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xploring the meaning of functional and response diversity
in the urban context



by Albert Ferreira

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EXPLORING THE MEANING OF FUNCTIONAL AND RESPONSE DIVERSITY IN THE URBAN CONTEXT

by

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**Dissertation submitted in fulfilment of the requirements for the degree Master of Town and Regional Planning in the Faculty of
Engineering, Built Environment and Information Technology, University of Pretoria**

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DECLARATION OF ORIGINALITY

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ABSTRACT

In the context of a progressively transforming, unpredictable and interconnected global environment, with city development and management subject to constant forces of change, resilience presents the potential ability to adapt to fluctuating and altering circumstances. The resilience of conterminous social and ecological systems, which includes cities, is crucial for the preservation, sustaining and survival of human-dominated domains. The principal challenge associated with the application of resilience concepts is constituted by resilience comprising an emergent behaviour of complex adaptive systems, which renders its direct measurement and appraisal extremely problematic and virtually unrealisable. However, it is possible to operationalise resilience, through the measurement of its constituent facets, such as diversity.

The purpose of this research project is to elucidate and investigate the manner by which an ecological resilience concept, viz. functional and response diversity could be extrapolated into an urban socio-ecological system. A case study, focused on the Central Business District of the City of Tshwane is utilised, to investigate the role of diversity in the resilience of the retail sector. Functional diversity refers to the structural heterogeneity created by similar entities exhibiting the comparable, identical or corresponding functional traits and attributes (i.e. performing the same function). Response diversity refers to the multitude of reactions a specific entity considers and implements towards disruptions, perturbations or threats. The characteristics of each unique entity (retailer) and groups of entities (types of retailers) determine their relative exposure to risk and vulnerability, in consort with their capacity to respond to variances, external influences or disruptions in their environment. These two components of functional and response diversity, when combined, in succession, render more dynamic, forceful functions, with less vulnerability, and thus are more resilient to change.

The findings initially evidence the existence of a functional group, characterised by a range of vast diversity. Concomitantly, the diversity within, and among, the case study retailer assemblage supports the establishment of a resilient functional group. The case study area creates 'an environment or habitat', within which a unique set of retailers are able to coexist, and which affects the overall resilience of the sector. Finally, the investigative results indicate that all retailers, to a varying extent, can contribute to functional and response redundancy and resilience. Diversity is multi-layered and contextual, and resilience is constituted from the layers of diversity, engendered by the functional group's structural and response diversity.

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LIST OF ABBREVIATIONS

BRT – Bus Rapid Transit

CAS – Complex Adaptive System

CBD – Central Business District

FRD – Functional and Response Diversity

FRDF – Functional and Response Diversity Framework

GFDRR - The Global Facility for Disaster Reduction and Recovery

GIS – Geographic Information System

IDP – Integrated Development Plan

SACN – South African Cities Network

SAPS – South African Police Service

SDF – Spatial Development Framework

SES – Social-ecological System

SPULMA – Spatial Planning and Land Use Management Act

UN- Habitat – United Nations Human Settlements Programme

UNESCAP - United Nations Economic and Social Commission for Asia and the Pacific

UNISDR – United Nations Office for Disaster Risk Reduction

Chapter 1 Introduction



This chapter introduces the research project, delineating the overall importance of cities and their resilience. Subsequently, there is a review and explication of the general background and rationale; the research questions and objectives; the case study location characteristics, concluding with the discourse structure and chapter outline.

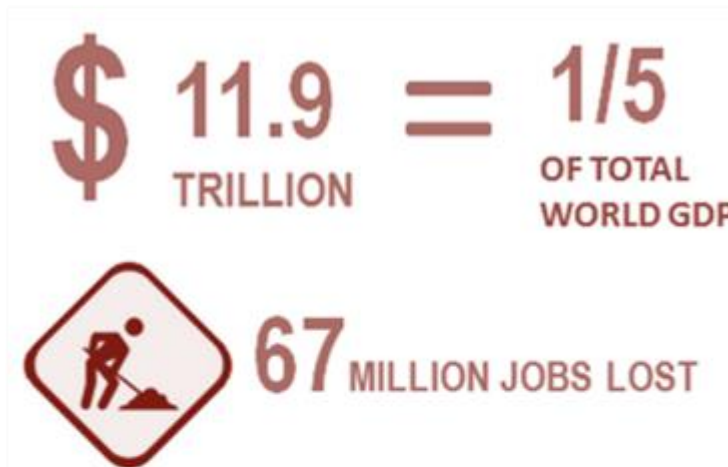
1. Introduction

Globally, there has been an upsurge in urban development over the previous century, with a shift from rural areas to urban centres, predominantly in developing nations. Notably, there are greater numbers of people residing in towns and cities than in outlying regions, which has never occurred before, denoting a significant juncture in our collective human history (McKinsey & Company, 2011, p. v). Cities provide both opportunities and constraints for their inhabitants and the general environment. These opportunities encompass an extensive range of potentialities, incorporating, *inter alia*, agglomeration advantages (McKinsey & Company, 2011); centres of innovation; social exchanges or interactions (Ernstson, *et al.*, 2010); the possibility of sustainable development; economic growth; and employment (Resilience Alliance, 2007). Conversely, the disadvantages, deleterious elements and constraints are inclusive of poverty; inequality; pollution; overcrowding and disease (Resilience Alliance, 2007).

Recently and throughout history a great number of natural disasters, social disturbances and economic turbulence have created the world that is increasingly volatile and unpredictable (Resilience Alliance, 2007). This denotes that cities and urban centres have to respond, demonstrating and developing resilience to these events and their ramifications, concurrently achieving their developmental goals in a sustainable manner.

This dissertation comprises an element of a larger research effort, “*Resiliency Strategies for Aspirational African Cities*”, which has as the primary objective of developing solutions (or the capacity to develop solutions) ensuring the continuing resilience of cities, grounded in the understanding of the identified factors determining resilience. As there is limited existing knowledge and experience, as essential facet of the extended research endeavour constitutes the distinguishing of a set of concepts developed to enhance the resilience of cities as a social-ecological system. The largest amount of research in this field has focused on human influence on ecosystems and mankind within the ecosystems. This dissertation will explore the application of resilience theory (or

Economic cost of the 2008 global financial crisis:



Global impacts of natural disasters since 1992:

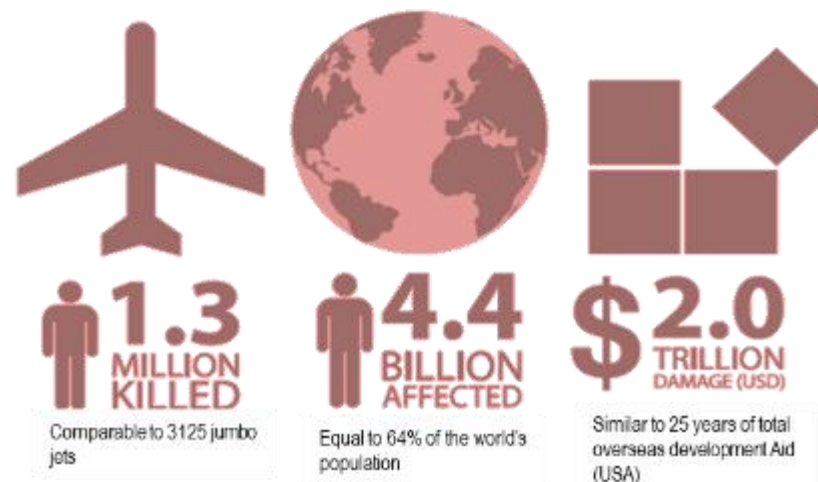


Figure 1: Global cost of financial and natural disasters (UN-MDG, 2013 & IMF, 2009)

operationalisation) on the city (urban social-ecological system). This study, in conjunction with the larger, expanded project, is intended to observe and portray the realities within cities as accurately, precisely and accurately as possible, endeavouring to expose the actualities and unique character of the City of Tshwane.

This chapter furnishes the overall background and rationale for this investigation, with specific deliberation towards operationalising resilience in the urban context. The principal considerations guiding the research effort, comprising the overall research aim, questions and objectives, are

explained. Subsequently, there is a description of the research scope and general case study orientation. Finally, the chapter layout structure and orientation are demarcated.

1.1 Background and Rationale

To understand the concept of urban resilience, it is necessary to consider the intension and conceptuality of resilience. The concept of resilience can be described as:

- 1.) The amount of change or stress a system can endure while retaining control of its function and structure;
- 2.) The system's capacity for adaptation when responding to pressures; and
- 3.) The system's ability for self-organisation in the pursuit of long-term objectives (UN-ESCAP, 2008, p. 6; Walker & Salt, 2006, p. 4).

