consists of settlements within two hours' commuting distance from a large city centre, thereby creating an indirect relationship. According to Geyer Jr. and Geyer (2015a), the hinterlands created by the daily (direct relationship) and weekly (indirect relationship) urban systems are regarded as a fair representation of the economic and social sphere of influence that exists between cities.

With the assumption that a travel distance at a speed of 80 kilometre an hour is considered a fair commuting distance (Hall *et al.*, 1980; Newman, 2004), a Speed Distance Time Calculator (Calculatoredge) converts a one and two-hour commuting time into an 80 and 160-kilometre distance, respectively, whereby the hinterlands created by the daily and weekly urban systems are established. For the purpose of the research, an 80-kilometre buffer representing a direct relationship is placed around each larger urban centre, as illustrated in Figure 8.2, whereby all settlements, including primary towns, intermediate towns and towns, are collapsed into broader economic regional nodes, as illustrated in Table 8.3 and Figure 8.3. This allows for the creation of a more refined classification of networks of urban centres, which defines the relative economic dominance of economic spillovers (see section 3.4) provided by the proximity of larger urban centres.

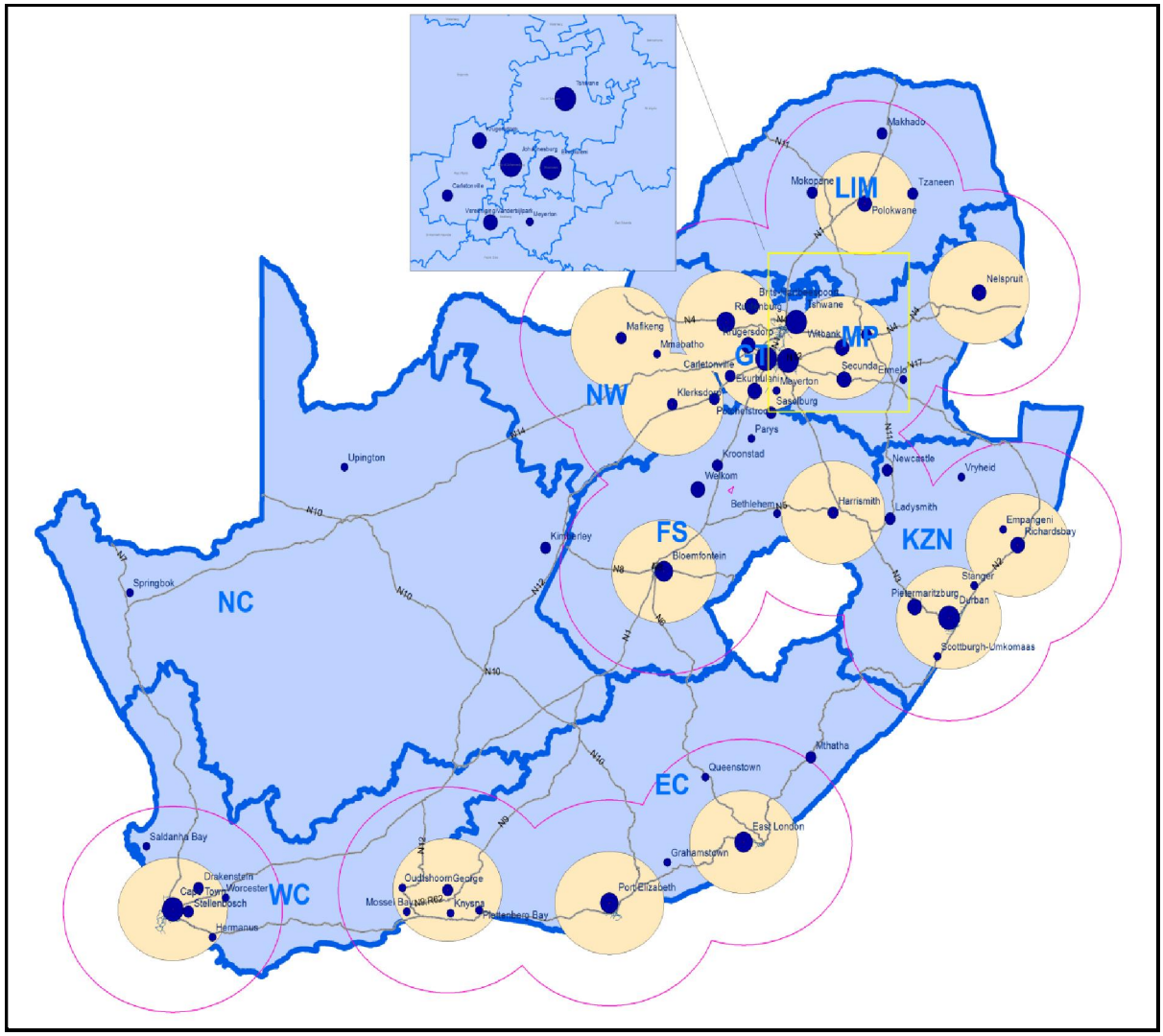


Figure 8-2 Daily urban system measuring economic spillovers provided by the proximity of larger urban centres

Source: Own compilation

Note: Daily urban system based on an 80 kilometre commuting distance buffer

Table 8-3 Functional network of urban centres (regional nodes) measuring economic spillovers provided by the proximity of larger urban centres

Regional nodes	Municipality				UFI	Population		Economic active		GVA	
1	EC	NMA	Nelson Mandela Bay	Port Elizabeth	34,93	1 152 117	*2,23%*	457 386	*2,44%*	42 415	*2,49%*
2	EC	BUF	Buffalo City	East London	19,26	755 202	*1,46%*	285 225	*1,52%*	28 005	*1,64%*
3	EC	EC157	King Sabata Dalindyebo	Mthatha	3,74	451 713	*0,87%*	95 577	*0,51%*	7 997	*0,47%*
4	EC	EC134	Lukanji	Queenstown	2,79	190 725	*0,37%*	53 262	*0,28%*	3 948	*0,23%*
5	EC	EC104	Makana	Grahamstown	2,32	80 391	*0,16%*	28 491	*0,15%*	2 143	*0,13%*
6	FS	MAN	Mangaung	Bloemfontein	25,91	747 429	*1,44%*	292 971	*1,56%*	30 394	*1,78%*
7	FS	FS184	Matjhabeng	Welkom	7,43	406 461	*0,79%*	158 175	*0,84%*	13 027	*0,76%*
8	FS	FS201	Moqhaka	Kroonstad	3,94	160 536	*0,31%*	55 593	*0,30%*	5 529	*0,32%*
9	FS	FS192	Dihlabeng	Bethlehem	3,92	128 703	*0,25%*	47 496	*0,25%*	3 288	*0,19%*
10	FS	FS194	Maluti a Phofung	Harrismith	2,10	335 784	*0,65%*	90 870	*0,48%*	6 891	*0,40%*
11	FS	FS203	Ngwathe	Parys	2,03	120 519	*0,23%*	39 555	*0,21%*	2 240	*0,13%*
	GT	JHB	Johannesburg	Johannesburg	94,51						
	GT	TSH	City of Tshwane	Tshwane	51,70						
	NW	NW372	Madibeng	Brits-Hartbeespoort	4,60						
	GT	EKU	Ekurhuleni	Ekurhuleni	38,49						
	GT	GT481	Mogale City	Krugersdorp	16,65						
	GT	GT421	Emfuleni	Vereeniging/Vanderbijlpark	7,83						
	FS	FS204	Metsimaholo	Sasolburg	3,03						
	GT	GT422	Midvaal	Meyerton	3,46						
12	GT	GT484	Merafong	Carletonville	2,74	12 538 182	*24,22%*	6 175 011	*32,89%*	609 004	*35,74%*
	KN	ETH	eThekwini	Durban	76,05						
	KN	KZN212	Umdoni	Scottburgh-Umkomaas	3,04						
	KN	KZN292	KwaDukuza	Stanger	3,08						
13	KN	KZN225	The Msunduzi	Pietermaritzburg	18,97	4 370 964	*8,44%*	1 768 764	*9,42%*	179 081	*10,51%*
	KN	KZN282	uMhlathuze	Richardsbay	5,88						
14	KN	KZN283	Ntambanana	Empangeni	4,92	408 795	*0,79%*	137 484	*0,73%*	14 892	*0,87%*
15	KN	KZN252	Newcastle	Newcastle	4,97	363 237	*0,70%*	100 653	*0,54%*	7 430	*0,44%*
16	KN	KZN232	Emnambithi/Ladysmith	Ladysmith	3,74	237 435	*0,46%*	72 252	*0,38%*	5 677	*0,33%*
17	KN	KZN263	Abaqulusi	Vryheid	2,60	211 062	*0,41%*	42 699	*0,23%*	4 253	*0,25%*
18	LIM	LIM354	Polokwane	Polokwane	11,82	628 998	*1,21%*	230 475	*1,23%*	17 177	*1,01%*
19	LIM	LIM333	Greater Tzaneen	Tzaneen	4,45	390 093	*0,75%*	116 019	*0,62%*	5 683	*0,33%*
20	LIM	LIM344	Makhado	Makhado	2,89	516 030	*1,00%*	124 473	*0,66%*	8 165	*0,48%*
21	LIM	LIM367	Mogalakwena	Mokopane	2,59	307 683	*0,59%*	78 645	*0,42%*	6 531	*0,38%*
22	MP	MP322	Mbombela	Nelspruit	12,21	588 792	*1,14%*	228 237	*1,22%*	17 226	*1,01%*
	MP	MP312	Emalahleni	Witbank	6,80						
	MP	MP313	Steve Tshwete	Middelburg	5,14						
23	MP	MP307	Govan Mbeki	Secunda	3,16	919 833	*1,78%*	432 114	*2,30%*	47 112	*2,77%*
24	MP	MP302	Msukaligwa	Ermelo	2,63	149 376	*0,29%*	56 964	*0,30%*	3 913	*0,23%*
25	NC	NC091	Sol Plaatjie	Kimberley	9,12	248 040	*0,48%*	92 562	*0,49%*	8 834	*0,52%*
26	NC	NC083	//Khara Hais	Upington	3,68	93 495	*0,18%*	32 232	*0,17%*	3 040	*0,18%*
27	NC	NC062	Nama Khoi	Springbok	2,02	47 040	*0,09%*	16 014	*0,09%*	2 507	*0,15%*
	NW	NW403	City of Matlosana	Klerksdorp	9,02						
28	NW	NW402	Tlokwe City Council	Potchefstroom	5,39	561 435	*1,08%*	224 808	*1,20%*	17 960	*1,05%*
29	NW	NW373	Rustenburg	Rustenburg	8,32	549 576	*1,06%*	266 472	*1,42%*	26 313	*1,54%*
	NW	NW383	Mafikeng	Mafikeng	3,68						
30	NW	NW384	Ditsobotla	Mmabatho	2,02	460 428	*0,89%*	145 329	*0,77%*	13 016	*0,76%*
	WC	CPT	City of Cape Town	Cape Town	100,00						
	WC	WC023	Drakenstein	Drakenstein	7,15						
	WC	WC024	Stellenbosch	Stellenbosch	8,24						
	WC	WC025	Breede Valley	Worcester	4,12						
31	WC	WC032	Overstrand	Hermanus	3,74	4 394 277	*8,49%*	1 977 552	*10,53%*	211 542	*12,42%*
	WC	WC044	George	George	11,23						
	WC	WC043	Mossel Bay	Mossel Bay	5,55						
	WC	WC048	Knysna	Knysna	5,05						
	WC	WC045	Oudtshoorn	Oudtshoorn	3,69						
32	WC	WC047	Bitou	Plettenberg Bay	3,56	496 851	*0,96%*	198 396	*1,06%*	17 026	*1,00%*
33	WC	WC014	Saldanha Bay	Saldanha Bay	2,77	99 192	*0,19%*	44 829	*0,24%*	3 406	*0,20%*
TOTAL						***33 110 394***	***63,96%***	***14 166 585***	***75,46%***	***1 375 665***	***80,74%***

Source: Own compilation

Note: Network of urban centres based on the daily urban system of an 80-kilometre commuting distance creating broader economic regional nodes

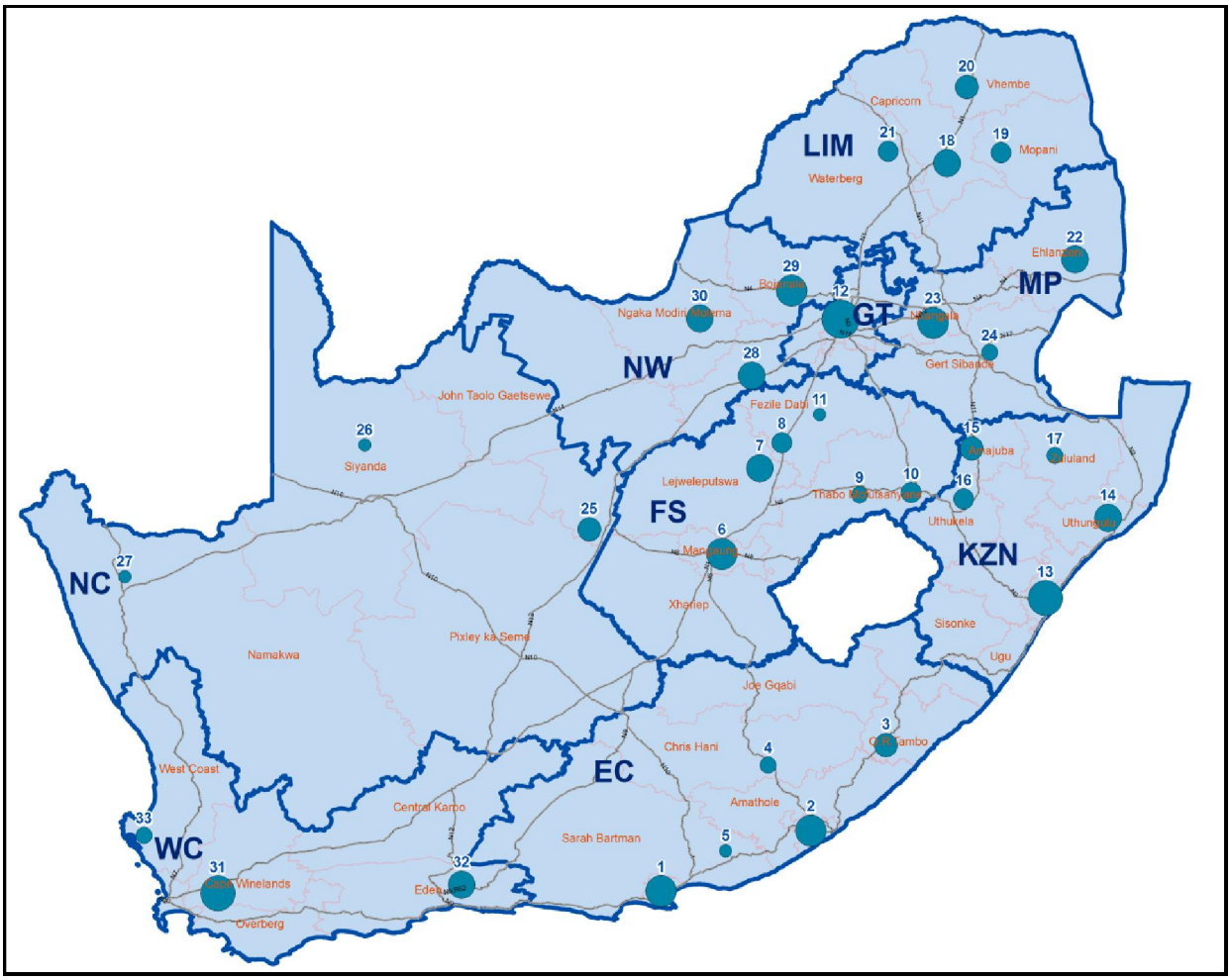


Figure 8-3 Functional network of urban centres (regional nodes) measuring economic spillovers provided by the proximity of larger urban centres

Source: Own compilation

Note: Network of urban centres based on the daily urban system of an 80-kilometre commuting distance creating broader economic regional nodes

Refining the functional network of cities into a broader network of economic regional nodes not only provides a more practical approach to visualising and analysing the dominant distribution of economic activities within the country, but also creates the opportunity to establish the degree of economic attraction or economic output levels exerted by each regional node relative to one another.

8.2.3 Economic impact factors

The third step is to establish the degree of economic attraction or economic output levels exerted by each regional node based on the economic weight, which is referred to as EIFs. According to Brand *et al*. (2015), the economic output exerted refers to the total population, in relation to economically active populations, as well as the value of all goods and services produced in an economy based on GVA as

an indicator, and is primarily used to compare the relative economic output that exists between cities and regions. Therefore, the outcome establishes the economic output levels of the functional networks of regional nodes relative to one another.

In Chapter 5 (see section 5.5), strong emphasis is placed on a well-developed, multimodal transportation network system as an essential ingredient in contributing towards the nature and extent of economic development. Furthermore, the outcome from Chapter 5 augmented sea and air transportation as the primary key gateways when unlocking a country's economic development opportunities. The main reason is based on the fact that the advancement in sea and air transportation resulted in lowering trade barriers, allowing for deeper integration of market access across the globe. Therefore, to establish the EIFs for each economic regional node would require including the multimodal transportation system.

Mitchell (2014) noted that a multimodal transport system was capable of joining together various networks that used different protocols. He also postulated that these different protocols had different impacts and played different roles in economic development. However, for the purpose of the research, only sea and airports were considered for inclusion. The reasons were that, except for the fact that sea and airports lower trade barriers globally, sea and airports also represent a nodal locality which is an important consideration in the continental ranking of urban centres (Geyer, 1988). Furthermore, the WB (2012) also made the statement that over 70 per cent of the world's trade by value and 80 per cent by volume travel by ship and/or aircraft. Nearly every ton of the world's commodities, and every container in global supply chains, passes through at least two seaports before reaching its destination. Similarly, the highest valued and most time-sensitive goods are transported by air, also passing through at least two airports before reaching their destination. Increasingly, these movements are further defined by the growing share of developing countries trading in global trade. According to the International Monetary Fund, 13 out of the top 25 bilateral maritime and aviation trading pairs are involved in at least one developing country. PricewaterhouseCoopers (PwC) estimated that the ratio will grow to 21 out of 25 by 2030. Therefore, with trade of developing countries growing at nearly 14 per cent per year, the efficiency of sea and airports becomes key in providing strategic and supporting networks that can guide the development of economic spaces at a national, as well as a global level.

The inclusion of sea and airports requires first establishing the degree of trade by sea and air movement, relative to one another. In this regard, a Multimodal Impact Factor (MmIF) is considered with the focus on the principal sea and airports managed by Transnet and ACSA, respectively. The MmIF refers to the total value of volume and movement of goods and people passing through sea and airports, and is primarily used to compare the relative trade output levels between the various ports. For the purpose of the study, both the MmIFs of each sea and airport are calculated as a mean. The reason is based on the fact that the mean is the most popular and well-known measure of central tendency, and can be used with both discrete and continuous data. Considering that the MmIF refers to the total values of volume

movement, the separate values are not restricted, but occupy values over a continuous range (between any two dates). The MmIFs of each sea and airport are calculated as z-values, which indicate the comparative trade output weight according to which the spatial dominance of each sea and airport is determined.

The Multimodal Port Impact Factor (MmPIF) illustrated in Tables 8.4 and 8.5 is calculated using the following algorithm:

$$MmPIFi = \left(\frac{\sum_{\frac{Ci}{n}}}{\sum_{CTi\ldots n}}\right) + \left(\frac{\sum_{\frac{COi}{n}}}{\sum_{COTi\ldots n}}\right) + \left(\frac{\sum_{\frac{Vi}{n}}}{\sum_{VTi\ldots n}}\right)$$

where *MmPIF* is the MmPIF for city i (i = 1…n); $\sum_{\frac{Ci}{n}}$ is the mean average for cargo in metric tonnes for city i; $\sum_{CTi\ldots n}$ is the sum of the total cargo in metric tonnes for all the cities; $\sum_{\frac{COi}{n}}$ is the mean average for container volume for city i; $\sum_{COTi\ldots n}$ is the sum of the total container volume for all the cities; $\sum_{\frac{Vi}{n}}$ is the mean average for vessel movement for city i; and $\sum_{VTi\ldots n}$ is the sum of the total vessel movement for all the cities.

Table 8-4 Total shipping movement

Port	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total	Mean Avg	
	Cargo (Metric Tonnes) movement											
Richards Bay	86 236 761	85 830 410	84 242 701	84 131 874	77 630 309	84 711 907	86 376 249	90 240 598	94 336 632	773 737 441	85 970 827	46,44%
eThekwini	37 607 348	41 077 715	39 053 624	39 102 339	37 171 245	39 297 656	44 138 867	42 977 231	44 829 621	365 255 646	40 583 961	21,92%
East London	821 715	613 360	856 803	1 119 728	1 796 569	746 113	1 850 507	1 775 316	1 625 731	11 205 842	1 245 094	0,67%
Port Elizabeth/Ngqura	3 195 730	4 149 882	4 597 207	4 537 428	4 606 226	5 831 596	7 502 959	7 814 372	8 418 179	50 653 579	5 628 175	3,04%
Mossel Bay	635 485	603 669	870 964	873 888	1 747 858	785 091	1 922 676	2 294 026	2 322 223	12 055 880	1 339 542	0,72%
Cape Town	2 302 399	3 142 331	2 999 497	2 114 213	2 938 703	2 354 324	3 678 761	4 106 137	3 677 462	27 313 827	3 034 870	1,64%
Saldanha Bay	33 397 088	33 004 052	35 625 028	44 086 360	47 037 971	52 801 419	59 697 120	61 272 743	58 955 683	425 877 464	47 319 718	25,56%
Total	164 196 526	168 421 419	168 245 824	175 965 830	172 928 881	186 528 106	205 167 139	210 480 423	214 165 531	1 666 099 679	185 122 187	
	Container movement											
Richards Bay	5 179	4 191	4 021	9 350	6 273	23 578	18 540	4 031	29 423	104 586	11 621	0,29%
eThekwini	1 899 065	2 198 600	2 479 232	2 642 165	2 395 175	2 553 392	2 511 380	2 586 886	2 632 513	21 898 408	2 433 156	61,69%
East London	49 338	38 308	41 986	57 418	40 286	52 956	54 546	52 073	46 591	433 502	48 167	1,22%
Port Elizabeth/Ngqura	369 759	392 813	422 846	423 885	510 826	674 023	819 044	812 551	1 064 802	5 490 549	610 061	15,47%
Mossel Bay	-	-	-	-	-	-	-	-	-	-	-	-
Cape Town	690 895	782 868	764 005	767 501	1 382 052	708 526	698 087	853 399	920 636	7 567 969	840 885	21,32%
Saldanha Bay	-	-	-	-	-	-	-	129	136	265	88	0,00%
Total	3 014 236	3 416 780	3 712 090	3 900 319	4 334 612	4 012 475	4 101 597	4 309 069	4 694 101	35 495 279	3 943 920	
	Vessel movement											
Richards Bay	-	-	-	-	-	-	1 800	1 651	1 836	5 287	1 762	14,90%
eThekwini	-	-	-	-	-	-	4 273	3 935	3 958	12 166	4 055	34,29%
East London	-	-	-	-	-	-	298	264	274	836	279	2,36%
Port Elizabeth/Ngqura	-	-	-	-	-	-	1 588	1 450	1 652	4 690	1 563	13,22%
Mossel Bay	-	-	-	-	-	-	1 081	649	995	2 725	908	7,68%
Cape Town	-	-	-	-	-	-	2 782	2 589	2 776	8 147	2 716	22,96%
Saldanha Bay	-	-	-	-	-	-	534	529	563	1 626	542	4,58%
Total	-	-	-	-	-	-	12 356	11 067	12 054	35 477	11 826	

Source: NDoT (2016)

Note: Cargo movement – bulk landed (imports and exports); Container movement – deep-sea/coastwise/transhipped/ (full and empty); and Vessel movement – cargo/bulk/container/tanker/passenger/R-Ro/coasters/fishing/trawlers/miscellaneous

Table 8-5 MmPIFs of seaport nodes within the country

Seaport	Cargo		Container		Vessel		MmPIF (z-value)
RichardsBay	85 970 827	0,464	11 621	0,003	1 762	0,149	**0,616**
eThekwini	40 583 961	0,219	2 433 156	0,617	4 055	0,343	**1,179**
East London	1 245 094	0,007	48 167	0,012	279	0,024	**0,043**
Port Elizabeth/Ngqura	5 628 175	0,030	610 061	0,155	1 563	0,132	**0,317**
MosselBay	1 339 542	0,007	0	0,000	908	0,077	**0,084**
Cape Town	3 034 870	0,016	840 885	0,213	2 716	0,230	**0,459**
SaldanhaBay	47 319 718	0,256	29	0,000	542	0,046	**0,301**
Total	185 122 187		3 943 920		11 826		

Source: Own compilation

The Multimodal Air Impact Factor (MmAIF), illustrated in Tables 8.6 and 8.7, is calculated using the following algorithm:

$$MmAIFi = \left(\frac{\sum_{\frac{Pi}{n}}}{\sum_{PTi\ldots n}}\right) + \left(\frac{\sum_{\frac{Ai}{n}}}{\sum_{ATi\ldots n}}\right) + \left(\frac{\sum_{\frac{Ci}{n}}}{\sum_{CTi\ldots n}}\right)$$

where *MmAIFi* is the MmAIFi for city i (i = 1…n); $\sum_{\frac{Pi}{n}}$ is the mean average for passenger movement for city i; $\sum_{PTi\ldots n}$ is the sum of the total passenger movement for all the cities; $\sum_{\frac{Ai}{n}}$ is the mean average for aircraft movement for city i; $\sum_{ATi\ldots n}$ is the sum of the total aircraft movement for all the cities; $\sum_{\frac{Ci}{n}}$ is the mean average for cargo in metric tonnes for city i; and $\sum_{CTi\ldots n}$ is the sum of the total cargo in metric tonnes for all the cities.

Table 8-6 Total air movement

Airport	Passenger volumes												
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total	Mean Avg	
Bloemfontein	305 701	424 924	411 683	400 814	403 800	437 996	426 672	380 284	363 895	393 471	**3 949 240**	**394 924**	**1,13%**
Cape Town	7 224 521	8 317 341	8 077 435	7 723 975	8 107 648	8 436 191	8 505 563	8 348 854	8 755 872	9 659 589	**83 156 989**	**8 315 699**	**23,84%**
eThekwini	4 032 193	4 799 702	4 458 715	4 304 729	4 757 800	5 038 231	4 747 224	4 504 929	4 524 894	4 930 155	**46 098 572**	**4 609 857**	**13,22%**
East London	664 824	744 949	715 206	675 980	671 895	681 741	663 206	658 363	638 012	726 049	**6 840 225**	**684 023**	**1,96%**
George	589 674	652 031	630 385	548 498	527 633	527 633	555 378	560 432	615 688	718 881	**5 926 233**	**592 623**	**1,70%**
Kimberley	129 037	147 285	155 615	130 644	132 756	135 939	153 126	152 667	160 442	166 960	**1 464 471**	**146 447**	**0,42%**
OR Tambo	17 229 694	19 336 300	18 501 628	17 444 503	18 383 549	18 922 346	18 681 458	18 792 857	19 135 093	20 375 626	**186 803 054**	**18 680 305**	**53,56%**
Port Elizabeth	1 409 607	1 491 551	1 465 429	1 342 861	1 408 754	1 368 334	1 317 698	1 269 634	1 350 744	1 604 381	**14 028 993**	**1 402 899**	**4,02%**
Upington	37 058	47 575	50 220	42 522	45 390	51 982	55 319	62 510	74 297	69 006	**535 879**	**53 588**	**0,15%**
Total	**31 622 309**	**35 961 658**	**34 466 316**	**32 614 526**	**34 439 225**	**35 600 393**	**35 105 644**	**34 730 530**	**35 618 937**	**38 644 118**	**348 803 656**	**34 880 366**	
	Aircraft movements												
Bloemfontein	20 953	17 729	27 035	22 896	18 476	20 144	18 339	14 533	16 702	17 359	**194 166**	**19 417**	**3,77%**
Cape Town	74 743	80 467	78 030	93 230	93 607	96 575	91 486	87 388	91 146	100 221	**886 893**	**88 689**	**17,22%**
eThekwini	49 802	55 434	53 562	52 394	54 587	54 940	50 853	49 341	49 355	52 316	**522 584**	**52 258**	**10,15%**
East London	23 254	16 482	23 826	35 135	39 557	34 111	29 624	31 136	31 798	30 007	**294 930**	**29 493**	**5,73%**
George	15 136	10 925	9 635	42 439	35 352	32 843	37 623	41 672	55 432	57 924	**338 981**	**33 898**	**6,58%**
Kimberley	13 672	4 675	12 646	12 106	12 415	12 516	11 949	10 369	11 819	10 095	**112 262**	**11 226**	**2,18%**
OR Tambo	217 670	233 457	225 984	203 210	210 686	212 132	203 007	202 750	217 627	224 191	**2 150 714**	**215 071**	**41,76%**
Port Elizabeth	40 099	25 276	36 425	76 869	74 074	68 387	63 289	67 777	62 594	64 328	**579 118**	**57 912**	**11,25%**
Upington	2 643	4 003	5 167	6 706	6 632	7 992	8 161	9 136	9 292	10 574	**70 306**	**7 031**	**1,37%**
Total	**457 972**	**448 448**	**472 310**	**544 985**	**545 386**	**539 640**	**514 331**	**514 102**	**545 765**	**567 015**	**5 149 954**	**514 995**	
	Cargo (metric tonnes) movements												
Bloemfontein	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**0,00%**
Cape Town	47 428	48 298	49 943	43 796	37 743	37 141	39 771	40 384	38 149	37 545	**420 198**	**42 020**	**10,52%**
eThekwini	-	-	-	-	-	-	-	603	5 993	5 795	**12 391**	**4 130**	**1,03%**
East London	-	-	-	-	-	-	-	-			**-**	**-**	**0,00%**
George	-	-	-	-	-	-	-	-			**-**	**-**	**0,00%**
Kimberley	-	-	-	-	-	-	-	-			**-**	**-**	**0,00%**
OR Tambo	339 194	366 075	353 866	381 453	385 377	377 726	316 840	348 278	338 450	354 584	**3 561 844**	**356 184**	**89,17%**
Port Elizabeth	-	-	-	-	-	-	-	-			**-**	**-**	**0,00%**
Upington	-	-	-	-	-	-	-	-			**-**	**-**	**0,00%**
Total	**386 623**	**414 373**	**403 809**	**425 249**	**423 120**	**414 866**	**356 611**	**389 265**	**382 592**	**397 924**	**3 994 433**	**399 443**	

Source: NDoT and ACSA (2016)

Note: Passenger movement – international/regional/domestic/unscheduled; Aircraft movement – international/ regional/ domestic/unscheduled; and Cargo movement – international/domestic (imports and exports)

Table 8-7 MmAIFs of airport nodes within the country

Airport	Cargo		Aircraft		Passenger		MmAIF (z-value)
Bloemfontein	0	0,000	19 417	0,038	394 924	0,011	**0,049**
Cape Town	42 020	0,104	88 689	0,172	8 315 699	0,238	**0,515**
eThekwini	4 130	0,010	52 258	0,101	4 609 857	0,132	**0,244**
East London	0	0,000	29 493	0,057	684 023	0,020	**0,077**
George	0	0,000	33 898	0,066	592 623	0,017	**0,083**
Kimberley	0	0,000	11 226	0,022	146 447	0,004	**0,026**
OR Tambo	356 184	0,885	215 071	0,418	18 680 305	0,536	**1,838**
Port Elizabeth	0	0,000	57 912	0,112	1 402 899	0,040	**0,153**
Upington	0	0,000	7 031	0,014	53 588	0,002	**0,015**
Total	**402 334**		**514 995**		**34 880 365**		

Source: Own compilation

Having established the dominance of the principal sea and airports relative to one another, the following step is to determine the EIFs for each regional node, which establishes the economic weight of each economic region relative to one another. Table 8.8 and Figure 8.4 illustrate the EIFs for each economic region and are calculated using the following algorithm:

$$EIFi = ((\frac{PEi}{PTi})/(\frac{\sum_{PEi\ldots n}}{\sum_{PTi\ldots n}})) + (MmPIFi + MmAIFi)x(\frac{GVAi}{\sum_{GVAi\ldots n}})$$

where $EIFi$ is the EIF for city i (i=1…n); PEi is the economically active population of city i; PTi is the total population of city i; $\sum_{PEi\ldots n}$ is the sum of the economically active population of all the cities; $\sum_{PTi\ldots n}$ is the sum of the total population of all the cities; $MmPIFi$ is the MmPIF of city i; $MmAIFi$ is the MmAIF of city i; $GVAi$ is the GVA of city i; and $\sum_{GVAi\ldots n}$ is the sum of the GVA of all the cities.