This Masters dissertation is a component of the expanded endeavour to explore resiliency concepts in the urban context.

There has been a recent trend and progression in academic and city management domains to exploit and utilise urban resilience and its imports or components, with several organisations pursuing the diverse and varied goals associated therewith. These entities include the UN Human Settlements Programme (UN-Habitat); UN Office for Disaster Risk Reduction (UNISDR); Inter-American Development Bank; the Rockefeller Foundation and its 100 Resilient Cities Centennial Challenge; the C40 Cities Climate Leadership Group; and ICLEI Local Governments for Sustainability in addition to the World Bank; and the Global Facility for Disaster Reduction and Recovery (GFDRR).

Urban resilience has directly influenced decision making through policy. In South Africa, resilience has gained importance through its inclusion within the Spatial Planning and Land Use Management Act, 16 of 2013 (SPLUMA). This Act guides, prescribes and governs spatial planning activities within South Africa, identifying spatial resilience as one of its principles (Republic of South Africa, 2013). Consequently, various policies

have been impacted and influenced by this legislation to include resilience as a major consideration. Additionally, the South African Cities Network (SACN) has introduced resilience as a focal component in its annual review of the state of major urban centres in the Country (SACN, 2011). Furthermore, within the municipal sphere, several city administrators have adopted resilience as an element of planning frameworks and future plans. The City of Tshwane has incorporated resilience as a principal factor in its Tshwane 2055 Future Vision for the City (City of Tshwane, 2012).

Beyond the assumption that it is good to be resilient, little agreement exists about what is meant by urban resilience (Davoudi, 2012). The term is often also confused or conflated with other concepts such as sustainability. The application of resilience theory in the urban context is unclear, with little guidance on how to assess resilience, how to measure resilience and finally how resilience can be achieved in the urban context. Among the urban policies that incorporate resilience, little or no reference is made to resilience theory or the application of resilience in the urban context. Porter and Davoudi (2012, p.329) contend that *“based on a simple frequency count, resilience appears to be fast replacing sustainability as the buzzword of the moment. It may well follow a similar fate and become a hollow concept for planning; an empty signifier which can be filled to justify almost any ends”*.

The empirical analysis of resiliency concepts is currently much fewer than the conceptual exploration of concepts specifically in the human or urban context (Leslie & McCabe, 2013; Cumming et al., 2005 & Bennett et al., 2005). The functional and viable application of resilience concepts poses practical challenges, inclusive of no specific designation, imprecise definitions and/or a lack of clarity pertaining to the meaning of the term; its development and measurement variables; and rendering resilience concepts observable (Davidson, et al., 2013).

Multiple authors (Leslie & McCabe, 2013, Sammie and Martin, 2010, Swanstrom, 2008) have endeavoured to commence the process of operationalising resilience in human or urban contexts. This employs an

approach which takes into account its foundations and derivations, investigating the application of resilience in its original ecological context (where it has been previously applied) and transferring concepts to urban circumstances. This transfers resilience from the ‘conceptual’ to the ‘practical’ realm.

Operationalisation denotes the procedures involved with defining and measuring variables (Babbie, 2014). The process is designed to define ‘fuzzy concepts’ (for example, resilience), permitting the researcher to measure these empirically. Essentially, it is the course of action undertaken in rendering an indistinct or ambiguous construct measurable. This procedure constitutes the fundamental, traditional model of science, which comprises theory, operationalisation and observation. The initial component is theory, defined as the process of deriving a hypothesis from a postulate. The subsequent stage constitutes the operationalisation of the hypothesis, wherein assorted variables are defined and measured. The final step, which succeeds the development of an appropriate conjectural understanding of a topic (theory) and the formulation of a strategy for measuring the variables in actuality (operationalisation), is the process of observing the variables in the real world or field. This combined, sequential procedure forms the basis of multiple scientific explorations. Within the context of applying resilience to the urban context, there is a necessity for the operationalisation of the concept to apply the theory within the urban context. As stated, this dissertation forms part of a larger project, in an endeavour to effectuate the operationalisation of resilience.

The principal focus of this discourse is to explore the application or ‘operationalisation’ of resilience theory within the urban context. It must be noted that this dissertation does not attempt to fully operationalise resilience within the urban context i.e. creating indicators to measure variables. The study is intended to engender the initial commencement and implementation of operationalising resilience concepts by exploring whether these constructs, as previously applied in ecology, are observable within the urban context; it would be inconceivable and unrealistic to attempt the

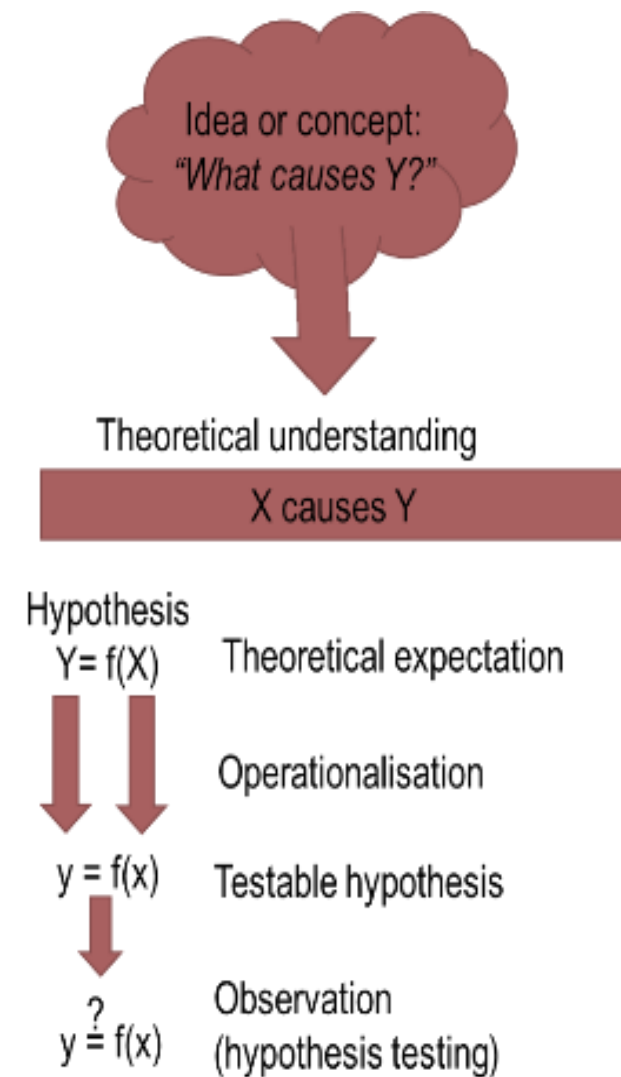


Figure 2: The traditional model of scientific inquiry (adapted from Babbie, 2014)

measurement of resilience without establishing that these resilience concepts are observable or present therein. Davidson *et al.* (2013: p.4) assert that operationalising resilience entails *“making resilience concepts useful and useable beyond their theoretical context”*. This dissertation is designed to function as a foundation and initiation point for further empirical investigations.

The marked differences and variances between ecological and social systems render the transfer and exploration of environmental nomenclature within a societal context a difficult endeavour. The primary differential factor comprises the human element, which has increasingly evolved into the principal force driving global ecosystem change. Human-dominated systems, for instance cities, function as ecosystems with various components, which are dynamic, intricate and complex in their interactions (Complex Adaptive Systems). This dissertation attempts to translate ecological terms, transferring them to the social system, in an endeavour to explore the key determinants of urban resilience. The basis of this study is constituted by the conversion of concepts between diverse 'knowledge fields' and contexts. This is deemed potentially viable, as despite their variances, human systems (cities) and ecological systems do have similar characteristics. This is due to the complex and integrated nature of systems, which are explained by the concepts of Complex Adaptive Systems (CAS) and Social-Ecological Systems (SES) (Cilliers, 1998; Resilience Alliance, 2010, p. 6 & Simonsen, 2007). CAS evinces resilience as one of its emergent characteristics.

Cities are systems of intricate, composite and cross-scale interacting entities and role players (Resilience Alliance, 2010, p. 5). Furthermore, cities may be perceived as social-ecological systems, composed of human-dominated systems linked to, and reliant on, ecological systems. Cities are required to adapt to change and fluctuations in order to retain their critical functions (resilience), paramount for human survival, concurrently ensuring that the planet's environmental integrity is not compromised. This facilitates continued human existence and sustains resources. The functions critical for human survival are interrelated, correlated and connected to those of ecosystems; thus cannot be separated, creating an integrated social-ecological system (Resilience Alliance, 2006).