Table 8-8 EIFs for each economic regional node, relative to one another

Regional nodes	Municipality				UFI	Population		Economic active		Seaport	Airport	MmIF	GVA		EIF
1	EC	NMA	Nelson Mandela Bay	Port Elizabeth	34,93	1 152 117	2,23%	457 386	2,44%	0,317	0,153	0,470	42 415	2,49%	0,0431
2	EC	BUF	Buffalo City	East London	19,26	755 202	1,46%	285 225	1,52%	0,043	0,077	0,120	28 005	1,64%	0,0204
3	EC	EC157	King Sabata Dalindyebo	Mthatha	3,74	451 713	0,87%	95 577	0,51%	0,000	0,000	0,000	7 997	0,47%	0,0029
4	EC	EC134	Lukanji	Queenstown	2,79	190 725	0,37%	53 262	0,28%	0,000	0,000	0,000	3 948	0,23%	0,0019
5	EC	EC104	Makana	Grahamstown	2,32	80 391	0,16%	28 491	0,15%	0,000	0,000	0,000	2 143	0,13%	0,0013
6	FS	MAN	Mangaung	Bloemfontein	25,91	747 429	1,44%	292 971	1,56%	0,000	0,049	0,049	30 394	1,78%	0,0213
7	FS	FS184	Matjhabeng	Welkom	7,43	406 461	0,79%	158 175	0,84%	0,000	0,000	0,000	13 027	0,76%	0,0086
8	FS	FS201	Moqhaka	Kroonstad	3,94	160 536	0,31%	55 593	0,30%	0,000	0,000	0,000	5 529	0,32%	0,0033
9	FS	FS192	Dihlabeng	Bethlehem	3,92	128 703	0,25%	47 496	0,25%	0,000	0,000	0,000	3 288	0,19%	0,0021
10	FS	FS194	Maluti a Phofung	Harrismith	2,10	335 784	0,65%	90 870	0,48%	0,000	0,000	0,000	6 891	0,40%	0,0032
11	FS	FS203	Ngwathe	Parys	2,03	120 519	0,23%	39 555	0,21%	0,000	0,000	0,000	2 240	0,13%	0,0012
	GT	JHB	Johannesburg	Johannesburg	94,51										
	GT	TSH	City of Tshwane	Tshwane	51,70										
	NW	NW372	Madibeng	Brits-Hartbeespoort	4,60										
	GT	EKU	Ekurhuleni	Ekurhuleni	38,49										
	GT	GT481	Mogale City	Krugersdorp	16,65										
	GT	GT421	Emfuleni	Vereeniging/Vanderbijlpark	7,83										
	FS	FS204	Metsimaholo	Sasolburg	3,03										
	GT	GT422	Midvaal	Meyerton	3,46										
12	GT	GT484	Merafong	Carletonville	2,74	12 538 182	24,22%	6 175 011	32,89%	0,000	1,838	1,838	609 004	35,74%	1,3233
	KN	ETH	eThekwini	Durban	76,05										
	KN	KZN212	Umdoni	Scottburgh-Umkomaas	3,04										
	KN	KZN292	KwaDukuza	Stanger	3,08										
13	KN	KZN225	The Msunduzi	Pietermaritzburg	18,97	4 370 964	8,44%	1 768 764	9,42%	1,179	0,244	1,423	179 081	10,51%	0,3084
	KN	KZN282	uMhlathuze	Richardsbay	5,88										
14	KN	KZN283	Ntambanana	Empangeni	4,92	408 795	0,79%	137 484	0,73%	0,616	0,000	0,616	14 892	0,87%	0,0152
15	KN	KZN252	Newcastle	Newcastle	4,97	363 237	0,70%	100 653	0,54%	0,000	0,000	0,000	7 430	0,44%	0,0035
16	KN	KZN232	Emnambithi/Ladysmith	Ladysmith	3,74	237 435	0,46%	72 252	0,38%	0,000	0,000	0,000	5 677	0,33%	0,0029
17	KN	KZN263	Abaqulusi	Vryheid	2,60	211 062	0,41%	42 699	0,23%	0,000	0,000	0,000	4 253	0,25%	0,0015
18	LIM	LIM354	Polokwane	Polokwane	11,82	628 998	1,21%	230 475	1,23%	0,000	0,000	0,000	17 177	1,01%	0,0107
19	LIM	LIM333	Greater Tzaneen	Tzaneen	4,45	390 093	0,75%	116 019	0,62%	0,000	0,000	0,000	5 683	0,33%	0,0029
20	LIM	LIM344	Makhado	Makhado	2,89	516 030	1,00%	124 473	0,66%	0,000	0,000	0,000	8 165	0,48%	0,0033
21	LIM	LIM367	Mogalakwena	Mokopane	2,59	307 683	0,59%	78 645	0,42%	0,000	0,000	0,000	6 531	0,38%	0,0028
22	MP	MP322	Mbombela	Nelspruit	12,21	588 792	1,14%	228 237	1,22%	0,000	0,000	0,000	17 226	1,01%	0,0113
	MP	MP312	Emalahleni	Witbank	6,80										
	MP	MP313	Steve Tshwete	Middelburg	5,14										
23	MP	MP307	Govan Mbeki	Secunda	3,16	919 833	1,78%	432 114	2,30%	0,000	0,000	0,000	47 112	2,77%	0,0376
24	MP	MP302	Msukaligwa	Ermelo	2,63	149 376	0,29%	56 964	0,30%	0,000	0,000	0,000	3 913	0,23%	0,0025
25	NC	NC091	Sol Plaatjie	Kimberley	9,12	248 040	0,48%	92 562	0,49%	0,000	0,026	0,026	8 834	0,52%	0,0058
26	NC	NC083	//Khara Hais	Upington	3,68	93 495	0,18%	32 232	0,17%	0,000	0,015	0,015	3 040	0,18%	0,0018
27	NC	NC062	Nama Khoi	Springbok	2,02	47 040	0,09%	16 014	0,09%	0,000	0,000	0,000	2 507	0,15%	0,0015
	NW	NW403	City of Matlosana	Klerksdorp	9,02										
28	NW	NW402	Tlokwe City Council	Potchefstroom	5,39	561 435	1,08%	224 808	1,20%	0,000	0,000	0,000	17 960	1,05%	0,0122
29	NW	NW373	Rustenburg	Rustenburg	8,32	549 576	1,06%	266 472	1,42%	0,000	0,000	0,000	26 313	1,54%	0,0217
	NW	NW383	Mafikeng	Mafikeng	3,68										
30	NW	NW384	Ditsobotla	Mmabatho	2,02	460 428	0,89%	145 329	0,77%	0,000	0,000	0,000	13 016	0,76%	0,0070
	WC	CPT	City of Cape Town	Cape Town	100,00										
	WC	WC023	Drakenstein	Drakenstein	7,15										
	WC	WC024	Stellenbosch	Stellenbosch	8,24										
	WC	WC025	Breede Valley	Worcester	4,12										
31	WC	WC032	Overstrand	Hermanus	3,74	4 394 277	8,49%	1 977 552	10,53%	0,459	0,515	0,974	211 542	12,42%	0,3115
	WC	WC044	George	George	11,23										
	WC	WC043	Mossel Bay	Mossel Bay	5,55										
	WC	WC048	Knysna	Knysna	5,05										
	WC	WC045	Oudtshoorn	Oudtshoorn	3,69										
32	WC	WC047	Bitou	Plettenberg Bay	3,56	496 851	0,96%	198 396	1,06%	0,084	0,083	0,167	17 026	1,00%	0,0136
33	WC	WC014	Saldanha Bay	Saldanha Bay	2,77	99 192	0,19%	44 829	0,24%	0,301	0,000	0,301	3 406	0,20%	0,0034
TOTAL						***33 110 394***	***63,96%***	***14 166 585***	***75,46%***				***1 375 665***	***80,74%***	

Source: Own compilation

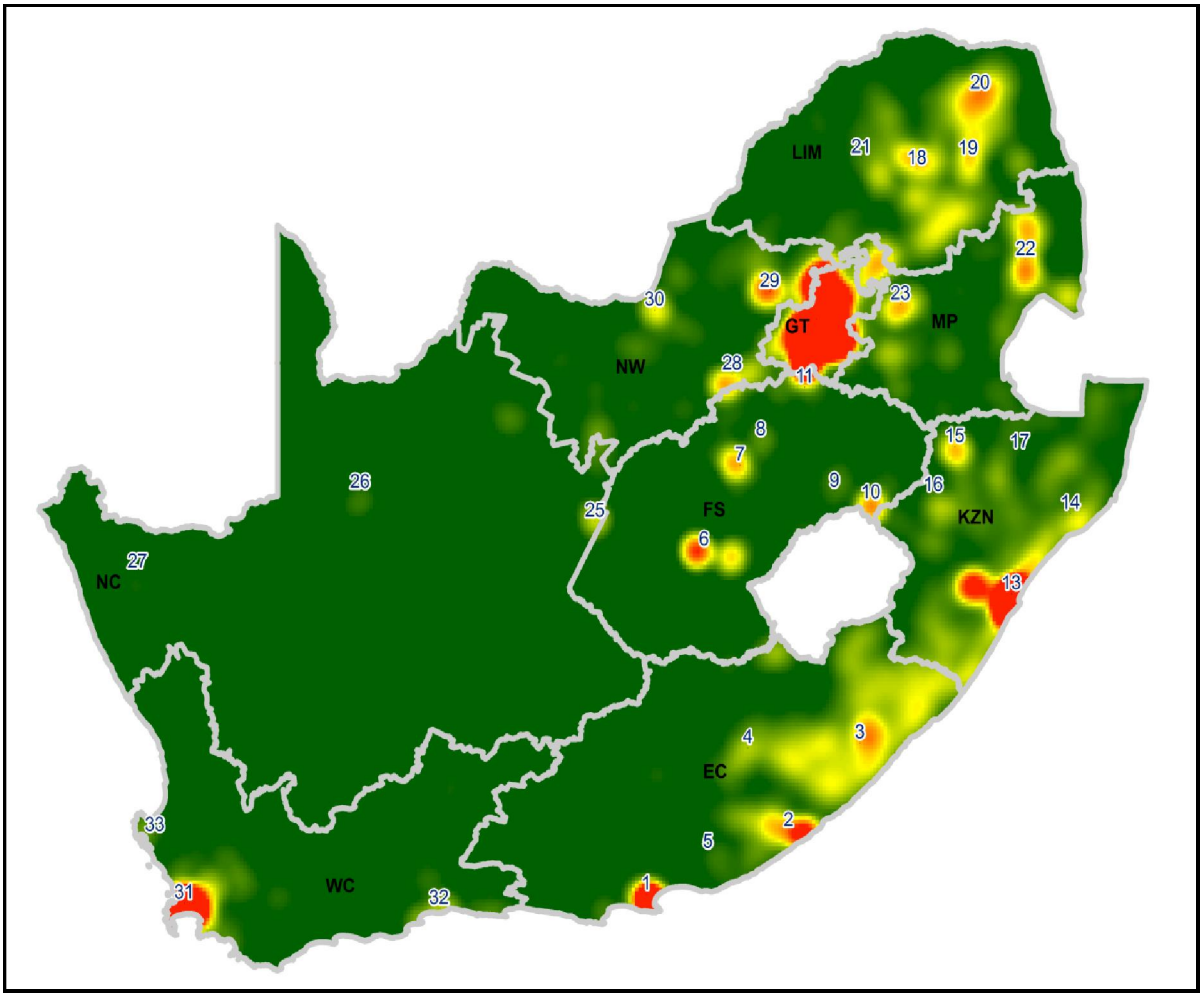


Figure 8-4 EIFs for each economic regional node, relative to one another

Source: Own compilation

Note: Heat map illustrating the EIFs for each economic regional node relative to one another

Establishing the degree of economic attraction exerted by each regional node, relative to one another, creates the opportunity to establish the primary network of functional urban centres, which ultimately controls the most dominant agglomeration of economic activities distributed across the South African landscape.

8.2.4 Networks of functional urban centres

The last step is to establish the primary network of urban centres, which ultimately measures the most dominant economic agglomeration distributed across the country. Having established the output levels from the EIFs, each regional node is further classified into three main categories: 1) primary nodes, if it has an EIF value of 0,1 and above; 2) secondary nodes, if it has an EIF value between 0,01 and 0,1; and 3) intermediate nodes, if it has an EIF value between 0,001 and 0,01. The reason for selecting the above three categories is based on the fact that the output levels from the EIFs provide for a natural break and

are illustrated in Table 8.11. Considering the EIF values, this classification provides the most relative economic dominance that exists between the networks of larger urban centres, which establishes the economic output levels of each regional node, relative to one another. However, it is also clear that regional nodes with an EIF value below a certain value, as illustrated in Table 8.8, will provide no significant contribution towards the establishment of a primary network of economic regions. To establish which regional nodes will provide no significant contribution, a per centile rank inclusive score (0 and 100 are included as values) was used. The per centile rank of a score is the per centage of scores in its frequency distribution that is equal to or lower than it, and this ranking is commonly used to clarify the interpretation of scores. However, also important is the fact that per centile ranks are not on an equal-interval scale, i.e. the difference between any two scores is not the same as between any other two scores where the difference in per centile ranks is the same. Furthermore, some per centile ranks are closer to some than to others, e.g. per centile rank 30 is closer on the bell curve to 40 than it is to 20. Table 8.9 illustrates the EIF per centile rank score for each economic regional node, relative to one another.

Table 8-9 EIFs' per centile rank scores

City/Town	Regional node	EIFs	Percentile score	Percentile
Parys	11	0,0012	0,00%	1
Grahamstown	5	0,0013	3,10%	
Vryheid	17	0,0015	6,20%	
Springbok	27	0,0015	6,20%	
Upington	26	0,0018	12,50%	
Queenstown	4	0,0019	15,60%	
Bethlehem	9	0,0021	18,70%	
Ermelo	24	0,0025	21,80%	
Mokopane	21	0,0028	25,00%	
Mthatha	3	0,0029	28,10%	
Ladysmith	16	0,0029	28,10%	
Tzaneen	19	0,0029	28,10%	
Harrismith	10	0,0032	37,50%	2
Kroonstad	8	0,0033	40,60%	
Makhado	20	0,0033	40,60%	
Saldanha Bay	33	0,0034	46,80%	
Newcastle	15	0,0035	50,00%	
Kimberley	25	0,0058	53,10%	
Mmabatho	30	0,0070	56,20%	
Welkom	7	0,0086	59,30%	
Polokwane	18	0,0107	62,50%	
Nelspruit	22	0,0113	65,60%	
Klerksdorp	28	0,0122	68,70%	3
Mossel Bay	32	0,0136	71,80%	
Richardsbay	14	0,0152	75,00%	
East London	2	0,0204	78,10%	
Bloemfontein	6	0,0213	81,20%	
Rustenburg	29	0,0217	84,30%	
Witbank	23	0,0376	87,50%	
Port Elizabeth	1	0,0431	90,60%	
Durban	13	0,3084	93,70%	
Cape Town	31	0,3115	96,80%	
Johannesburg	12	1,3233	100,00%	

Source: Own compilation

Note: Regional nodes represent a broader classification of cities and towns and should be read along with Table 8.8

According to the ranking, EIF values falling within the first per centile are considered not significant in contributing towards the establishment of a primary network of economic regions and are, therefore,

excluded (illustrated in Table 8.10). In this regard, only the primary, secondary and intermediate nodes with an EIF value of above 0, 003, as illustrated in Table 8.11, are considered significant in the establishment of a primary network of economic regions for South Africa.

Table 8-10 Regional nodes considered not significant in contributing towards the primary network of economic regions

City/Town	Regional node	EIFs	Percentile score	Percentile
Parys	11	0,0012	0,00%	1
Grahamstown	5	0,0013	3,10%	
Vryheid	17	0,0015	6,20%	
Springbok	27	0,0015	6,20%	
Upington	26	0,0018	12,50%	
Queenstown	4	0,0019	15,60%	
Bethlehem	9	0,0021	18,70%	
Ermelo	24	0,0025	21,80%	
Mokopane	21	0,0028	25,00%	
Mthatha	3	0,0029	28,10%	
Ladysmith	16	0,0029	28,10%	
Tzaneen	19	0,0029	28,10%	

Source: Own compilation

Furthermore, applying an EIF value of 0,003 and above constitutes an economic contribution of more than 75 per cent towards the national economy, close to 60 per cent of the total population count and more than 70 per cent of the total economically active population. Table 8.11 and Figure 8.5 illustrate the primary network of economic regional nodes distributed across the South African landscape.

Table 8-11 Primary functional network of economic regions measuring the degree of economic agglomeration within South Africa

Regional nodes		Municipality				UFI	Population		Economic active		Seaport	Airport	MmIF	GVA		EIF
Primary nodes		GT	JHB	Johannesburg	Johannesburg	94,51										
		GT	TSH	City of Tshwane	Tshwane	51,70										
		NW	NW372	Madibeng	Brits-Hartbeespoort	4,60										
		GT	EKU	Ekurhuleni	Ekurhuleni	38,49										
		GT	GT481	Mogale City	Krugersdorp	16,65										
		GT	GT421	Emfuleni	Vereeniging/Vanderbijlpark	7,83										
		FS	FS204	Metsimaholo	Sasolburg	3,03										
		GT	GT422	Midvaal	Meyerton	3,46										
	12	GT	GT484	Merafong	Carletonville	2,74	12 538 182	*24,22%*	6 175 011	*32,89%*	0,000	1,838	1,838	609 004	*35,74%*	1,3233
		KN	ETH	eThekwini	Durban	76,05										
		KN	KZN212	Umdoni	Scottburgh-Umkomaas	3,04										
		KN	KZN292	KwaDukuza	Stanger	3,08										
	13	KN	KZN225	The Msunduzi	Pietermaritzburg	18,97	4 370 964	*8,44%*	1 768 764	*9,42%*	1,179	0,244	1,423	179 081	*10,51%*	0,3084
		WC	CPT	City of Cape Town	Cape Town	100,00										
		WC	WC023	Drakenstein	Drakenstein	7,15										
		WC	WC024	Stellenbosch	Stellenbosch	8,24										
		WC	WC025	Breede Valley	Worcester	4,12										
	31	WC	WC032	Overstrand	Hermanus	3,74	4 394 277	*8,49%*	1 977 552	*10,53%*	0,459	0,515	0,974	211 542	*12,42%*	0,3115
Total							**21 303 423**	***41,15%***	**9 921 327**	***52,85%***				**999 627**	***58,67%***	
Secondary nodes	1	EC	NMA	Nelson Mandela Bay	Port Elizabeth	34,93	1 152 117	*2,23%*	457 386	*2,44%*	0,317	0,153	0,470	42 415	*2,49%*	0,0431
	2	EC	BUF	Buffalo City	East London	19,26	755 202	*1,46%*	285 225	*1,52%*	0,043	0,077	0,120	28 005	*1,64%*	0,0204
	6	FS	MAN	Mangaung	Bloemfontein	25,91	747 429	*1,44%*	292 971	*1,56%*	0,000	0,049	0,049	30 394	*1,78%*	0,0213
		KN	KZN282	uMhlathuze	Richardsbay	5,88										
	14	KN	KZN283	Ntambanana	Empangeni	4,92	408 795	*0,79%*	137 484	*0,73%*	0,616	0,000	0,616	14 892	*0,87%*	0,0152
	18	LIM	LIM354	Polokwane	Polokwane	11,82	628 998	*1,21%*	230 475	*1,23%*	0,000	0,000	0,000	17 177	*1,01%*	0,0107
	22	MP	MP322	Mbombela	Nelspruit	12,21	588 792	*1,14%*	228 237	*1,22%*	0,000	0,000	0,000	17 226	*1,01%*	0,0113
		MP	MP312	Emalahleni	Witbank	6,80										
		MP	MP313	Steve Tshwete	Middelburg	5,14										
	23	MP	MP307	Govan Mbeki	Secunda	3,16	919 833	*1,78%*	432 114	*2,30%*	0,000	0,000	0,000	47 112	*2,77%*	0,0376
		NW	NW403	City of Matlosana	Klerksdorp	9,02										
	28	NW	NW402	Tlokwe City Council	Potchefstroom	5,39	561 435	*1,08%*	224 808	*1,20%*	0,000	0,000	0,000	17 960	*1,05%*	0,0122
	29	NW	NW373	Rustenburg	Rustenburg	8,32	549 576	*1,06%*	266 472	*1,42%*	0,000	0,000	0,000	26 313	*1,54%*	0,0217
		WC	WC044	George	George	11,23										
		WC	WC043	Mossel Bay	Mossel Bay	5,55										
		WC	WC048	Knysna	Knysna	5,05										
		WC	WC045	Oudtshoorn	Oudtshoorn	3,69										
	32	WC	WC047	Bitou	Plettenberg Bay	3,56	496 851	*0,96%*	198 396	*1,06%*	0,084	0,083	0,167	17 026	*1,00%*	0,0136
Total							**6 809 028**	***13,15%***	**2 753 568**	***14,67%***				**258 520**	***15,17%***	
Intermediate nodes	7	FS	FS184	Matjhabeng	Welkom	7,43	406 461	*0,79%*	158 175	*0,84%*	0,000	0,000	0,000	13 027	*0,76%*	0,0086
	8	FS	FS201	Moqhaka	Kroonstad	3,94	160 536	*0,31%*	55 593	*0,30%*	0,000	0,000	0,000	5 529	*0,32%*	0,0033
	10	FS	FS194	Maluti a Phofung	Harrismith	2,10	335 784	*0,65%*	90 870	*0,48%*	0,000	0,000	0,000	6 891	*0,40%*	0,0032
	15	KN	KZN252	Newcastle	Newcastle	4,97	363 237	*0,70%*	100 653	*0,54%*	0,000	0,000	0,000	7 430	*0,44%*	0,0035
	20	LIM	LIM344	Makhado	Makhado	2,89	516 030	*1,00%*	124 473	*0,66%*	0,000	0,000	0,000	8 165	*0,48%*	0,0033
	25	NC	NC091	Sol Plaatjie	Kimberley	9,12	248 040	*0,48%*	92 562	*0,49%*	0,000	0,026	0,026	8 834	*0,52%*	0,0058
		NW	NW383	Mafikeng	Mafikeng	3,68										
	30	NW	NW384	Ditsobotla	Mmabatho	2,02	460 428	*0,89%*	145 329	*0,77%*	0,000	0,000	0,000	13 016	*0,76%*	0,0070
	33	WC	WC014	Saldanha Bay	Saldanha Bay	2,77	99 192	*0,19%*	44 829	*0,24%*	0,301	0,000	0,301	3 406	*0,20%*	0,0034
Total							**2 589 708**	***5,00%***	**812 484**	***4,33%***				**66 298**	***3,89%***	
TOTAL							**30 702 159**	**59,30%**	**13 487 379**	***71,84%***				**1 324 445**	**77,73%**	

Source: Own compilation

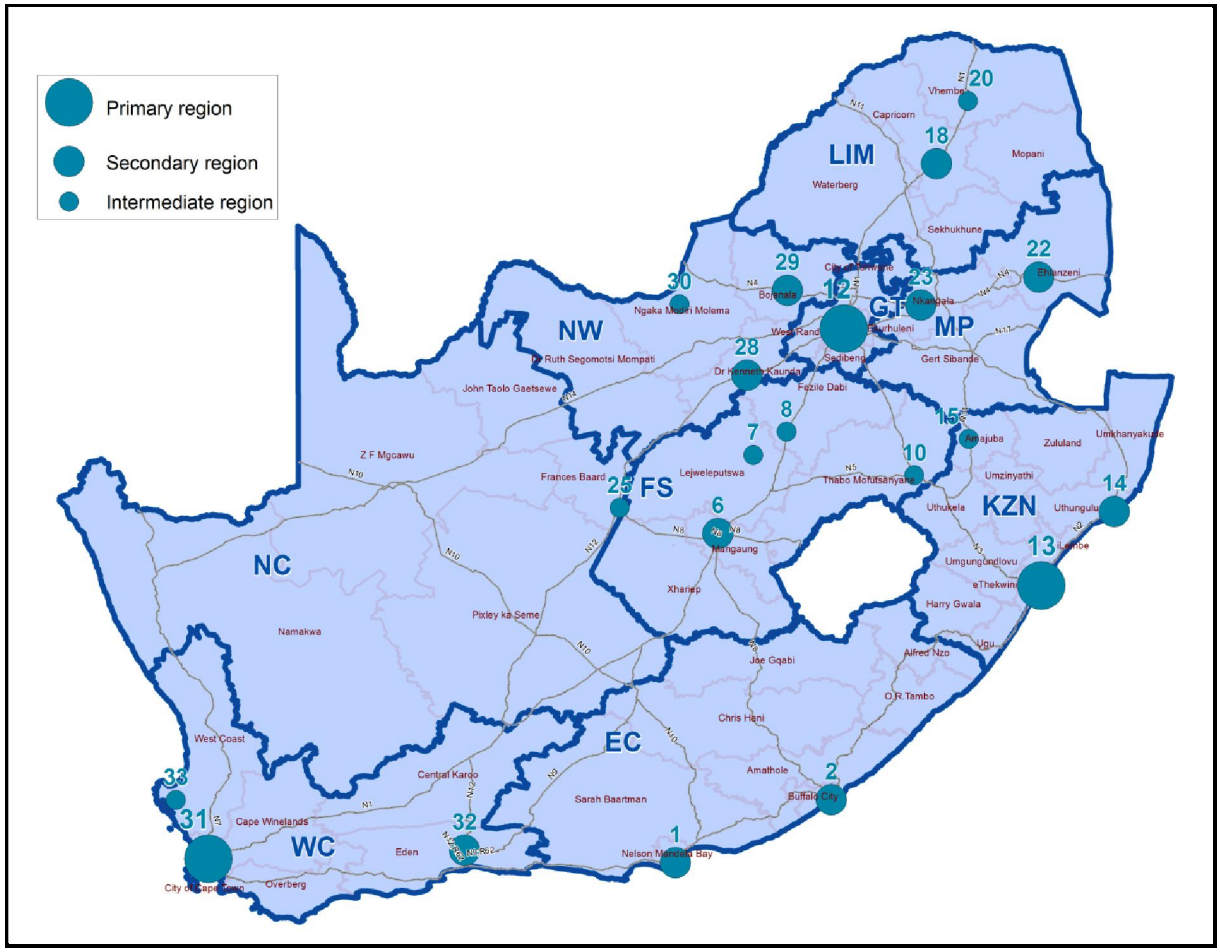


Figure 8-5 Primary functional network of economic regions measuring the degree of economic agglomeration within the country

Source: Own compilation

Important from the primary functional network is the fact that close to 60 per cent of all economic activities; 40 per cent of the total population count and 50 per cent of the total economically active population are located within the Gauteng, Durban (eThekwini) and Cape Town economic regions. Furthermore, also evident is the fact that close to 36 per cent of all economic activities; 25 per cent of the total population count and close to 30 per cent of the total economically active population are located in the Gauteng economic region alone. This not only confirms that the three regions are considered the main powerhouses which control most of the country's economic activities, but also emphasises the emergence of the Gauteng economic region as a very strong monocentric powerhouse which ultimately dominates the country's economic growth and development. This also highlights the fact that the spatial distribution of economic activities, population distribution and economically active population distribution across the country represent an uneven geography. This basically means that the notion highlighted in Chapter 4, also emphasised by the South African spatial planning system highlighted in section 7.4, that cities are recognised as the key ingredient in providing for economic growth and development, is implicated. Furthermore, it also suggests that the establishment of the Gauteng, Durban (eThekwini) and

Cape Town economic regions as the main economic powerhouses is the result of the backwash effect which caused people and industries to gravitate towards these centres (explained in Chapter 3 under section 3.5).

8.3 Modified Law of Gravitation

The previous section determined the primary network of functional urban centres, which ultimately defines the distribution of the main agglomeration of economic activities within the country, thereby supporting the notion of potential development corridors based on the distribution of economies. However, according to Brand *et al*. (2015), consideration should also be given to the relative strength between these economic regions to obtain a more refined classification of potential corridors. For the purpose of the research, a modified law of gravitation was considered because it is based on relative advantage, which is an index of link-demand. According to Janelle (1968), the relative advantage of a given place attracts the centralisation and specialisation of economic activities, i.e. larger urban areas attract people, ideas and commodities more than smaller urban areas. This is also emphasised by Johnston (1976), indicating that gravity correlates positively with the size of the economy, but negatively with distance, thereby providing a good fit in determining growth poles. Sheppard (2012) noted, however, that with respect to a gravity model, to establish the distance friction effect which ultimately defines the attraction levels between two places, it is important to incorporate direct and indirect connectivity between locations. For the purpose of the research, direct connectivity takes into account the distance between two places (centroid to centroid), while indirect connectivity considers the population count and the economic output levels that exist between two places. Establishing how the sizes of economies of the primary networks of functional urban centres correlate with one another is based on two key steps: 1) to focus on the strength of the relative advantage that exists between each economic regional node when establishing primary and secondary growth poles; and 2) to convert the strength of the relative advantage into a Cumulative Corridor Impact Factor (CCIF) to establish potential development corridor zones.

8.3.1 Link demand value

The first step is to establish the relative advantage that exists between each economic regional node which constitutes the primary network of functional urban centres. The relative advantage illustrated in Table 8.12 is derived from calculating the Link Demand Value (LDV) between each economic regional node classified as the primary functional network of the larger urban centres as a simple gravity model, using the following algorithm:

$$LDVi/ii = \frac{(Pi\ x\ Pii)}{Di/ii^2} x \frac{(EIFi\ x\ EIFii)}{Di/ii^2}$$

where $LDVi/ii$ is the LDV between cities i and ii; $Pi\ x\ Pii$ is the total population of city i and total population of city ii; Di/ii^2 is the square of the distance between cities i and ii; $EIFi\ x\ EIFii$ is the EIF of city i and EIF of city ii; and Di/ii is the square of the distance between cities i and ii.

Table 8-12 The relative link advantage between the nodes classified as the primary functional network of larger urban centres within the country

Regional nodes	1	2	6	7	8	10	12	13	14	15	18	20	22	23	25	28	29	30	31	32	33
1		0,259	0,014	0,001	0,000	0,000	1,679	0,306	0,000	0,000	0,000	0,000	0,000	0,003	0,001	0,001	0,001	0,000	0,277	0,071	0,000
2	233		0,008	0,000	0,000	0,000	0,995	0,448	0,000	0,000	0,000	0,000	0,000	0,002	0,000	0,001	0,001	0,000	0,029	0,002	0,000
6	487	414		0,173	0,006	0,003	15,902	0,459	0,001	0,001	0,001	0,000	0,000	0,014	0,017	0,028	0,008	0,003	0,030	0,001	0,000
7	617	520	134		0,045	0,002	22,630	0,118	0,000	0,001	0,000	0,000	0,000	0,012	0,001	0,072	0,010	0,002	0,004	0,000	0,000
8	678	571	196	80		0,000	12,452	0,018	0,000	0,000	0,000	0,000	0,000	0,004	0,000	0,031	0,004	0,001	0,000	0,000	0,000
10	672	502	287	221	207		4,216	0,415	0,001	0,010	0,000	0,000	0,000	0,010	0,000	0,001	0,001	0,000	0,001	0,000	0,000
12	837	712	359	225	163	255		397,620	1,745	4,761	16,008	1,172	8,559	546,638	0,600	149,665	692,799	17,239	9,243	0,144	0,002
13	684	464	465	447	447	243	487		14,892	0,517	0,052	0,008	0,170	1,255	0,010	0,102	0,151	0,021	0,608	0,014	0,000
14	838	618	572	523	504	302	493	154		0,002	0,000	0,000	0,002	0,008	0,000	0,000	0,000	0,000	0,002	0,000	0,000
15	773	591	391	307	276	108	258	240	238		0,000	0,000	0,001	0,028	0,000	0,001	0,001	0,000	0,002	0,000	0,000
18	1118	974	647	514	452	477	289	645	580	413		0,087	0,017	0,085	0,000	0,001	0,006	0,000	0,002	0,000	0,000
20	1225	1080	752	619	556	582	394	740	663	514	107		0,002	0,005	0,000	0,000	0,001	0,000	0,000	0,000	0,000
22	1060	880	638	521	466	388	337	479	381	290	226	288		0,108	0,000	0,001	0,003	0,000	0,002	0,000	0,000
23	897	746	442	316	257	249	180	439	411	199	229	335	215		0,001	0,035	0,310	0,007	0,014	0,000	0,000
25	532	539	193	255	304	463	447	657	759	559	726	823	770	558		0,001	0,000	0,000	0,005	0,000	0,000
28	736	653	250	135	104	307	166	548	596	361	438	536	502	287	288		0,153	0,077	0,007	0,000	0,000
29	874	768	388	257	199	335	130	571	578	344	290	385	390	191	439	152		0,045	0,007	0,000	0,000
30	830	769	358	260	233	432	236	675	712	474	444	526	561	357	329	130	171		0,003	0,000	0,000
31	704	925	931	1044	1101	1211	1252	1320	1461	1318	1531	1625	1565	1358	805	1093	1242	1108		0,240	4,806
32	262	484	584	715	778	835	940	902	1050	942	1229	1333	1214	1026	537	805	955	865	443		0,000
33	751	963	926	1031	1086	1210	1231	1336	1472	1316	1504	1595	1552	1342	784	1069	1214	1072	99	490	

Distance in Kilometre (centroid to centroid)

Relative advantage (Link Demand Value)

Source: Own compilation

Considering that distance friction ultimately defines the attraction levels between two places, i.e. if the distance increases, the attraction levels decrease and vice versa, a LDV value above one is considered the best fit (strongest attraction level) in determining which of the regional nodes classified as the primary functional network of larger urban centres within the country are considered to be based on attraction levels, the most prominent growth poles. Table 8.13 illustrates the larger urban centres considered as the most prominent growth poles.

Table 8-13 The relative link advantage between growth poles

Primary nodes	EIF	Primary nodes	EIF	Secondary nodes	EIF	Intermediate nodes	EIF	LDV
Johannesburg	1,3233					Makhado	0,0033	1,172
Durban	0,3084			Witbank	0,0376			1,255
Johannesburg	1,3233			Port Elizabeth	0,0431			1,679
Johannesburg	1,3233			Richardsbay	0,0152			1,745
Johannesburg	1,3233					Harrismith	0,0032	4,216
Johannesburg	1,3233					Newcastle	0,0035	4,761
Cape Town	0,3115					Saldanha Bay	0,0034	4,806
Johannesburg	1,3233			Nelspruit	0,0113			8,559
Johannesburg	1,3233	Cape Town	0,3115					9,243
Johannesburg	1,3233					Kroonstad	0,0033	12,452
Durban	0,3084			Richardsbay	0,0152			14,892
Johannesburg	1,3233			Bloemfontein	0,0213			15,902
Johannesburg	1,3233			Polokwane	0,0107			16,008
Johannesburg	1,3233					Mmabatho	0,0070	17,239
Johannesburg	1,3233					Welkom	0,0086	22,630
Johannesburg	1,3233			Klerksdorp	0,0122			149,665
Johannesburg	1,3233	Durban	0,3084					397,620
Johannesburg	1,3233			Witbank	0,0376			546,638
Johannesburg	1,3233			Rustenburg	0,0217			692,799

Source: Own compilation

With the establishment of the primary network of functional urban centres (see section 8.2), the Gauteng, Durban (eThekwini) and Cape Town economic regions came forward as the main powerhouses controlling most of the economic activities within the country. Calculations of the LDVs also confirm the notion that the Gauteng, Durban (eThekwini) and Cape Town regions are the most prominent primary nodes. However, it is also clear that the Johannesburg economic region is notably the most predominant primary node, considering that most of the LDVs spread out or radiate from the Johannesburg node. This further confirms the overall dominance of the Gauteng region over the country's economic growth and development. The contributing factor is the emergence of the Gauteng economic region as a very strong, predominant monocentric powerhouse. Further evidence is the high LDV (398) between the Johannesburg and Durban (eThekwini) regions. In this case, the high LDV is the result of the relative close proximity (less distance friction) and the linkage between a strong, predominant monocentric powerhouse and a prominent primary node. The opposite is also true when considering the linkage between the Johannesburg and Cape Town regions as primary nodes. In this case, the low LDV (9) is the result of the great distance friction, i.e. even the linkage with a strong, predominant monocentric powerhouse does not overcome distance friction. On the other hand, the high LDVs that exist between the Johannesburg and the Klerksdorp (150), Witbank (547) and Rustenburg (693) regions are the result of a combination of close proximity and the linkage between a strong, predominant monocentric powerhouse and prominent secondary nodes. This suggests that the creation of the Gauteng economic regions as a predominant, monocentric powerhouse resulted in the spread effect causing nearby areas to develop and grow (explained in Chapter 3 under section 3.5). In summary, this confirms that there is a

direct correlation between distance friction and the level of attraction, i.e. the higher the LDV, the closer the distance and vice versa.