Resilience is seen as an incipient or emergent behaviour of complex social-ecological systems, rendering its measurement difficult and virtually impossible (Berkes, Colding, & Folke, 2003) However, it is viable to

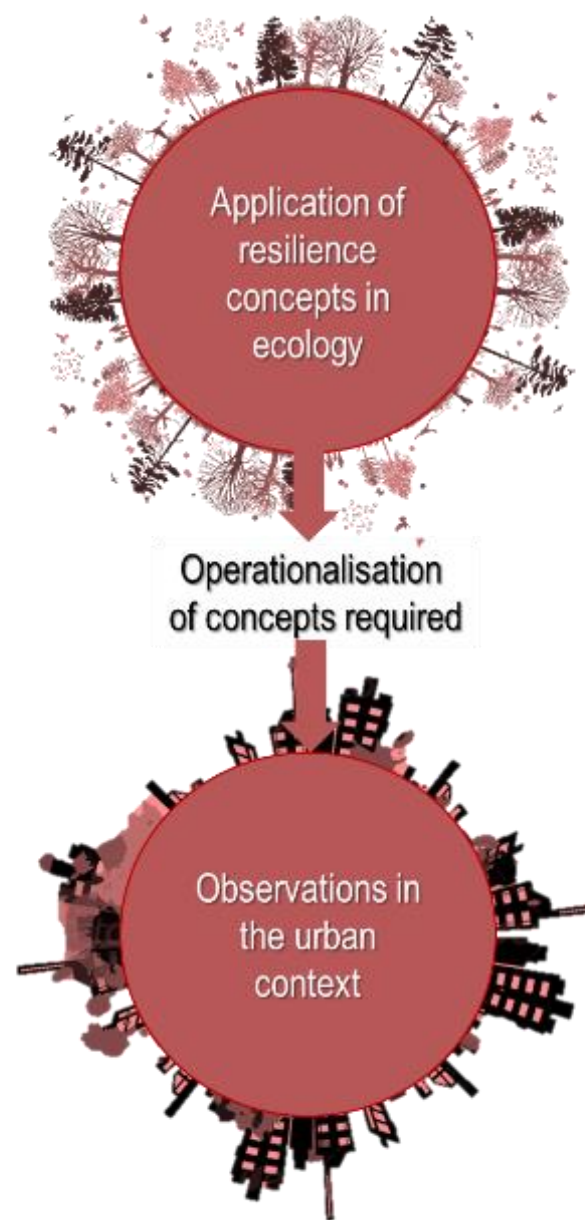


Figure 3: Operationalising resilience from the ecological to urban context

measure the constituents of resilience in social-ecological systems by utilising proxies, for instance diversity (Robertson & Berkes, 2010).

Diversity is a crucial factor in the functioning of cities; the economy; as well as eco-, human- and social-ecological systems. Diversity is deemed one of the most significant and essential elements in determining the resilience of ecosystems (Walker & Salt, 2006), in conjunction with comprising an integral component of cities in general (Jacobs, 1969; Talen, 2006). Moreover, diversity extends to play a central role in the resilience of

complex systems. At its core, diversity constitutes an attribute of a system (complex systems) "whose elements may be apportioned into categories", which directly associates its value to various fields from ecology to economics (Leonard & Jones, 1989). Diversity can "provide insurance, improve productivity, spur innovation, enhance robustness, produce collective knowledge, and sustain further diversity" (Page, 2011, p. 4). This dissertation considers the concept of diversity as a bridge between the ecological sciences and urban planning and management, to operationalise resilience within the urban context and to develop a common taxonomy between these fields. The research utilises the ecological resilience concept of functional and response diversity to operationalise resilience within the urban context.

The concept of functional response diversity is critical in continued ecosystem functioning, as it provides buffers or multiple redundancies to ecosystem transformations. Functional and response diversity relates, initially, to a number of species with similar functional traits, for example a group of herbivores composing the functional group (Mori, *et al.*, 2012). The latter component denotes how these species respond to ecosystem change or disturbance. Each species has different characteristics and operates at varied scales, connoting that they may respond differently to ecosystem changes. The amalgamation of these two components create stronger, more dynamic ecosystem functions, rendering less vulnerability and more resilience to changes therein (Elmqvist *et al.*, 2003). The application of functional and response diversity has only recently been adopted in the study of 'coupled human-natural systems' or social-ecological systems (Leslie & McCabe, 2013).

Functional and response diversity has been established as a central factor in the continued resilience of an ecosystem, with this logic is transferred to an urban context, through the exploitation of urban specific concepts and functions. Due to the constraints engendered by the limited scope and time available for this research endeavour, a specific function has been selected and the responses to that function reviewed, as an initiation point for the

exploration of the urban context. The chosen function is that of retail or the trading of goods and services. Retail activity is a critical function in the urban context.

From the commencement of mankind connecting in groups, to build settlements for security, assistance and collaboration, commerce began. The market place or trading place constitutes a fundamental and essential element of the city and, in certain instances, is the principal actuating factor for the establishment thereof (Adnew et al, 1984 & Morris, 1994). Retail activities comprise a significant facet of urban functionality and are crucial for the economic health of a city in the consumer-orientated economy of cities (Amin , 2003). This study proposes that retail diversity or diversification can be seen as a set of multiple redundancies or 'fail-safes' for the provision of commercial activities in a city or neighbourhood. This extends from merely considering and enumerating retail entities, essentially, describing and expounding the dynamic interactions and characteristics that provide redundancy and adaptive capacity to a functional group. Multiple layers of diversity within the retail spectrum are established as critical to the continued functionality of the sector. In an urban context, this creates less vulnerable activities, employment and increased supply options within the city. This multiple redundancy logic may engender a more sustainable and resilient retail functional array within an urban centre.

In order to apply to the concept of functional and response diversity, the formulation of a framework was required, to transfer the concept from the ecological to the urban context. The framework facilitates the exploration of the function of retail activities in the case study area and consists of three primary components. The first component involves describing and categorising the functional retail group, inclusive of the dynamic interactions between the group and the urban environment. This component classifies the assorted retailers into various discrete groups, elucidated from a variety of characteristics within and across retailer sub-groups. These attributes can be considered the multiple layers of diversity that exist within the retail

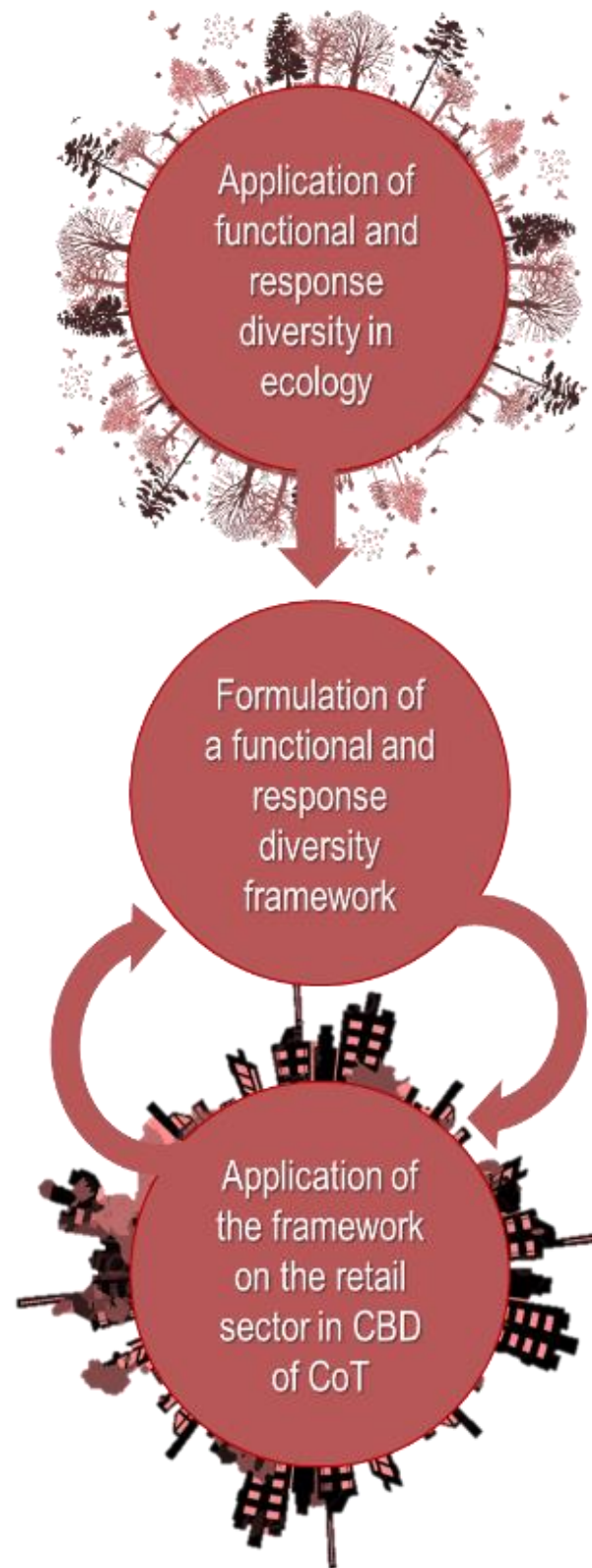


Figure 4: Research process

Functional and response diversity is explored in the ecological context, where after a framework is created through an iterative process of exploring the meaning of the concept in the urban environment.