8.3.2 Cumulative corridor impact factor

Having established the most prominent growth poles allows the opportunity to convert the linkage between these poles into potential corridor zones. Therefore, the second step is to convert the outcome from the LDVs into a CCIF. To achieve this, the links between primary, secondary and intermediate nodes are segmented into sections, as illustrated in Table 8.13, and cumulative adding of each adjacent section (increasing by one addition after another) within the potential link determines the vitality of a corridor zone. The reason for selecting cumulative addition is that it allows quantifying of the degree or the force each primary, secondary and intermediate node exerts as benefits through successive additions, which determine the overall strength of a corridor zone. The outcome allows the establishment of potential development corridor zones upon which integrated and supporting networks to structure economic space development can be created. Table 8.14 illustrates the strength of each potential development corridor zone when considering the CCIF and is calculated using the following algorithm:

$$PC = (SC1 + SC2 + \ldots SCn)$$

where PC is the potential corridor (1…n); $SC1$ is the section corridor 1 of the potential corridor; $SC2$ is the section corridor 2 of the potential corridor; and SCn is the section corridor n of the potential corridor.

Important to understand is that the segmentation is created from the primary node as the starting point to either a primary, secondary or intermediate node. Furthermore, each segment is created on a minimum of three nodes, which explains why the linkages between Cape Town and Saldanha Bay as well as Durban (eThekwini) and Richards Bay fall away. The idea is to establish an initial, overall CCIF strength for each potential development corridor zone, whereafter it is converted into an Economic Corridor Space Development Axis (ECSDA), which is discussed in detail in the next section.

Table 8-14 The Cumulative Corridor Impact Factor (CCIF) of potential development corridor zones in the country

Potential corridor zones	Segmented		Strenght	CCIF
Johannesburg - Makhado	JHB-POL	Jhb-Pol+Pol-Mak	16,095	17,3540
	POL-MAK	Jhb-Mak+Pol-Mak	1,259	
Johannesburg - Port Elizabeth	JHB-KR	Jhb-Kr+Kr-Bl+Bl-Pel	12,472	31,7660
	KR-BL	Jhb-Bl+Jhb-Pel+Kr-Bl+Bl-Pel	17,601	
	BL-PEL	Jhb-Pel+Kr-Pel+Bl-Pel	1,693	
Johannesburg - Richardsbay	JHB-HAR	Jhb-Har+Har-Et+Et-Rb	19,523	450,8330
	HAR-ET	Jhb-Et+Jhb-Rb+Har-Et+Et-Rb	414,672	
	ET-RB	Jhb-Rb+Har-Rb+Et-Rb	16,638	
Johannesburg - Newcastle	JHB-WIT	Jhb-Wit+Wit-Nec	546,666	551,4550
	WIT-NEC	Jhb-Nec+Wit-Nec	4,789	
Johannesburg - Nelspruit	JHB-WIT	Jhb-Wit+Wit-Nel	546,746	555,4130
	WIT-NEL	Jhb-Nel+Wit-Nel	8,667	
Johannesburg - Cape Town	JHB-KR	Jhb-Kr+Kr-Bl+Bl-Cpt	12,488	46,9480
	KR-BL	Jhb-Bl+Jhb-Cpt+Kr-Bl+Bl-Cpt	25,181	
	BL-CPT	Jhb-Cpt+Kr-Cpt+Bl-Cpt	9,279	
Johannesburg - Cape Town	JHB-KL	Jhb-Kl+Kl-Wel+Wel-Bl+Bl-Cpt	149,913	232,6000
	KL-WEL	Jhb-Wel+Jhb-Bl+Jhb-Cpt+Kl-Wel+Wel-Bl+Bl-Cpt	48,020	
	WEL-BL	Jhb-Bl+Jhb-Cpt+Kl-Bl+Kl-Cpt+Wel-Bl+Bl-Cpt	25,383	
	BL-CPT	Jhb-Ct+Kl-Cpt+Wel-Ct+Bl-Cpt	9,284	
Johannesburg - Bloemfontein	JHB-KL	Jhb-Kl+Kl-Wel+Wel-Bl	149,910	204,7900
	KL-WEL	Jhb-Wel+Jhb-Bl+Kl-Wel+Wel-Bl	38,777	
	WEL-BL	Jhb-Bl+Kl-Bl+Wel-Bl	16,103	
Johannesburg - Bloemfontein	JHB-KR	Jhb-Kr+Kr-Bl	12,458	28,3660
	KR-BL	Jhb-Bl+Kr-Bl	15,908	
Johannesburg - Mmabatho	JHB-RUS	Jhb-Rus+Rus-Mm	692,844	710,1280
	RUS-Mm	Jhb-Mm+Rus-Mm	17,284	
Johannesburg - Welkom	JHB-KL	Jhb-Kl+Kl-Wel	149,737	172,4390
	KL-WEL	Jhb-Wel+Kl-Wel	22,702	
Johannesburg - eThekwini	JHB-HAR	Jhb-Har+Har-Et	4,631	402,666
	HAR-ET	Jhb-Et+Har-Et	398,035	
eTthekwini - Witbank	ET-RB	Et-Rb+Rb-Nec+Nec-Wit	14,922	18,0150
	RB-NEC	Et-Nec+Et-Wit+Rb-Nec+Nec-Wit	1,802	
	NEC-WIT	Et-Wit+Rb-Wit+Nec-Wit	1,291	

Source: Own compilation

8.4 Economic Space Development Axes

Having established the potential development corridor zones does not constitute development corridors. Therefore, to determine the potential of the most predominant, prominent and significant development corridors to ultimately determine the nodes with the strongest investment potential within the country, the outcomes from the CCIF are converted into ESDA. Although the outcomes from the CCIF establish

potential development corridor zones based on the linkage between the primary, secondary and intermediate nodes, the ESDA determines, with the use of a potential classification index, the ultimate, integrated and supporting networks of development axes upon which a national spatial framework can be built to guide economic space development. Figure 8.6 illustrates the potential development corridor zones based on the outcomes from the CCIF.

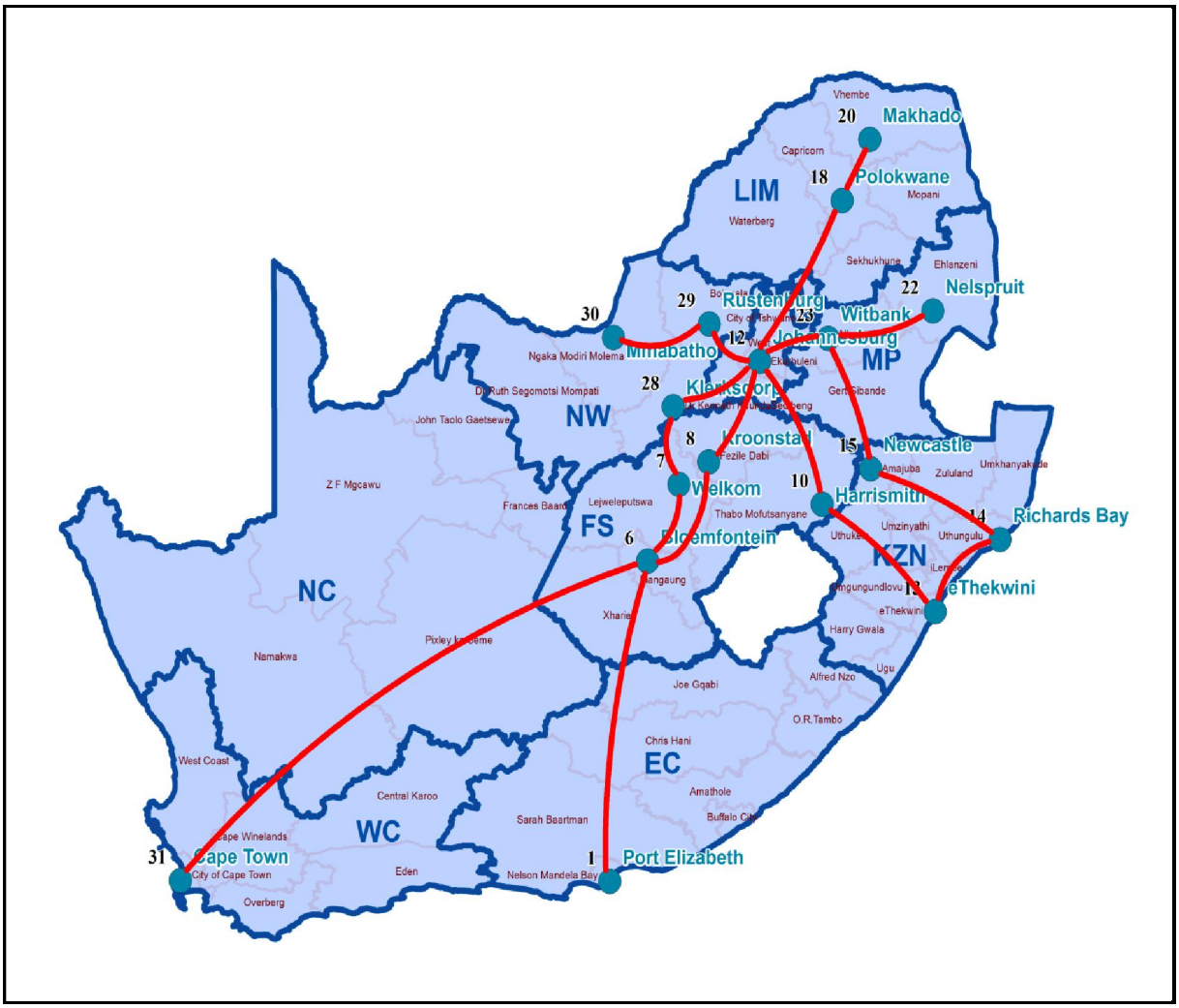
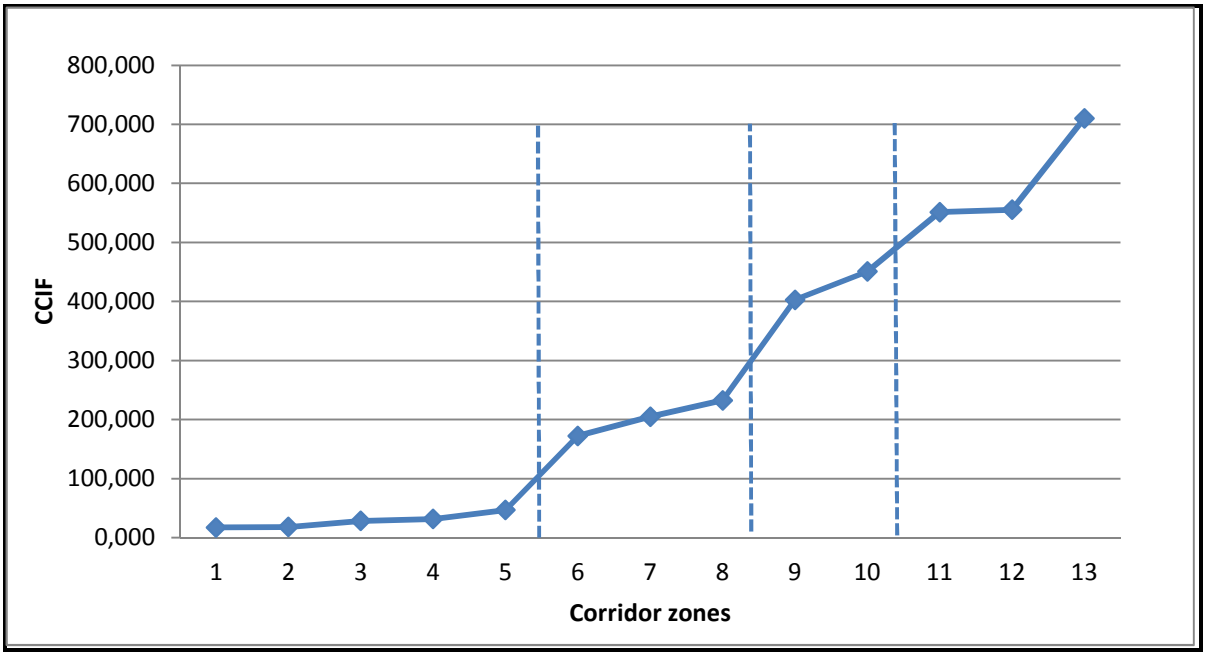


Figure 8-6 Potential development corridor zones within the country

Source: Own compilation

It follows from the CCIF that certain zones are more prominent in strength than others. Therefore, applying an ESDA classification index establishes the following: 1) the degree of integrated and supporting networks of the development corridor zones; and 2) the potential type linked to each development corridor zone. The classification index is based on a line graph (see Graph 8.1) which determines specific breakpoints between the different strengths for each potential development corridor zone.



Graph 8-1 The CCIF of the potential development corridor zones within the country

Source: Own compilation

The breakpoints as illustrated in the graph and also summarised in Table 8.15 are the following:

1) CCIF value above 500 supports a high degree of integrated networks of potential development axes creating predominant corridor development zones
2) CCIF value between 300 and 500 supports a medium to high degree of integrated networks of potential development axes creating prominent corridor development zones
3) CCIF value between 100 and 300 supports a medium degree of integrated networks of potential development axes creating significant corridor development zones
4) CCIF value below 100 supports a low degree of integrated networks of potential development axes creating less significant corridor development zones.

Table 8-15 ESDA classification index

ESDA	Degree of integrated networks	Potential type of DCZ
>500	High	Predominant
500 - 300	Medium to high	Prominent
300 - 100	Medium	Significant
<100	Low	Less significant

Source: Own compilation

Applying the ESDA classification index establishes the degree of integrated networks and the potential corridor development zone within the country (see Table 8.16 and Figures 8.7 and 8.8).

Table 8-16 Degree of integrated networks and the potential type of Development Corridor Zones (DCZs)

	Potential corridor zones	CCIF	Degree of network	Potential DCZ
1	Johannesburg-Polokwane-Makhado	17,354	Low	Less significant
2	eThekwini-Richardsbay-Newcastle-Witbank	18,015	Low	Less significant
3	Johannesburg-Kroonstad-Bloemfontein	28,366	Low	Less significant
4	Johannesburg-Kroonstad-Bloemfontein-Port Elizabeth	31,766	Low	Less significant
5	Johannesburg-Kroonstad-Bloemfontein-Cape Town	46,948	Low	Less significant
6	Johannesburg-Klersdorp-Welkom	172,439	Medium	Significant
7	Johannesburg-Klerksdorp-Welkom-Bloemfontein	204,790	Medium	Significant
8	Johannesburg-Klerksdorp-Welkom-Bloemfontein-Cape Town	232,600	Medium	Significant
9	Johannesburg-Harrismith-eThekwini	402,666	Medium-High	Prominent
10	Johannesburg-Harrismith-eThekwini-Richardsbay	450,833	Medium-High	Prominent
11	Johannesburg-Witbank-Newcastle	551,455	High	Predominant
12	Johannesburg-Witbank-Nelspruit	555,413	High	Predominant
13	Johannesburg-Rustenburg-Mmabatho	710,128	High	Predominant