functional group, directly affecting the adaptive capacity of retailers. Subsequent to the establishment of the functional group dynamics, characteristics and adaptive capacity, the response diversity component can be investigated. As the various retailers operate on disparate scales and possess distinct, contrasting characteristics, they contend with dissimilar threats, and thus, due to their adaptive capacities, respond differently thereto. This variety in responses to change is referred to as response diversity (Elmqvist, et al., 2003).

The study investigates the structural, geographic and response diversity of the retail sector, encompassing the entire retail sector, considering the range from large multi-national supermarket chains to the informal traders operating within the study area. The investigative focus comprised comprehensively assessing not only the superficial differences among traders, but additionally, the various 'forms of difference' or diversity within certain retail groups and throughout the sector. These layers of diversity include, *inter alia*, their physical manifestations; organisational structures; locations; and their interface with public space. The motivation for taking the entire sector into account arises from the links and interactions among retailers this reveals. The research methods utilised to distinguish diversity comprised semi-structured interviews, employing a proportional convenience sampling model; GIS mapping of retailers; and field observations in the Tshwane Central Business District (CBD), undertaken in June 2013.

1.2 Research Question and Objectives

The principal objectives of the study constitute operationalising resilience within the urban context, in consort with establishing the meaning of functional and response diversity within this contextual milieu. The primary research question is:

“What is the role of diversity in creating a resilient retail functional group in the City of Tshwane?”

This denotes that the study is required to expose the nature and elements of the relationship between diversity and resilience in the urban context. This entails distinguishing whether this relationship exists or can be observed. If so, the study would be able to extrapolate and apply functional and response diversity to the urban context.

In order to answer the principal research question, certain objectives were identified and are explicated in the ensuing section.

1.2.1 Research Objectives

- To construct a framework for investigating functional response diversity in the urban functional context.

As it states, the purpose of this objective is to formulate a framework to scrutinise functional and response diversity in the urban context. Initially, this entails a detailed contemplation of the principal concepts utilised in constructing the framework. The application of the framework is facilitated by the translation and employment of the ecological resiliency concept to the urban context. This extrapolation is possible because cities are complex adaptive and social-ecological systems. Functional and response diversity are both deemed essential to ensure the sustained operation and by extension resilience of the functional group.

- To explore the functional and response diversity of the selected function within the identified study area.

The functional and response diversity framework will guide the empirical study of the functional and response diversity of the retail sector in the case study area. This structure should first identify the retail functional group, considering location, composition and revealing the layers of diversity that are present in therein. Thereafter, the framework will differentiate the response diversity to specific, distinct threats with which the retail sector contends.

1.2.2 Research Scope and Study Delineation

In order to conduct concise, accurate and meaningful research, it is deemed necessary to clearly demarcate the assumptions and the limits (delineation) of the research project. This research project comprises several assumptions, constituting elements of the theoretical foundation for this project. At the fore, is resilience, which, for this study, specifically refers to resilience as a concept adopted from the ecological field (social-ecological or evolutionary resilience). Resilience is construed as the capacity of systems to adapt to changing circumstances (Walker, et al., 2004). This is contrary to, and negates, the engineering or mechanistic view of resilience, which accentuates the ability of systems to rebound and return to the previous status quo.

The second assumption comprises cities being both complex adaptive and social-ecological systems, meaning that they exhibit complex behaviour that can be unpredictable and that they are intrinsically linked to ecological systems (forming social-ecological systems). Resilience is determined by various intricate and composite factors, which can substitute or constitute proxies for resilience itself. This study utilises diversity (functional and response diversity) as a proxy for resilience. There are, however, a multitude of existing alternate proxies that will not be specifically considered for this study, inclusive of modularity and systemic connections.

The study centres on the provision of goods and services or the retail sector as crucial to the urban social-ecological system. Although other functions are acknowledged, the retail sector serves as a commencement point to investigate the aforementioned ecological concepts within the urban context. The study exclusively involves the observable retail entities, in order to facilitate assessing the meaning of the ecological concepts on the sector. This excludes internet or on-line retailers, as well as individual bartering. Although these types of retail activity are significant and impact the overall sector, they are by nature difficult to observe, and thus, excluded. The study focuses on a single, comprehensive and detailed 'snap-shot' of the functional and response diversity of the case study area's retail sector.

Multiple or long-term evaluations are considered valuable, however these require this initial exploration, to assess whether the investigation of these concepts is viable.

1.3 Case Study Area and Context

The intent of this study is to test and explore resiliency concepts in the urban context. As previously mentioned, the principal focus constitutes the extrapolated application of the ecological diversity concept of functional response diversity to the urban function of retail activity. In order to apply this concept within the urban context and to the function of retail, it is necessary to select appropriate case studies. This is undertaken in an endeavour to operationalise resiliency concepts, to essentially proceed from a conceptual and theoretical discourse to practical application. As a component of the larger research project, *Resiliency Strategies for Aspiring African Cities*, the City of Tshwane (Capital of South Africa) was selected for the investigation of the application of resiliency concepts, forming the backdrop of this study. In the endeavour to explore these concepts, considering the general limitations of time and the scope of the dissertation, a single case study area was chosen. Furthermore, the selected locale is representative of a principal retail investment landscape in South Africa.

The City of Tshwane forms part of a greater urban area, within the province of Gauteng, including the larger Gauteng city region. This region consists of the City of Tshwane; City of Johannesburg; City of Ekurhuleni; as well as additional districts, constituting the economic powerhouse of South Africa and, by extension, Africa. Within the Municipal borders of the City of Tshwane, a single case study area has been chosen, considered representative of a variety of economic and political characteristics, not only of Tshwane, but of all South African cities. The case study area, selected for the application of the diversity framework, is the inner-city or CBD of Tshwane.

The CBD is identified by the Integrated Development Plan (IDP) of the City of Tshwane as the Capital Core, exhibiting the major economic activities.

The CBD has the longest history of development, including retail activity and, due to its locational advantages, continues to be a retail hub of the city. The explorative nature of the study, in conjunction with certain alternate constraints compelled the selection of a distinct focus area of 800mX800m, in which diversity framework would be applied.

The study area has specific relevance for this investigation, as the locale showcases major retail activities, comprising both formal and informal retailers, representative of the larger South African retail landscape (Bureau of Market Research, 2004; City of Tshwane, 2005). The subsequent section will describe the research layout and chapter delineation of this research dissertation.

1.4 Research Layout and Chapter Breakdown

Chapter 2 Theoretical Underpinning

This section contributes to the theoretical foundation required for the translation of resiliency concepts from the ecological to the urban context. The chapter initiates with a description of cities as a both CAS and SES, explaining that cities share similar traits and characteristics with other complex systems. These characteristics include the emergent behaviour of resilience, which contends that diversity (specifically functional and response diversity) is one of the determinants of resilience and can be investigated to determine this resilience in a CAS or SES.