Source: Own compilation

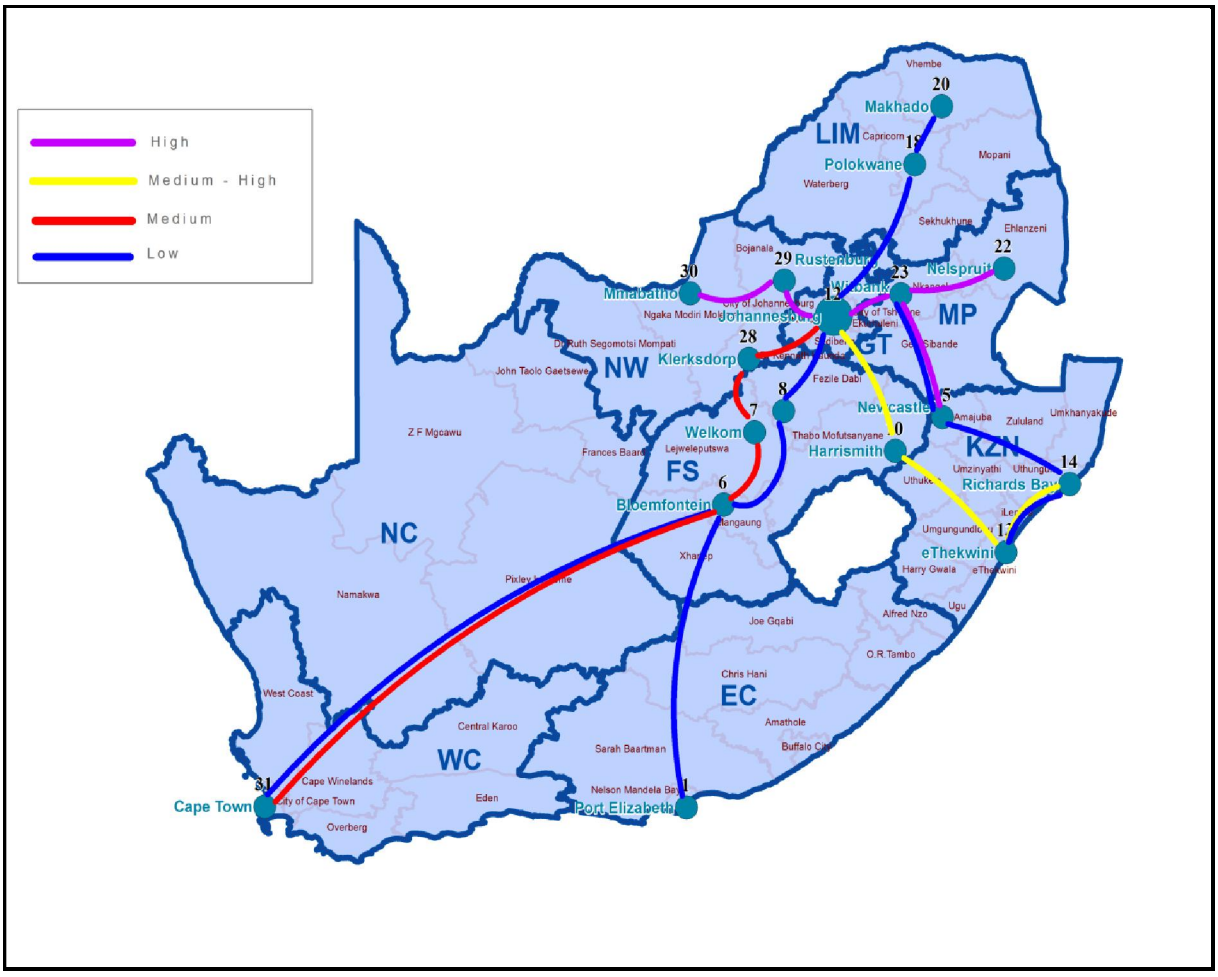


Figure 8-7 Degree of integrated and supporting networks of potential development axes in the country

Source: Own compilation

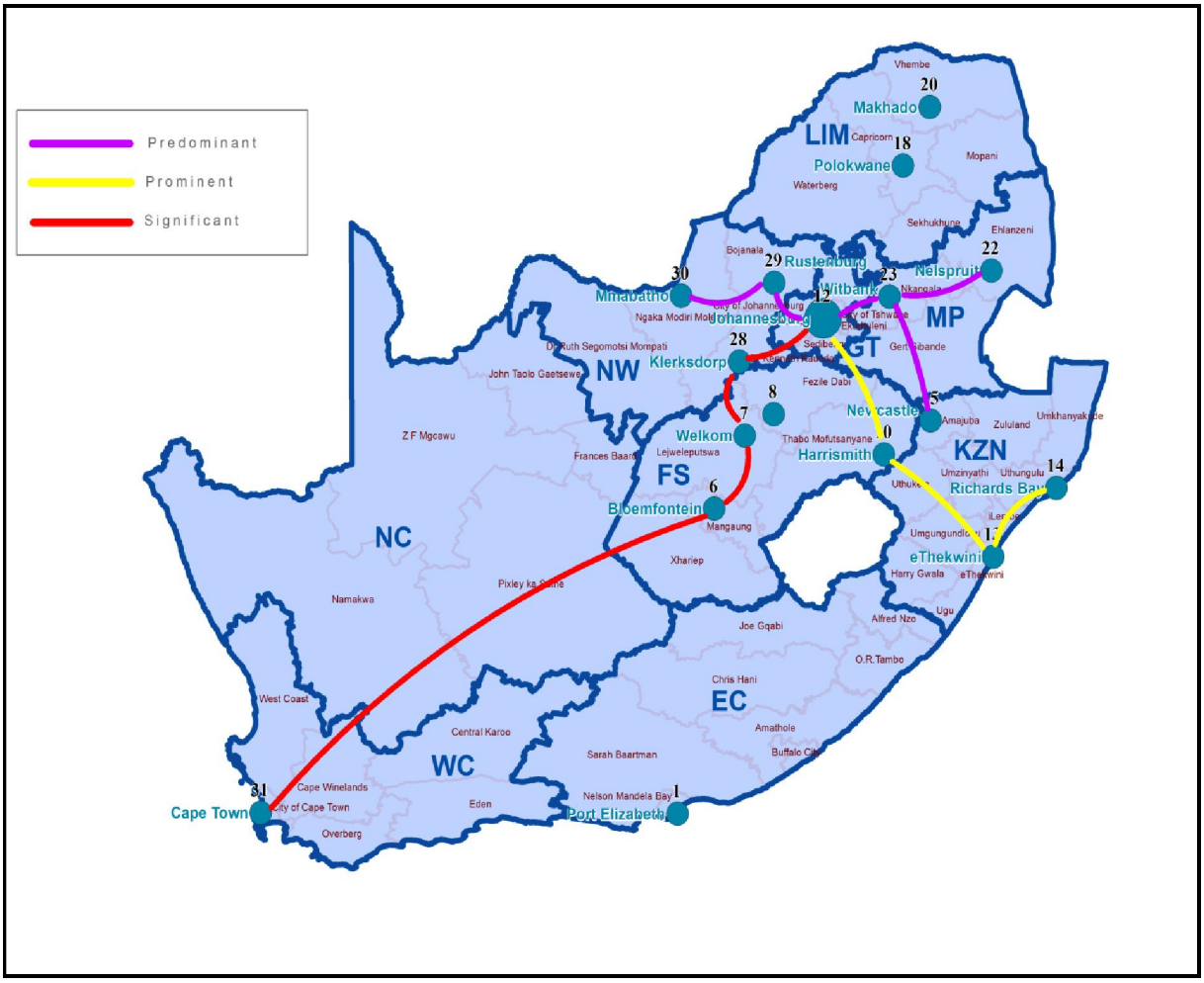


Figure 8-8 Potential type of Corridor Development Zones (CDZ) in the country

Source: Own compilation

Evident from the outcome are the following:

1) The most predominant potential corridor development zones, with an CCIF value of above 500, are:
   a) The Johannesburg to Newcastle (Johannesburg, Witbank and Newcastle) link
   b) The Johannesburg to Nelspruit (Johannesburg, Witbank and Nelspruit) link
   c) The Johannesburg to Mmabatho (Johannesburg, Rustenburg and Mmabatho) link.
2) The most prominent potential corridor development zone, with a CCIF value of between 300 and 500, is the Johannesburg to Richards Bay (Johannesburg, Harrismith, Durban (eThekwini) and Richards Bay) link.
3) The most significant potential corridor development zone, with a CCIF value of between 100 and 300, is the Johannesburg to Cape Town (Johannesburg, Klerksdorp, Welkom, Bloemfontein and Cape Town) link.

The combined economic contributions of these axes are 70 per cent of the national economy. It can be argued that the existence of the Gauteng region as the monocentric powerhouse contributing 36 per cent towards the national economy is considered the main contributing factor towards the establishment of these axes as the strongest potential corridor development zones within the country. This further highlights the spread effect, as explained in Chapter 3 under section 3.5. Furthermore, the outcome also confirms that distance, as suggested by Johnston (1976), Geyer (1986) and Brand *et al*. (2015), does play a determining role in development corridors, considering that, although Port Elizabeth (Nelson Mandela Bay) is categorised as a main urban system (see section 7.2), no potential corridor development zone link could be established.

8.5 Summary and Conclusion

The Spatial Corridor Model (SCM) (illustrated in Diagram 8.1) is based on three key functional output levels: 1) to establish the spatial distribution of the size of economies; 2) to establish the relative strength of economies based on proximity relative to one another; and 3) to establish the integrated and supporting networks of development axes, creating potential corridor development zones, as well as determining the strongest investment nodes. It is clear that the Spatial Corridor Model (SCM) provides a strong theoretical platform upon which an integrated national spatial framework to guide economic space development within the country can be built. This is further confirmed when considering research conducted by Marrian (2001) in the United States of America, Canada and France, suggesting that the area in which corridors are to be developed must show or be dependent on the pre-existence of strong economic growth. In the South African landscape, the existence of strong economic growth is distributed across three main urban systems, namely Gauteng (City of Johannesburg; Tshwane and Ekurhuleni), Cape Town and Durban (eThekwini), contributing 58 per cent towards the national economy. However, it is also clear that the Gauteng economic region dominates economic development, contributing 36 per cent towards the national economy, thereby making it a monocentric powerhouse which ultimately controls economic space development. Furthermore, it is also clear that the Gauteng economic region as a monocentric powerhouse creates a very uneven economic geography, considering that: 1) no potential corridor development zone link with the Port Elizabeth (Nelson Mandela Bay) region (contributing 2,5 per cent towards the national economy) could be established; 2) only a significant corridor development zone link with the Cape Town region (contributing 12 per cent towards the national economy) could be established; 3) only a prominent corridor development zone link with the Durban (eThekwini) region (contributing 10 per cent towards the national economy) could be established. The reason is based on the extent of the distance between these nodes. Lastly, urban centres such as Witbank, Newcastle, Rustenburg, Mmabatho, Nelspruit, Klerksdorp, Welkom, Bloemfontein and Richards Bay, although contributing only 11 per cent towards the national economy, when combined, are standing out as potential growth poles. The reason is based on the extent of the economic advantages exerted by the Gauteng region as a monocentric powerhouse (spread effect). Therefore, in conclusion, it is safe to

argue that development corridors do not create economic strength, but rather channel and focus existing or potential economic development and growth.

Lastly, Chapter 2 (see section 2.3.4) revealed that a good model should be measured against four key characteristics. Assessing the findings against these characteristics, it is safe to argue that the Spatial Corridor Model (SCM) specified as a model of interest is applicable, considering the following:

1) The model was formulated against what constitutes the principles behind economic space development, with specific focus on spatial theories, case studies and the conditions of economic spaces within the South African context.
2) The model was identified against providing a strong theoretical platform upon which an integrated national spatial framework guiding economic space development can be constructed.
3) The model was estimated against three key functional output levels: to establish the spatial distribution of the size of economies; to establish the relative strength of economies based on proximity relative to one another; and to establish the integrated and supporting networks of development axes, creating potential corridor development zones as the main parameters.
4) The model fits the data used for each parameter and the results were interpretable.

In this regard, it is clear that the model will not require any re-specification or modification.

Chapter 9 Conclusion

9.1 Introduction

It seems that over the last two decades, policymakers and academics have adopted a different perspective on the link between space and economic development. According to Lambregts *et al*. (2003), in the past, space was primarily considered an indirect relation to economic development, only functioning as a stage or container facilitating economic interaction. However, in the present view, the actual spatial configuration of economic activities is considered a key factor in economic development. In other words, spatial configuration gives geographical expression to economic space development. One such a platform or geographical expression for the spatial configuration of economic spaces is development corridors, a link between nodes providing efficient access to a higher level of economic opportunities and nodes, which represents the intensity of economic development varying in size and dominance.

Considering that the four key objectives of the research constitute separate chapters, the focus of this chapter will be, firstly, to briefly summarise the main findings of the study and, secondly, to make deductions regarding the contributions the Spatial Corridor Model (SCM) can provide as a theoretical framework towards economic space development.

9.2 Main Findings

The research problem was based on the premise that development corridors as strategic supporting networks to structure economic space development are lacking. What was specifically found lacking was an integrated approach to identifying development corridors that will recognise areas or zones as potential investment opportunities that will promote the structuring of economic space development.

In this regard, the aim of the research was to construct a Spatial Corridor Model (SCM) as a theoretical framework for providing direction in the restructuring of economic spaces. The objectives of the research were: 1) to outline the principles responsible for the creation of economic spaces; 2) to discuss the role of development corridors in the structuring of economic spaces; 3) to investigate case studies as real-life events to contextualise the background for the construction of a Spatial Corridor Model (SCM); and 4) to construct a Spatial Corridor Model (SCM) as a theoretical framework to guide economic space development.

Chapter 3 outlines the main principles responsible for the creation of urban systems as it is seen and understood. Emerging from the principles were the characteristics of central functions (location), which ultimately determine a settlement's position within the hierarchy of lower and higher-order settlements. This is an indication of a settlement's place within the overall economic spaces. In essence, economic

spaces and their modification are found at a variety of scales – a hierarchy of lower and higher-order settlements – which is the result of the cause and effect of market forces. Therefore, economic forces are required for any development or growth, as people and businesses primarily locate in areas where it is economical viable.

Chapter 4 outlines the main principles responsible for the creation of economic spaces as it is understood. Emerging from the principles were the opportunities, creativity and innovation provided by cities to exploit economies of agglomeration. The existence of agglomeration economies is central to the process of how cities grow and develop – resources are used more efficiently to create more freedom in the structuring of economic spaces. This freedom allows for synergy where one or two cities co-operate to form a network of cities. Furthermore, a link to a network affects accessibility, inclusive of trade, finance and markets of cities connected to it. This means that cities, especially a network of cities, are considered the most important spatial level, or key ingredient in the evolution of economic space development.

Chapter 5 discusses the role of development corridors in the structuring of economic spaces. Development corridors represent axes between main or dominant centres which lead to the manifestation of economic space development. The functional relationships – strength of economy – between urban centres or nodes play a more decisive role in the establishment of corridors than the distance. Furthermore, development corridors create opportunities to strengthen functional relationships, thereby increasing the spatial attractiveness of regions or urban centres and creating a myriad of new economic investment opportunities. The main point of development corridors is to propel economic development and growth. Furthermore, development corridors should be considered a concept or system that elevates an area to a certain level of economic development. However, certain conditions should apply, since development corridors are aimed at the following: 1) the development of a node or region from the inside; and 2) linking with other regions or nodes to extend economic development. Therefore, development corridors are a multidimensional, dynamic system which not only strengthens and supports internal development networks, but also changes constantly through the addition of new nodes and links. This means that development corridor approaches to polycentric or multinodal urban areas supporting secondary development areas will gain capacities and advantages on a par with a classical monocentric urban powerhouse. Lastly, the chapter also highlights the most critical elements applicable to what constitutes a development corridor, namely: 1) transportation systems – usually more than one mode of transport; 2) the economic viability of urban centres – high economic cohesiveness; 3) spatial governance – enhanced economic sustainability; 4) private and public initiatives – creating investment opportunities; 5) strong networks – enhancing accessibility and interaction; and 6) strong, viable interactions between urban centres – the degree of strength between urban centres.

Chapters 6 and 7 investigate case studies as real-life events to contextualise the background for the construct of a Spatial Corridor Model (SCM). The key lesson emerging from the international cases is the thinking and consideration that cross-border and transnational infrastructure (road, rail, water and air) would reduce remoteness and being on the periphery, making economic integration more viable. In the South African context, it is clear that the main agglomeration of economies distributed across South Africa resides within the main urban centres, allowing for an interconnected network of cities and functional relationships. Furthermore, South Africa is also comprised of a well-developed infrastructure network, which is essential for promoting economic development, as well as addressing mobility, accessibility and integration. The country has created comprehensive planning frameworks through policies and legislation which were in line with the government's broader spatial development perspectives outlined in the NDP. However, spatial governance does little to bridge the gap between the ideas and principles promoted through the NDP, and the concrete dilemma of spatial planning and economic spaces. Spatial governance shows that the government still has a monopolistic stranglehold on economic growth, thereby labelling economic space development as nebulous and vague.

Chapter 8 describes the construction of a Spatial Corridor Model (SCM) as a theoretical framework to guide economic space development, especially within the South African economic landscape. In the South African context, the spatial configuration of economic activities is very unique, with the Gauteng economic region and, to a lesser extent, the Cape Town and Durban (eThekwini) economic regions, being the economic powerhouses, contributing more than 36 per cent towards the national economy. It is clear that the Gauteng region is comprised of a well-established infrastructure and economic services, and is the main driver of not only economy of Gauteng, but also of the country's economy. This is evident, considering that the predominant, prominent and significant corridors identified through the Spatial Corridor Model (SCM) are very dependent on the Gauteng region being the most dominant economic node within the country, which is supported by three distinct notions. The first notion refers to the benefits created by the Gauteng economic region, when projected towards the economic regions of Mmabatho, Rustenburg, Witbank, Newcastle and Nelspruit, where the combined economic contribution towards the national economy is 6,5 per cent. This creates the opportunity for establishing strong, integrated and supporting networks of development axes. The reason is that the proximity of the economic regions of Rustenburg (secondary node linking Johannesburg with Mmabatho) and Witbank (secondary node linking Johannesburg with Newcastle and Nelspruit), in relation to the Gauteng region, makes these regions strong secondary development nodes supporting the emergence of these axes as predominant corridors. The second notion refers to the benefits created by the Gauteng economic region, when projected towards the regions of Klerksdorp, Welkom and Bloemfontein, where the combined economic contribution towards the national economy is 3,5 per cent. This also creates the opportunity for establishing strong, integrated and supporting networks of development axes. The reason is that the proximity of Klerksdorp and Welkom (secondary and intermediate nodes linking Johannesburg with Bloemfontein), in relation to the Gauteng region, makes them strong development nodes supporting

the emergence of a prominent corridor. Both of the above support the notion of the spread effect explained in Chapter 3. Furthermore, the proximity of the Durban (eThekwini) economic region as a strong primary node contributing more than 10 per cent towards the national economy, overcomes the notion of distance friction, thereby supporting the emergence of a prominent axis between Johannesburg and Durban (eThekwini) stretching through to Richards Bay. The third notion refers to the emergence of significant axes between Johannesburg and Cape Town (Johannesburg/ Klerksdorp/ Welkom/ Bloemfontein/ Cape Town). The reason is based on two considerations: 1) the emergence of a prominent axis between Johannesburg and Bloemfontein (Johannesburg/ Klerksdorp/ Welkom/ Bloemfontein), which allows for reducing distance friction with Cape Town; and 2) Cape Town being classified as a strong primary node contributing more than 12 per cent towards the national economy, which is a contributing factor to overcoming distance friction.