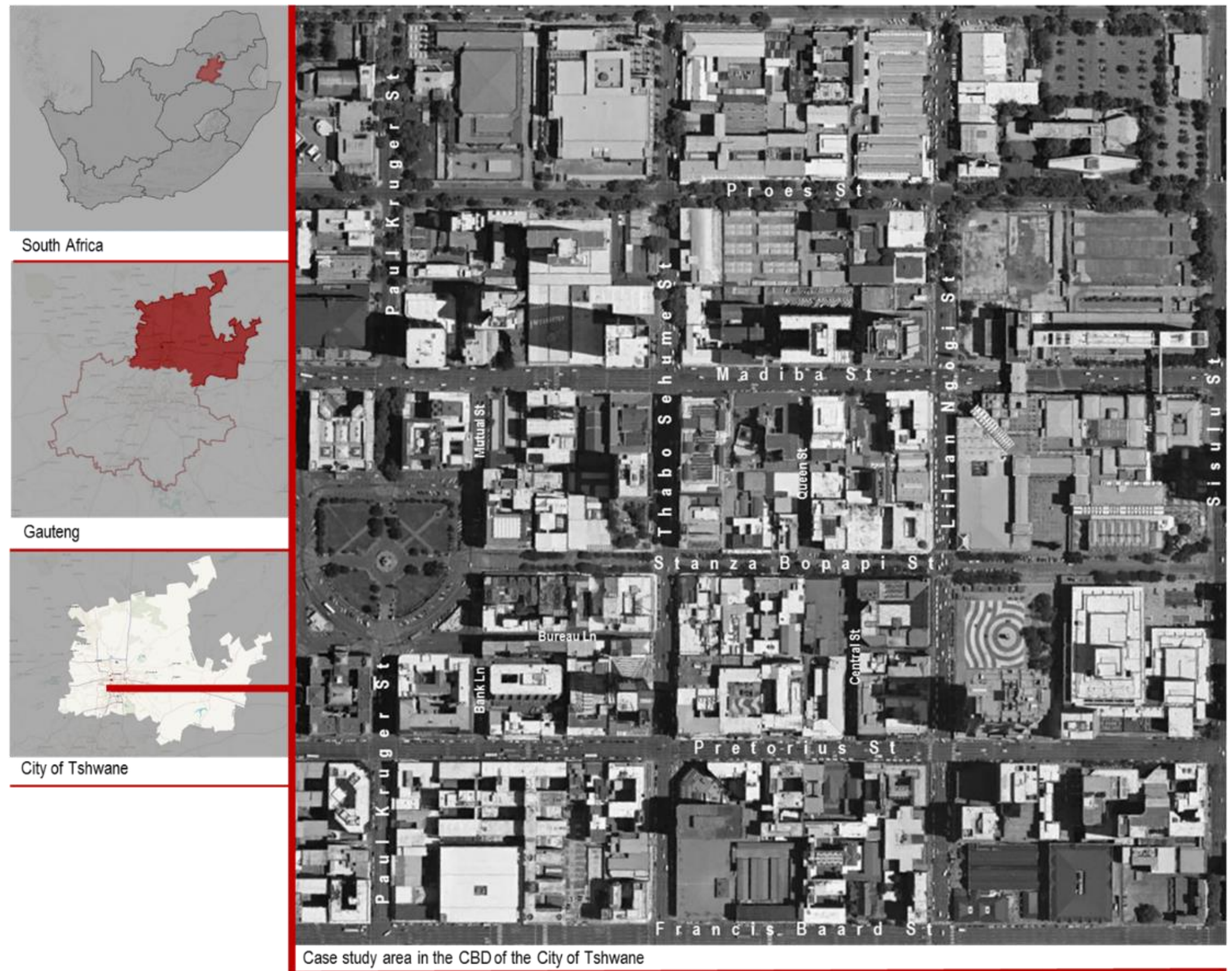


Figure 5: Case study area contextualization

Chapter 3: Towards a Framework to Investigate Functional and Response Diversity

The chapter outlines the application of functional and response diversity through a diversity framework. This includes an explanation of all the relevant components of the framework, as it relates to the urban context. The chapter concludes by delineating and showcasing the diversity framework utilised to operationalise resilience within the urban context.

Chapter 4 Methodological and Analysis Approach

This division of the discourse expounds the research design, methodologies as well as the analysis approaches exploited in the investigation. The chapter describes the process of applying the framework in the case study area as well as expounding the methods used in the data collection process.

Chapter 5 Findings: Application of the FRD framework

The findings of the case study area are separated into three sections viz. area contextualisation; description of the retail functional group (structural and geographical diversity including the “layers of diversity”); and the response diversity, associated with each discrete grouping of retailers in the case study area.

Chapter 6 Conclusion

The chapter concludes the investigation, discussing how the project has resolved and achieved the overall research questions and objectives. Subsequently, the discourse elucidates and explicates the assorted and varied lessons effectuated by the application of resilience on the urban context. The chapter concludes by demarcating the research limitations and advocates future research endeavours.

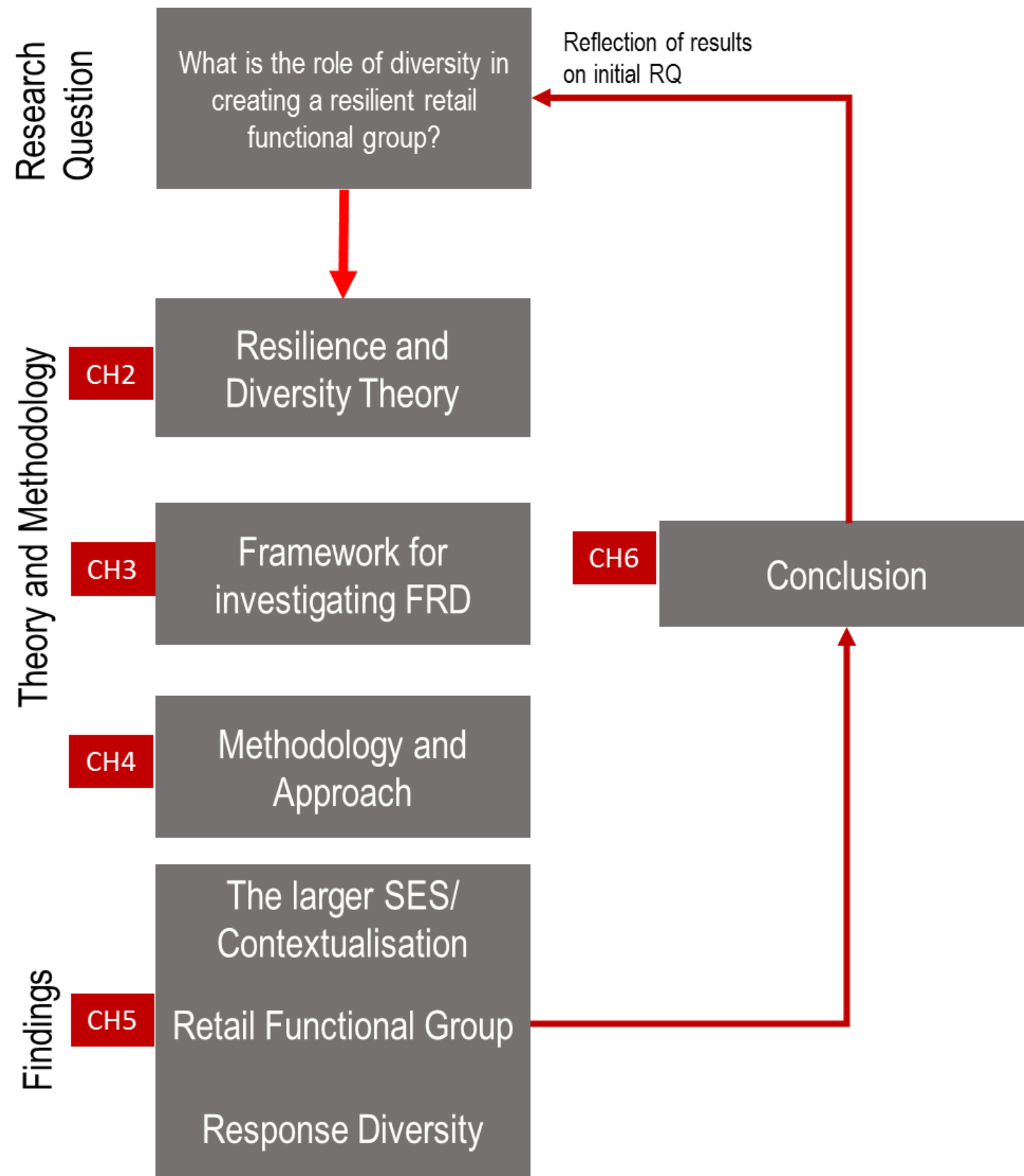


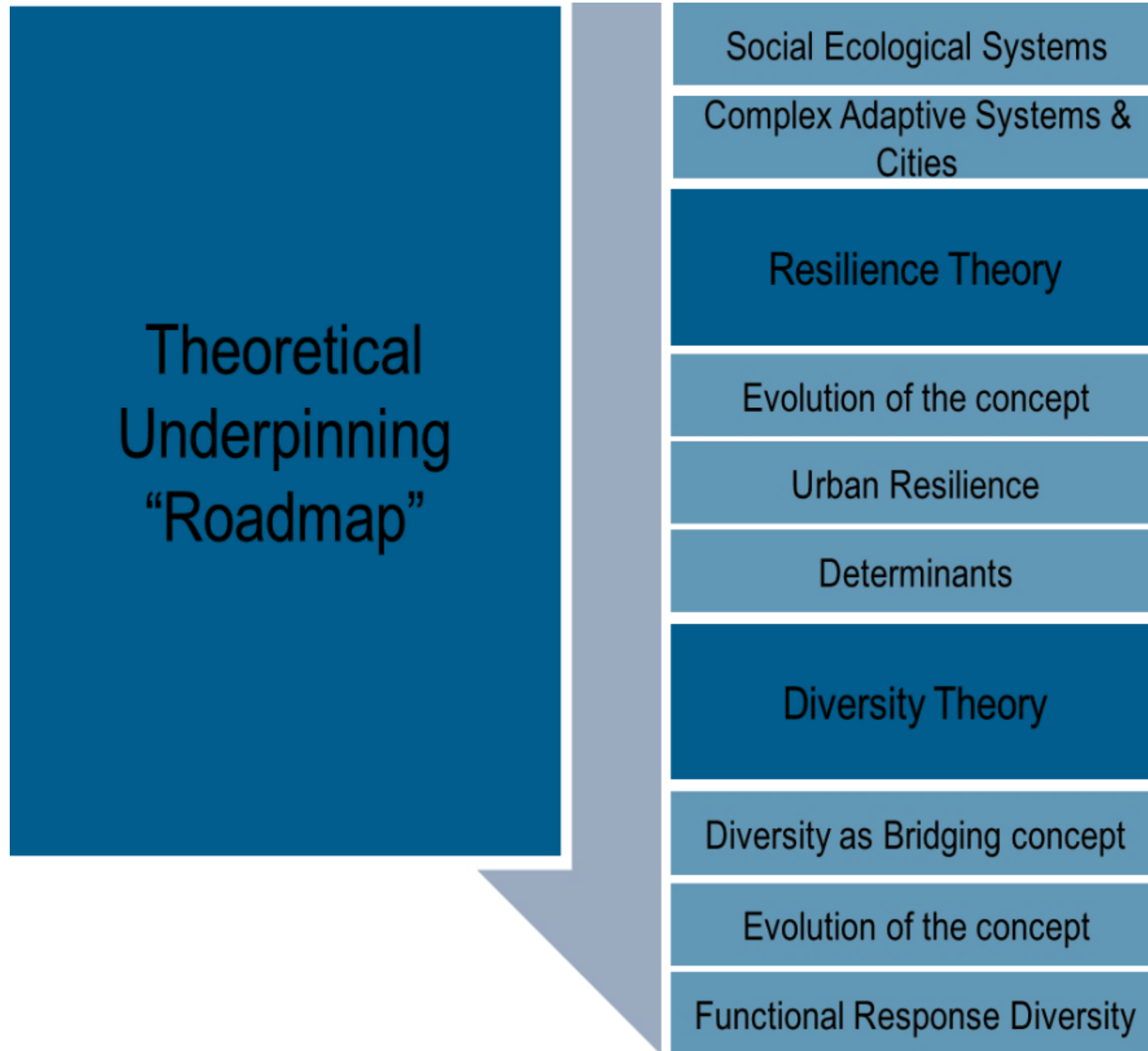
Figure 6: Chapter layout

Chapter 2

Theoretical Underpinning



The chapter presents the theoretical foundation that is required for the translation of resiliency concepts from ecology to the urban context. The chapter starts with describing cities as a both CAS and SES and that cities share similar traits and characteristics with other complex systems. These characteristics include the emergent behaviour of resilience, and this chapter argues that diversity (specifically functional and response diversity) is one of the determinants of resilience and can be investigated to determine said resilience of a CAS or SES.



2.1 Introduction

Several fields have shown a progressive trend towards contemplating and evaluating the theoretical concept of resilience, including psychology (Conrad, 1999, Smit & Wandel, 2006); ecology (Walker & Salt, 2006; Resilience Alliance, 2007); engineering (Holling, 1996); and planning and development theory (Ward, 2007; Burton, et al., 2013). However, there is no generally accepted consensus, definition or characterisation *vis-à-vis* the concept and its applications, denoting that the establishment of a precise understanding is requisite, to justify and effectively extrapolate ecological resilience concepts to the urban context. This chapter contributes components of the theoretical background related to the topic(s), with specific focus to the research endeavours of this master's dissertation.

The basis of this study rests on the translation of concepts among assorted fields of knowledge and contexts. This is enabled by human systems (cities) and ecological systems exhibiting similar characteristics (Ahern, 2011; Batty, 2007; Batty, 2008; Du Plessis, 2008; Resilience Alliance, 2007; Sanders, 2008). These similarities arise through the complex and integrated nature of systems, as captured by the concepts of CAS and SES, with resilience an emergent behaviour of CAS. This division of the discourse follows the evolution of the concept of resilience, from its initial employment in engineering studies through to its most recent, contemporary application in social-ecological systems. Subsequently, taking this into account, there is a clarification of the determinants of resilience, specifically considering diversity. The urban and social functions (specifically retail activities) which occur in cities will be presented as critical and intrinsic to the resilience of the overall urban social-ecological system. Functional and response diversity is introduced as a crucial determinant of ecological system resilience, with the concept, made transferable by the characteristics of SES and CAS, to urban or human-dominated systems.

Figure 7: Chapter 2 layout

2.2 Complex Adaptive Systems, Social-Ecological Systems and Cities

Fundamental to exposing resilience and its connection to cities is the requirement of panoptic comprehension of complex adaptive and social-ecological systems, in consort with the manner by which resilience comprises a central attribute thereof. This section defines the constitution of a complex adaptive system, towards constructing a foundation by which to investigate the relationship among urban systems, CAS and SES. Systems exist in all aspects of our lives, inclusive of, *inter alia*, ecological; social; cultural; and economic systems. A system may be defined as “a set of elements or parts that is coherently organised and interconnected in a pattern or structure that produces a characteristic set of behaviours, often classified as its ‘function’ or ‘purpose’” (Meadows, 2008, p. 188). Furthermore, systems can be categorised in a variety of distinct types, with a diverse range, which includes simple; complicated; complex adaptive; and social-ecological systems. The principal, fundamental determination in assigning these system classifications comprises the degree of complexity and intricacy present, if at all. The ensuing section initially explains the inherent characteristics of CAS, succeeded by an exposition of SES, concluding by elaborating how cities can be considered as both.

2.2.1 Complex Adaptive Systems

To effectively describe and elaborate complexity, and, by extension, complex systems, requires differentiating it from complicated systems. Cilliers (1998) defines a complicated system as one that can be described by its individual constituents, even if it has multiple components. This system type can comprise a computer or a car. Conversely, complex systems cannot be assessed by merely considering their components, requiring a more detailed evaluation that incorporates the interactions among its various elements, as well as the system within its environment. These relationships constantly shift, fluctuate and are dynamic, due to the underlying self-organisation intrinsic to these systems (Barthelemy, et al., 2013). The resultant behaviour of these complex systems can render new,