Furthermore, the expectations for certain areas were also not fulfilled regarding the establishment of potential development corridors. The Port Elizabeth (Nelson Mandela Bay) economic region, which is classified as a main urban system (*city region*) was never realised as a possible economic powerhouse or primary node, only contributing 2,5 per cent towards the national economy. Therefore, there is a lack of: 1) a potential development corridor extending from Cape Town through to Durban (eThekwini); and 2) a potential development corridor extending to Johannesburg through Bloemfontein. Even the Gauteng economic region, considered the main driver of the country's economy, was not able to extend its benefits towards the Polokwane and Makhado regions. It seems that the reason why these mentioned areas lack the potential for establishing development corridors is based on the notion that the spatial configuration of these areas is lacking the emergence of strong secondary development nodes, i.e. there is no evidence of the spread effect.

9.3 Contributions

The Spatial Corridor Model (SCM) in itself is probably the most important contribution of the study. Apart from the outcomes and benefits mentioned above, the Spatial Corridor Model (SCM) provides a platform where most of the spatial planning frameworks, considered key planning instruments to achieve spatial transformation and economic development, can be integrated. The Spatial Corridor Model (SCM) provides a mechanism through which spatial transformation and economic development can be interpreted to create investment opportunities, i.e. the outcome from the Spatial Corridor Model (SCM) led to the selection of cities and regions as preferred investment locations to promote economic growth. However, it also seems that spatial visioning processes have reached a stalemate. The problem is compounded by the fact that spatial governance remains far removed from more concrete forms of spatial planning such as development corridors. So, what scope is there for a national spatial framework through which corridor development can be integrated as strategic and supporting networks promoting economic space development?

There are five very distinct elements that the Spatial Corridor Model (SCM) offers as a framework to promote economic space development:

1) It provides a framework for the establishment of potential economic zones.
2) It promotes explicit, focused areas guiding economic space development under the auspices of the following conditions: primary, secondary and intermediate nodes supporting predominant, prominent and significant development axes.
3) It highlights nodes lacking potential development axes.
4) Considering the benefits provided by the framework of primary, secondary and intermediate nodes, it promotes economic advantages for nodes located in close proximity to the connecting predominant, prominent and significant links.
5) It creates economic conditions stimulating intra-regional and cross-border trade opportunities.

9.4 Implications

The importance of development corridors for economic development is traced back as far as 1975 with the National Physical Development Plan initiating a link between metropolitan areas and future growth poles (secondary centres) by means of development axes. Like most developing countries, South Africa is experiencing continuous urbanisation. The UN estimated that 71 per cent of the South African population would live in urban areas by 2030, reaching nearly 80 per cent by 2050. The South African population is growing larger as people migrate into core cities and towns where jobs are created and household incomes are larger. Therefore, urban centres such as *city regions* and *cities* dominate the country's economy, as these centres produce over 80 per cent of the country's economy (see Table 8.2). This notion is further confirmed by Van Huyssteen *et al*. (2014), stating that 12 per cent of South Africans reside in high-density 'rural' settlements and that a mere 14 per cent of the country's population reside further than 20 kilometre away from a formal town or city.

The influence of development corridors to advance economic space development stretches beyond its boundaries, i.e. corridor development needs to be dealt with in an integrated manner and should never be considered in isolation. It is evident that development corridors do not generate significant economic benefits in isolation, but rather as part of an integrated network system. In saying that, it is important to measure the priority areas and investment opportunities as illustrated in section 7.4 of Chapter 7, against the outcomes of the Spatial Corridor Model (SCM) (see Table 9.5 and Figure 9.2): 1) the IDZs and IPPs introduced by national government to sustain economic growth; 2) South Africa's 20-year planning framework, investing in the creation of regional corridors; and 3) the southern African vision to develop economic opportunities to stimulate intra-regional and global trade between African countries. Figure 9.1, the South African model, provides a consolidated summary of the above priority areas and investment opportunities which are key policy initiatives aimed at enhancing and sustaining economic growth for South Africa as well as the southern African countries. A comparison of the South African model (see

Figure 9.1) against the outcomes from the Spatial Corridor Model (SCM) (see Figure 9.2) highlights the gaps that exist between the two models. The outcomes of these gaps and differences are described in more detail in Tables 9.1, 9.2, 9.3 and 9.4 and further summarised in the section (see page 194) following Table 9.5.

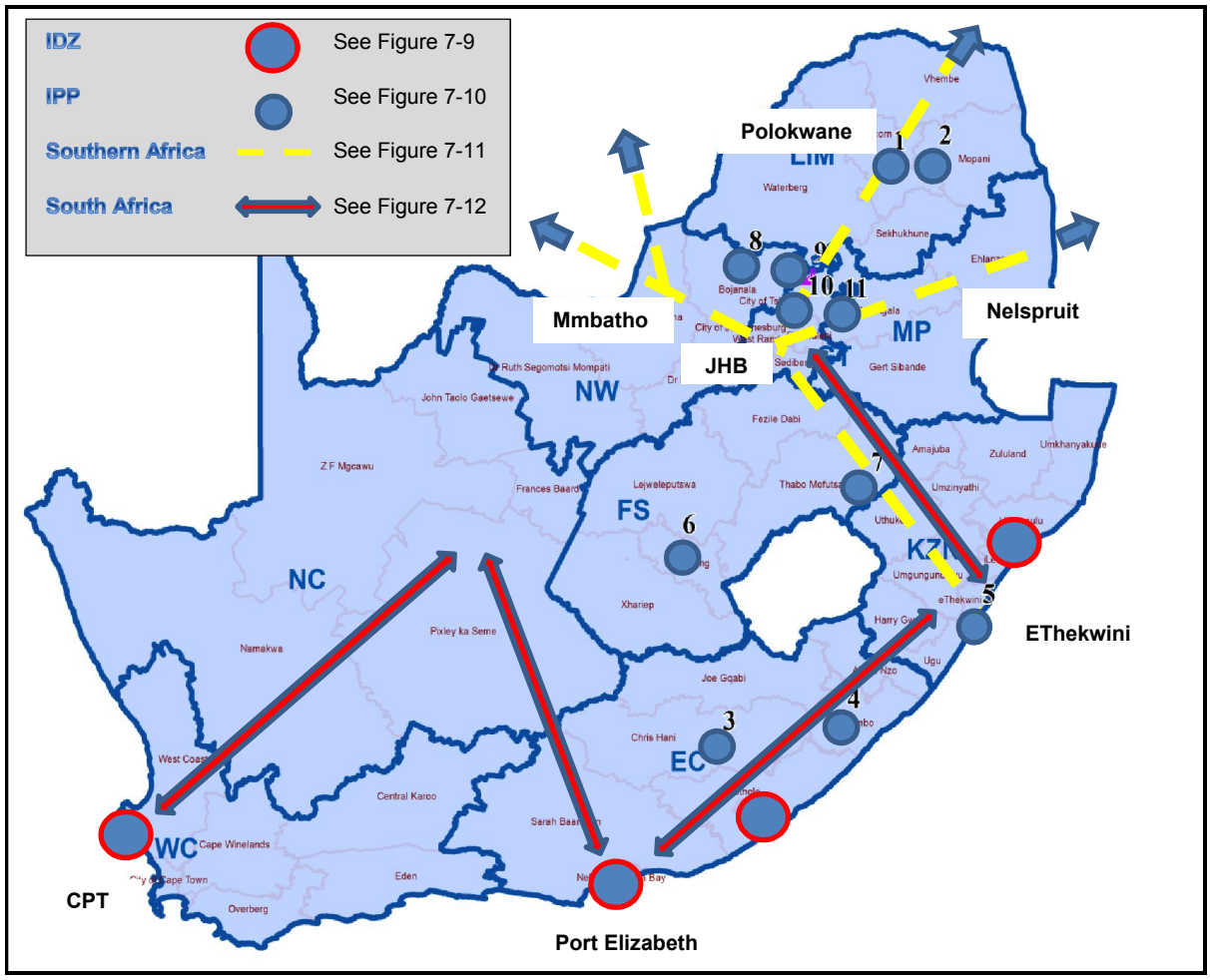


Figure 9-1 Key policy initiatives to enhance economic growth for South Africa as well as the southern African countries

Source: Own compilation

Note: To be read in conjunction with the Figures indicated in the legend

The IDZs and IPPs were introduced as a mechanism to assist in the economic development of regions to support sustained economic growth of the manufacturing sector as a whole. In this regard, four IDZs and various IPPs were established. The measurement of the outcomes is illustrated in Tables 9.1 and 9.2. The findings took into consideration the growth poles as illustrated in Table 8.13.

Table 9-1 The measurement of IDZs against the Spatial Corridor Model (SCM)

	Industrial Development Zones (IDZ)	Place	Province	*SCM axes*
1	Coega	Port Elizabeth	Eastern Cape	*Less significant*
2	Richards Bay	Richards Bay	KwaZulu-Natal	*Prominent*
3	Saldanha Bay	Saldanha Bay	Western Cape	*Less significant*
4	East London	East London	Eastern Cape	*na*
na - no result				

Source: Own compilation

From the analysis of IDZs against the Spatial Corridor Model (SCM), only Richards Bay aligns with the outcome of the Spatial Corridor Model (SCM). The reason is based on the fact that Richards Bay emerged as a viable secondary node with its linkage with Durban (eThekwini) as a viable primary node. Coega and Saldanha Bay came out as less significant because both these IDZs are linked to growth poles that lack potential investment opportunities. East London does not conform to any potential growth pole, rendering a no result.

Table 9-2 The measurement of IPPs against the Spatial Corridor Model (SCM)

	Industrial Parks (IPP)	Place	Province	*SCM axes*
1	Seshego	Polokwane	Limpopo	*Less significant*
2	Nkowankowa	Tzaneen	Limpopo	*na*
3	Queenstown	Queenstown	Eastern Cape	*na*
4	Vulindlela	Mthatha	Eastern Cape	*na*
5	Isithebe	Durban/Richards Bay	KwaZulu-Natal	*Prominent*
6	Botshabelo	Thaba Nchu/Bloemfontein	Free State	*Significant*
7	Phuthaditjhaba	Harrismith	Free State	*Prominent*
8	Bodirelo	Mogwase	North West	*na*
9	Babelegi	Hammanskraal	North West	*Less significant*
10	Garankuwa	Pretoria	Gauteng	*Predominant*
11	Ekandustria	Bronkhorstspruit	Gauteng	*Predominant*
na - no result				

Source: Own compilation

Considering the IPPs, only Isithebe, Botshabelo, Phuthaditjhaba, Garankuwa and Ekandustria align with the outcome of the Spatial Corridor Model (SCM). The reasons are based on the following facts: 1) Isithebe is located on a prominent linkage between Durban (eThekwini) and Richards Bay; 2) Botshabelo is located in the proximity of Bloemfontein, which emerged as a strong, viable secondary node; 3) Phuthaditjhaba is located on a prominent linkage between Johannesburg and Durban (eThekwini); 4) Garankuwa is located in the Gauteng economic region, considered a monocentric powerhouse; and 5) Ekandustria is located on a predominant linkage between Johannesburg and Nelspruit, as well as being located in the proximity of Witbank, which emerged as a strong, viable secondary node. Seshego and

Babelegi came out as less significant because both these IPPs are linked to growth poles that lack potential investment opportunities. Nkowankowa, Queenstown, Vulindlela and Bodirelo do not conform to any growth pole or linkage, rendering a no result.

The South African 20-year planning framework has a specific spatial focus promoting three main development corridors (see section 7.5): 1) the *Durban—Free State—Gauteng corridor* – earmarked to form part of the government's 2050 vision to be the backbone of South Africa's freight transportation network, and vital in facilitating economic growth for the country and the southern African region; 2) the *South-Eastern corridor* – earmarked to improve the industrial and agricultural development and export capacity of the Eastern Cape region, and expanding the region's economic and logistics linkages with the Northern Cape and KwaZulu-Natal regions; and 3) the *Saldanha—Northern Cape corridor* – earmarked to ensure that the Saldanha—Northern Cape region becomes a value-adding centre to economic development. The measurement of the outcomes is illustrated in Table 9.3. The findings took into consideration the degree of integrated networks and potential type of development corridor zones as illustrated in Table 8.16.

Table 9-3 The measurement of South African corridors against the Spatial Corridor Model (SCM)

South African corridors		Corridor axes	*SCM axes*
1	Durban-Free State-Gauteng	Johannesburg-eThekwini	*Predominant*
2	South-East	Northern Cape-Nelson Mandela Bay-eThekwini	*na*
3	Saldanha-Northern Cape	Saldanha Bay-Northern Cape	*Less significant*
na - no result			

Source: Own compilation

Of the South African corridors only the *Durban—Free State—Gauteng corridor* stands out as a good investment opportunity to create integrated regional corridors for fostering economic space development. The reason is related to the emergence of the Durban (eThekwini) and Gauteng economic regions as dominant primary nodes. The *Saldanha - Northern Cape corridor* appeared less significant because the corridor is not linked to the emergence of any potential node. The *South-East corridor* initiative does not conform to any potential node, rendering a no result.

The notion of a phenomenon such as the Gauteng economic region fosters possibilities of creating transnational or cross-border trade opportunities between major economic agglomerations of different countries. The southern African vision, under the auspices of the UN and the ADB, supported by the regional integration programmes established under COMESA, the EAC and SADC to develop economic opportunities to stimulate intra-regional and global trade between African countries, identified nine main development corridors, of which three relate directly to South Africa (see section 7.5): 1) the *Trans—*

Kalahari corridor – extending from Walvis Bay to Botswana, from Botswana to Johannesburg and linking up with the Maputo corridor; 2) the *North—South corridor* – traversing eight countries and covering two existing corridors, i.e. the Durban and Dar es Salaam corridors, linking the port of Durban in southern Africa to the East African port of Dar es Salaam; and 3) the *Maputo corridor* – linking the Gauteng region in South Africa with the Maputo region in Mozambique. The measurement of the outcomes is illustrated in Table 9.4. The findings took into consideration the degree of integrated networks and potential types of development corridor zones, as illustrated in Table 8.16, as well as the locality of the closest cross-border link.

Table 9-4 The measurement of southern African corridors against the Spatial Corridor Model (SCM)

	Southern African corridors	Corridor axes	Nodal cross-border link	*SCM axes*
1	Walvis Bay	Mmabatho-Johannesburg-Nelspruit	Nelspruit	*Predominant*
2	Maputo	Johannesburg-Nelpruit	Nelspruit	*Predominant*
3	North-South	eThekwini-Johannesburg-Mmabatho	Mmabatho	*Predominant*
4	North-South	eThekwini-Johannesburg-Polokwane	Polokwane	*Less significant*
Best scenario considering the potential type at nodal cross-boder link				

Source: Own compilation

Measuring of the southern African corridors against the Spatial Corridor Model (SCM), the *Trans—Kalahari* and the *Maputo corridor* initiatives are supported as economic investment opportunities to stimulate cross-border or intra-regional trade. The reasons are related to the alignment of these corridors to the 1) Johannesburg—Mmabatho (Johannesburg, Rustenburg, Mmabatho) and the 2) Johannesburg—Nelspruit (Johannesburg, Witbank, Nelspruit) axes as the most predominant corridors. Furthermore, it is also evident that the *North—South corridor* initiative is partially supported, only linking with the Johannesburg—Mmabatho (Johannesburg, Rustenburg, Mmabatho) axes. Unfortunately, there are no potential axes extending from Johannesburg to Polokwane. The reason is related to the lack of the emergence of a viable secondary node.

As discussed in section 7.2, in the South African landscape, strong economic growth is distributed across five main urban systems: Gauteng (City of Johannesburg, Tshwane and Ekurhuleni); Cape Town; Durban (eThekwini); and Port Elizabeth (Nelson Mandela Bay), contributing more than 60 per cent towards the national economy. Emerging from the main urban system is the fact that close to 58 per cent of all economic activities; 40 per cent of the total population count; and 50 per cent of the total economically active population are located within the Johannesburg, Durban (eThekwini) and Cape Town economic regions. Furthermore, also emerging is the fact that close to 36 per cent of all economic activities; 25 per cent of the total population count and close to 30 per cent of the total economically active population are located in the Johannesburg economic region alone. This provides evidence that the three regions are considered the main powerhouses controlling most of the country's economic

activities and, secondly, it also places emphasis on the emergence of the Johannesburg economic region as a very strong monocentric powerhouse which ultimately dominates the country's economic growth and development. This is also confirmed when considering the NIP predictions on urbanisation and projected economic growth highlighting Johannesburg, Durban (eThekwini) and Cape Town as the mostly likely areas where people will migrate to, and where economic growth will take place (see section 7.4.2).