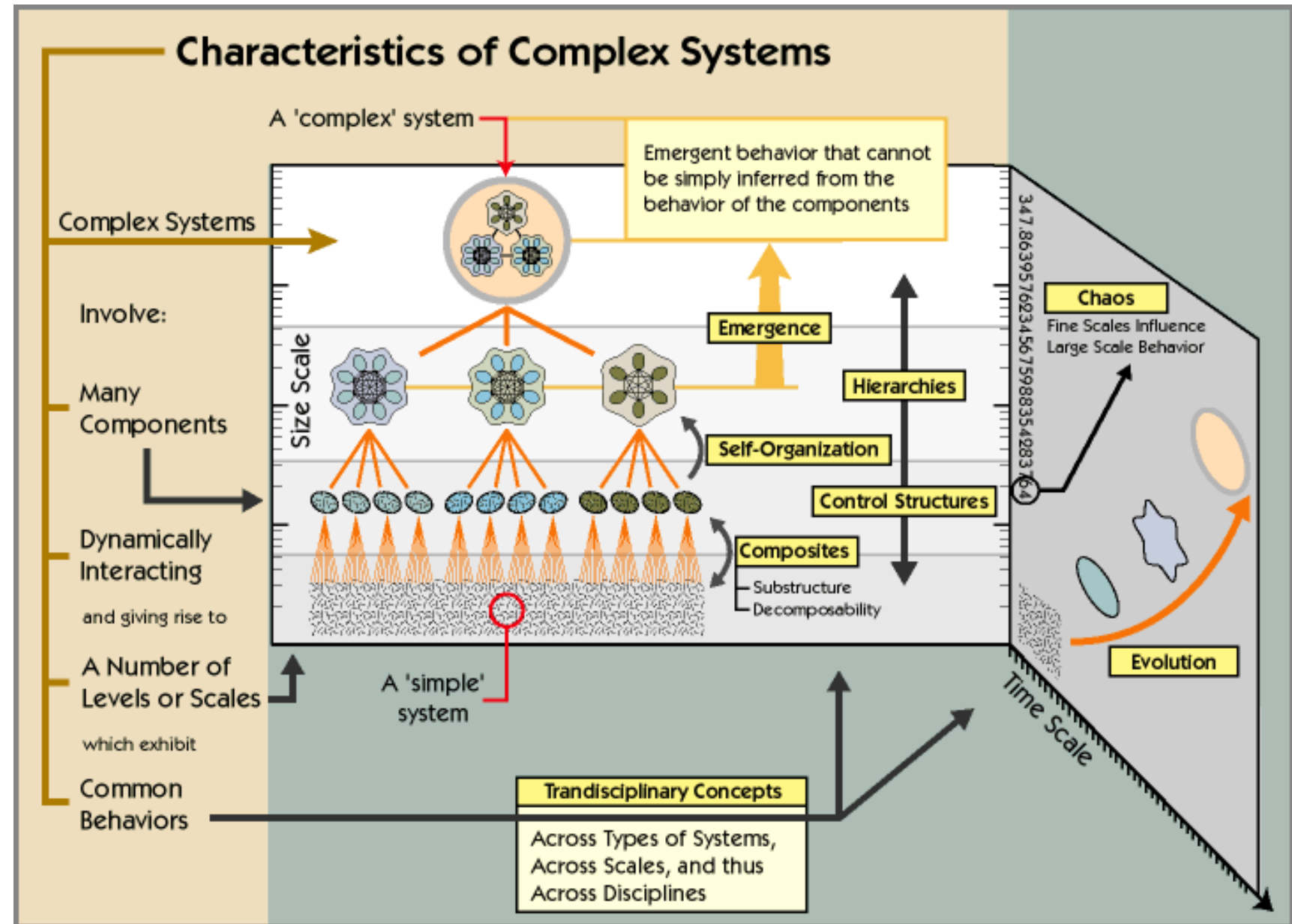


Figure 8: Characteristics of a Complex Adaptive System (http://necsi.edu/projects/mclemens/cs_char.gif)

original and nascent features, considered emergent properties (Cilliers, 1998, p. 56). Complexity is associated with living beings, rather than inanimate objects in general, with the complexity produced by the interactions among components, consequentially resulting in emergent attributes, behaviours and dimensions (Johnson, 2002; Batty, 2008)

Because of their composite, intricate and multifactorial nature, complex systems are challenging to define. Cilliers (1998; 2008) identifies complex systems as exhibiting the following determining characteristics (Figure 8 demarcates the overall characteristics and 'behaviours' evinced by CAS):

- I. Complex systems consist of large numbers of elements, components or agents, inter-connected in irregular ways.
- II. Elements within a system must exhibit dynamic interactions to constitute a complex system. Simple interchanges among various elements can engender systems' self-organisation into complex structures.
- III. Elements influence other elements through interactions, although these interactions do not determine the behaviour of the system.

- IV. The interactions between elements are non-linear in nature. This denotes that the magnitude of a facet does not dictate the import of its impact; small causes or actions can create large ramifications and vice versa.
- V. Information is ordinarily available locally to elements, with the distance of interaction commonly short in range.
- VI. Feedback loops exist in the exchanges, essentially the interactions can 'feedback' onto themselves. Feedback can be considered positive, enhancing, ameliorating and stimulating or negative, which detracts and both are deemed requisite. This is referred to as recurrency.
- VII. Complex systems operate considerably away from an equilibrium state and are in constant flux. In the case of complex systems, equilibrium can be equated to the death or termination thereof.
- VIII. Complex systems are open systems, shaped by their interactions and exchanges with their environment. To define complex systems is challenging as their delineation and boundaries are unclear. The process of framing demarcates the scope of the system, founded on the position or purpose of observation.
- IX. The history of a complex system is an important component of the system as it is 'co-responsible' for its behaviour in its present form.
- X. Each element can only respond to the information that is available to the entity. Complete, comprehensive knowledge (consciousness) of the integral, aggregate system is not possible in a single element without that factor reflecting the entire complexity of the whole in itself.

In addition, several authors have identified the primary characteristics of CAS (see Figure 8) incorporating diversity among components (Ahern, 2011; Gunderson and Holling, 2002; Page, 2011); non-linear interactions (Cilliers, 1998; Meadows, 2008); self-organisation (Barthelemy, *et al.*, 2013; Meadows, 2008; Sauders, 2008); local information processing; emergence (Johnson, 2002; Batty, 2008); adaptation (Innes and Booher, 2010; Page, 2011); organisation across multiple scales or hierarchies (Cilliers, 2008;

Gunderson and Holling, 2001; Johnson, 2002; Meadows, 2008); sensitivity to changes in initial conditions (Cilliers, 2008); and a non-equilibrium state (Resilience Alliance, 2010). These combined attributes form the basis for understanding and describing CAS. They have been linked to other systems, for instance SES (Stockholm Resilience Centre, 2015). The study of connected human and natural systems (SES) is produced through clarifying and comprehending the characteristics of CAS.

2.2.2 Social-Ecological Systems

Systems incorporate a variety of discrete elements, which interact with each other (Cilliers, 2000). The interactions between human and natural systems have generally been analysed as either social or ecological systems. Berkes *et al.* (1998) contend that social and ecological systems are, in actuality, integrated systems (social-ecological systems), thus should be analysed there as. SES emphasises the conception that humans and nature are interlinked and interdependent ('humans-in-nature' perspective), with nature providing essential ecological services for human existence and development (Resilience Alliance, 2010, p. 6). These constitute complex and coupled systems, join and interweave human and natural systems (Simonsen, 2007). Understanding the complex nature of these systems is crucial in comprehending their emergent behaviours, for example resilience.

A SES comprises an integrated and complexed system of ecological- and human systems with "reciprocal feedbacks and interdependence" (Resilience Alliance, 2010, p. 52). The interactions between systems are in accord with CAS characteristics, denoting that interactions between linked ecological and human systems are dynamic, non-linear and constantly fluctuating. Within these systems, change is constant and frequently unpredictable.

The system's adaptation and response to changing circumstances comprises a fundamental feature of a CAS and SES. The dynamics of a SES can be described and analysed by a sequential revolution, termed the

adaptive cycle. The adaptive cycle is derived from the process of succession in the ecological field (Encyclopaedia Britannica, 2013). Ecosystems undergo four distinct phases in succession, viz. rapid growth (r); conservation of resources (k); release of resources (Ω); and reorganisation (α) (Resilience Alliance, 2010). The sequence of these phases constitute the adaptive cycle, which can be utilised to portray how systems alter over a period of time.

Forest fire strategies may be utilised to exemplify the individual phases of the adaptive cycle. The rapid growth phase (r) constitutes the establishment of a forested area through successive ecosystems, each created and supported from the preceding, which engender the ideal circumstances for progressively complex systems. The mature forest is established by the conservation (k) of nutrients and energy. The release (Ω) of nutritive media and energy occurs when an environmental disruption, for instance a wild fire, destroys the mature forest; however, a foundation (nutrient deposition) for the growth of a new mature forest is created by this destruction, through ecosystem succession. This is a dynamic, continuous process, comprising