Furthermore, the strong economic advantages presented by the Johannesburg region as a primary node allowed for the emergence of Witbank, Newcastle, Rustenburg, Mmabatho, Nelspruit, Klerksdorp, Welkom and Bloemfontein as viable secondary nodes. The same applies to the Durban (eThekwini) region as a primary node, allowing Harrismith and Richards Bay to emerge as viable secondary nodes; however, distance friction prevented the Port Elizabeth (Nelson Mandela Bay) region from emerging as a viable primary or secondary node. Lastly, poor economic correlation with the Johannesburg region prevented Kroonstad, Polokwane and Makhado from emerging as viable secondary nodes.

Table 9.5 below contextualises the above discussions and provides a summary of: 1) the outcomes derived from the Spatial Corridor Model (SCM), with reference to a) the growth poles (nodes); b) the node type; c) the degree of integrated networks for each node; d) the potential CDZ for each node; and e) the investment potential for each node; 2) NIP predictions in relation to a) increased urbanisation; and b) projected economic growth; and 3) the IDZ, IPP, South African corridor and southern African corridor initiatives linked to each node as discussed above.

Table 96: Investment nodes

SDM					Predictions		Initiatives			
Node	Type	Degree	Potential	Investment	Increase industrialisation	Projected economic growth	IDZ	IPP	South African corridor initiatives	Southern African corridor initiatives
Johannesburg	Primary	High	Predominant	Yes	Johannesburg	Johannesburg	na	Eskom Strategic Grain Value	Durban Free State Gauteng	Maputo/North South/Trans Kalahari
Cape Town	Primary	Medium	Significant	Yes	Cape Town	Cape Town	na	na	na	na
eThekwini	Primary	Medium High	Prominent	Yes	eThekwini	eThekwini	na	na	Durban Free State Gauteng	North South
Port Elizabeth	Secondary	Low	Less Significant	No	Port Elizabeth	na	Coega	na	South East	na
Bloemfontein	Secondary	Medium	Significant	Yes	Bloemfontein	na	na	Eskom Kolo	na	na
Polokwane	Secondary	Low	Less Significant	No	na	na	na	Sasol Mega	na	North South
Makhado	International	Low	Less Significant	No	na	na	na	na	na	North South
Kroonstad	International	Low	Less Significant	No	na	na	na	na	na	na
Harrismith	International	Medium High	Prominent	Yes	na	na	na	Phuthaditjhaba	Durban Free State Gauteng	North South
Richards Bay	Secondary	Medium High	Prominent	Yes	na	na	Richards Bay	na	na	na
Witbank	Secondary	High	Predominant	Yes	na	na	na	Ekandustria	na	Maputo
Newcastle	International	High	Predominant	Yes	na	na	na	na	na	na
Vaalkom	International	Medium	Significant	Yes	na	na	na	na	na	na
Rustenburg	Secondary	High	Predominant	Yes	na	na	na	na	na	North South/Trans Kalahari
Mafikeng	International	High	Predominant	Yes	na	na	na	na	na	North South/Trans Kalahari
Klerksdorp	Secondary	Medium	Significant	Yes	na	na	na	na	na	na
Saldanha Bay	International	Low	Less Significant	No	na	na	Saldanha Bay	na	Saldanha Northern Cape	na
Nelspruit	Secondary	High	Predominant	Yes	na	na	na	na	na	Maputo

Degree and potential – best scenario considering the outcome on 1) degree of integrated network and 2) potential type of development corridor zones

Investment – 1) Degree – medium and above and 2) Potential – significant and above

Source: Own compilation

To visually contextualise the outcomes of the findings as illustrated in Table 9.5, each outcome is categorised and illustrated in Figure 9.2 as follows:

1) Nodes emerging as preferred locations for creating investment opportunities to enhance economic growth, are:
   a) Johannesburg, Cape Town and Durban (eThekwini) as dominant primary nodes and economic powerhouses
   b) Witbank, Newcastle, Rustenburg, Mmabatho, Nelspruit, Klerksdorp, Welkom, Bloemfontein, Harrismith and Richards Bay as dominant secondary nodes. The Newcastle region can open up a linkage with the Richards Bay region to the south and vice versa.
2) Nodes emerging as lacking potential for creating investment opportunities, are:
   a) Port Elizabeth (Nelson Mandela Bay) as a primary node – to open up linkages with the Cape Town region to the south; the Durban (eThekwini) region to the east and the Bloemfontein region to the north. The investment could enhance the opportunity to create a coastal corridor extending between the Cape Town and Durban (eThekwini) regions
   b) Polokwane and Makhado as secondary nodes – to open up a linkage to the Gauteng economic region to the south, as well as to enhance regional integration to the north, supporting the North-South corridor initiative.
3) Nodes emerging as preferred locations for creating investment opportunities to enhance and support cross-border integration, are:
   a) Polokwane and Makhado, as mentioned, enhancing regional integration to the north and supporting the North-South corridor initiative
   b) Mmabatho enhancing regional integration to the north and west, and supporting the Trans-Kalahari, North-South and Maputo corridors initiative
   c) Nelspruit enhancing regional integration to the east and supporting the Maputo corridor initiative.

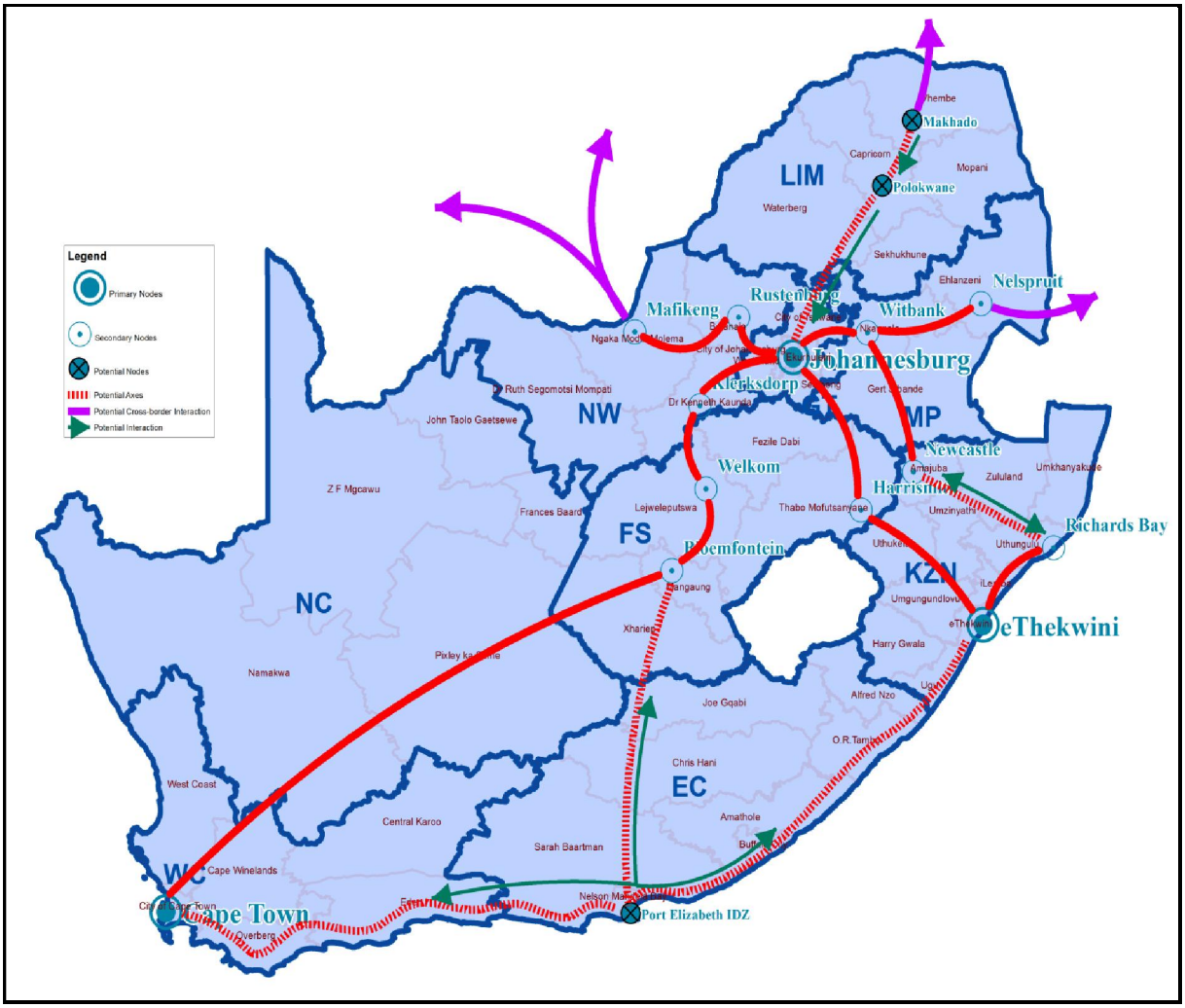


Figure 9-2 Investment opportunities Source: Own compilation

Furthermore, it is also clear that the development of the primary nodes of Johannesburg, Cape Town and Durban (eThekwini) – powerhouses, megacities and/or world cities – is beyond major impacts by a single development corridor. Instead, these kinds of powerhouses have amassed production, transformation and access to market functions comparable to those of the combined activities of the several other cities and nodes linked to potential corridors. Moreover, this kind of urban conglomeration is considered the capital of the country, thereby further concentrating resources and functions away from the other urban areas. This allows for development nodes and/or cities, as illustrated and discussed above, to be categorised as follows:

1) Powerhouses, megacities and/or world cities that are mostly immune from the impact of corridor development – Johannesburg, Cape Town and Durban (eThekwini)
2) Cities in established corridors – Mmabatho, Rustenburg, Witbank, Newcastle and Nelspruit
3) Cities in emerging corridors – Cape Town, Bloemfontein, Welkom, Klerksdorp, Harrismith, Durban (eThekwini) and Richards Bay
4) Cities in proposed corridors – Port Elizabeth (Nelson Mandela Bay), Polokwane and Makhado.

Considering the findings from the Spatial Corridor Model (SCM), a possible question is, “What will be the difference in the development of the cities and nodes linked to potential or successful corridors, as opposed to those cities and nodes that do not or cannot fully benefit from corridors?” While corridors may not prove to be the only deciding factor, it is clear that participation in the development of corridors is a desirable option not to be dismissed. One can anticipate that the evolution of development corridors will result in, on the one hand, the strengthening of cities and nodes linked to the benefits exerted by corridors and, on the other hand, strong intra-national and inter-regional economic integration. Therefore, development corridors do not contain, as such, the resolution of the challenges presented by different development agendas; development corridors are created to seek development opportunities.

Therefore, South Africa faces a variety of actions to be taken, in relation to the establishment of sustainable cities and nodes through the creation of development corridors. The agenda to be replicated at the national and regional level in an interactive and integrated manner should include the following considerations, as illustrated in Diagram 9.1:

1) Recognise the economic position of cities and nodes in the country, relative to one another
2) Identify the economic strength impacts of cities and nodes, relative to one another
3) Analyse the present situation, and the desirable outcome of the feasibility and limitations of cities and nodes as development corridors and investment potential
4) Define policies and strategic action alternatives to advise government on development corridors, and potential investment opportunities to strengthen free market trade to promote sustainable economic development
5) Organise infrastructure and resources for implementation.

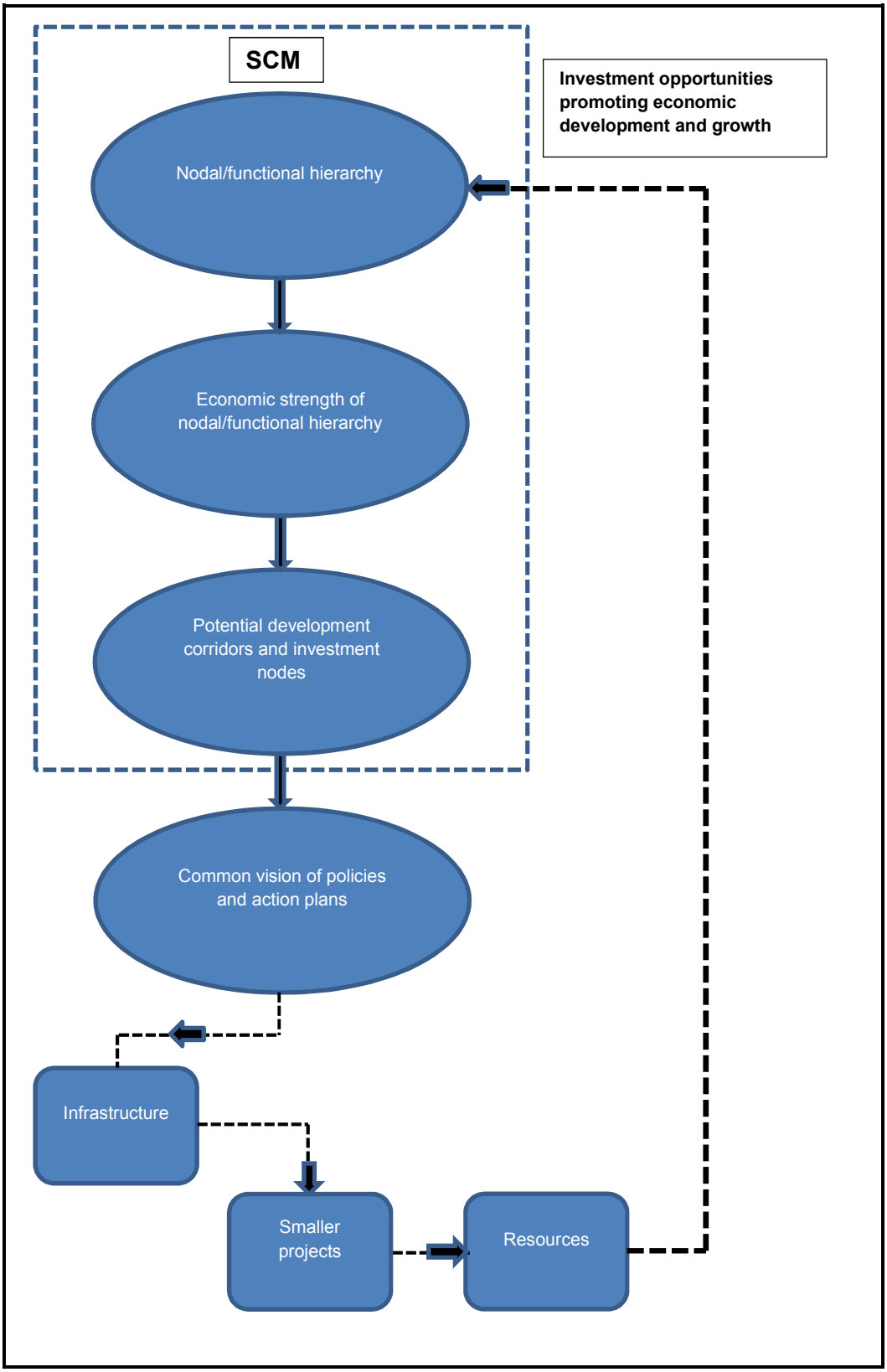


Diagram 9-1 South African development corridor concept approach

Source: Own compilation

9.5 Summary and Conclusion

It can be concluded that the Spatial Corridor Model (SCM) does provide the opportunity to spatially transform economic space development. This is based on the fact that cities and regions are identified as preferred locations to promote economic space development. Furthermore, it is also clear that current spatial planning policies and legislation do not provide for an integrated system whereby ideas such as the Spatial Corridor Model (SCM) can be promoted as an instrument to transform economic space development. The key question would be how to introduce the Spatial Corridor Model (SCM) as a strategic planning framework that would promote and enhance economic space development? The answer starts with the NDP highlighting the notion that interconnected interventions such as economic solutions are needed to manage economic transformation. It is, therefore, clear that the Spatial Corridor Model (SCM) provides such a solution, whereby preferred locations for investment opportunities are identified to guide economic development. However, emerging from the study are two very important considerations: 1) the government has a monopolistic stranglehold on economic growth, which must be broken or softened; and 2) the implication that factors to increase preferred locations appeal as destinations for investment to promote inclusive growth, lies with cities, i.e. drawing local authorities into the playing field.

Previously, according to Daniels (1994), the primary role of local authorities was one of control and regulations, and they were not considered appropriate agencies to effectively rebuild economic spaces. The traditional role of local authorities was to administer and deliver services within a context of gradual change. However, recognised through the NDP, NIP, IPAD, NATMAP, IUDF and SPLUMA, cities are increasingly being acknowledged as the appropriate level for more effective and efficient interventions to transform spatial legacies, and influence economic space development. This places substantial responsibility on the local and regional level to effectively plan, manage and implement strategies and programmes. Furthermore, although the obligation to participate in spatial planning is placed on all three spheres of government, it is the local sphere where the biggest impact will be experienced. However, an important requirement will be the alignment of strategies between the different spheres of government. National government should, through the Spatial Corridor Model (SCM), develop a realistic spatial perspective on long-term settlement patterns and investment opportunities which will transform economic space development, while provincial and local governments should identify opportunities that align with their circumstances, i.e., local authorities should respond pro-actively and innovatively to rapid change; they should realise their economic potential as a consumer, producer, landowner or investor to develop and promote economy growth.

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