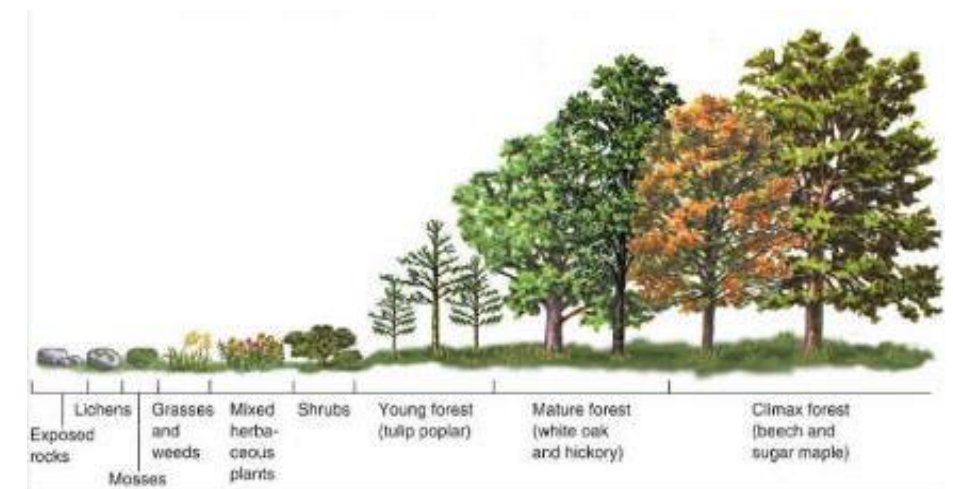


Figure 9: Ecological succession.
(<http://intothegardenstrawberries.weebly.com/ecological-succession.html>)

CHAPTER 2: THEORETICAL UNDERPINNING

a cycle of acclimatised forest, destruction, the initial growth of small pioneer species (small plants) and the successive establishment of increasingly complex systems. This can be considered the sequential, responsive adaptation of the ecosystem towards reinstating more complex ecosystems; indicated by the consequential modifications shown, i.e. as the forest gains maturity, rigidity commences (as growth slows and peaks), rendering the overall system increasingly vulnerable to perturbations or transformations (Encyclopaedia Britannica, 2013; Resilience Alliance, 2010).

This adaptive process contributes the foundation for the theory of the adaptive cycle, proposed by Holling (2001) as constituting a crucial characteristic of a CAS.

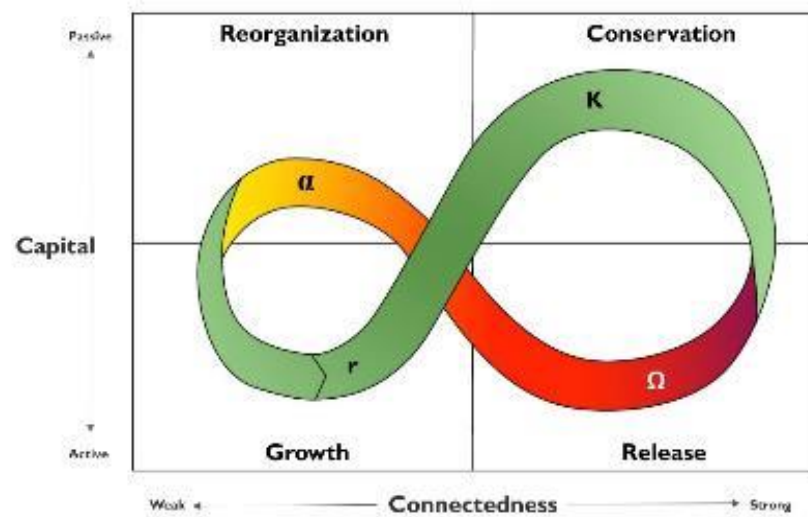


Figure 11: The adaptive cycle (Holling 2001)

The adaptive cycle manifests in several, diverse scales, represented as nested systems, which have various cross-scale interactions, referred to as a panarchy (Gunderson & Holling, 2002) (see Figure 10). Within a panarchy, what happens on one scale concurrently influences and affects what occurs on a different scale (both in time and space) (Simmie & Martin, 2010, p. 34). Cross-scale linkages or dynamic interactions exist in within the subsystems contained in a system, although they may be at differing phases in the adaptive cycle, thus responses will deviate and contrast, depending on the scale of the nested systems (Resilience Alliance, 2010).

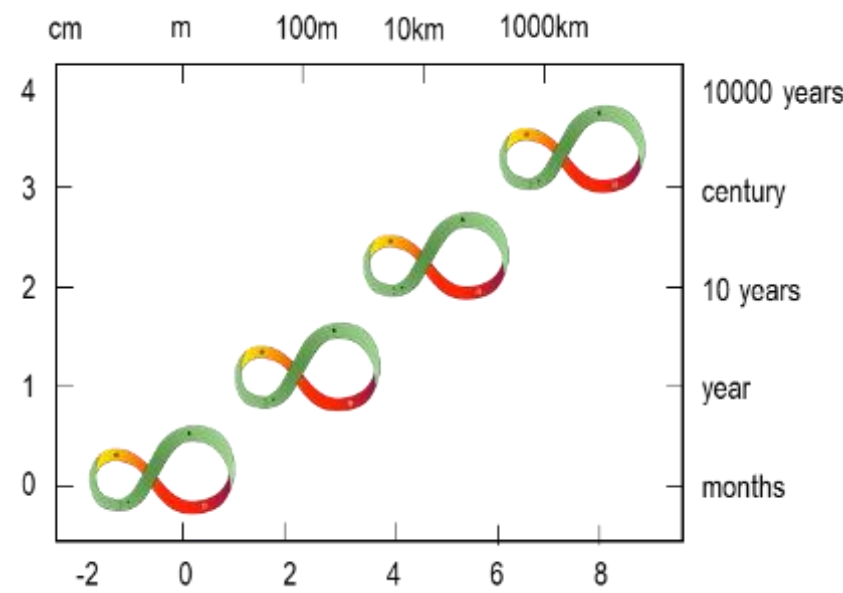
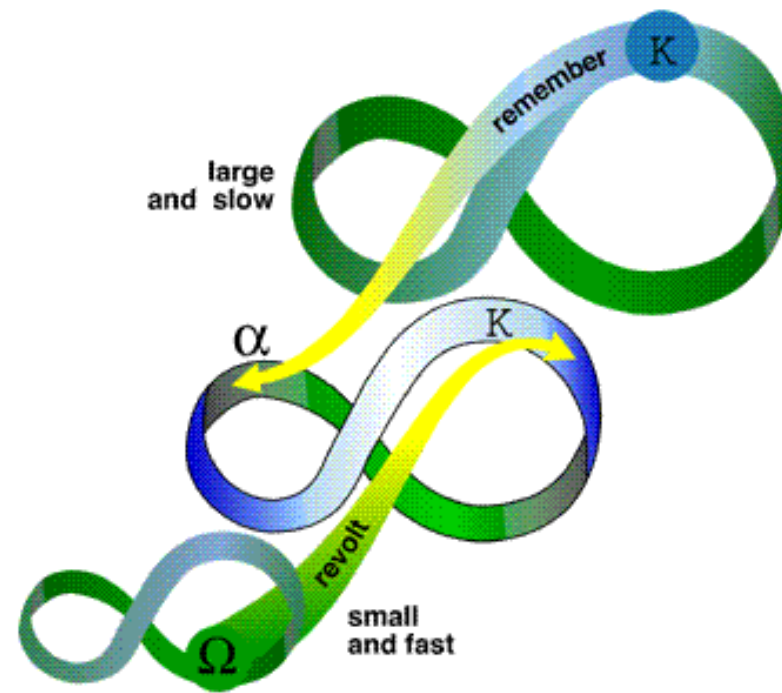


Figure 10: Elements of the panarchy thesis (Holling, 2001). The top figure shows the linking and transformative mechanism of the small and fast processes while below figure shows these adaptive cycles arranged in a panarchy

Holling (2001) asserts that the panarchy “explains the evolving nature of complex adaptive systems”, which can constitute a system of nature (i.e. grassland or wetland); humans (i.e. social systems); human-nature systems (i.e. natural resource management); and social-ecological systems (co-evolved systems of management), inter-linking in perpetual adaptive cycles.

Systems that operate on a large scale are typically slow in reference to their adaptive cycles, whereas small scale systems function at a more rapid pace. Larger scale systems often contain ‘system memory’, which may assist the focal system in the retention of an essential or significant component after a disruption, enabling the system to recover. However, the system memory may present a liability when change is required at a focal level. Smaller nested subsystems can provide innovation and novelty vertically upwards. This could be exemplified through utilising the forest analogy; wherein it may be more advantageous allowing minor fires to burn, as this can ultimately reduce the risk of major fire events (Resilience Alliance, 2010). The following division expand on the characteristics and properties of CAS and SES as they pertain to cities, relevant to this dissertation.

2.2.3 Cities as Complex Adaptive Systems and Social-Ecological Systems

The consideration of cities as systems comprises an enduring and established facet of planning theory and practice, having been incorporated at the latest in the 1960s and 1970s. In this ‘systems view’ of cities, as well as society, salience and prominence was inclined towards mathematical calculation and analysis of systems (Berry, 1964). This facilitates planners and planning theorists with the ability to predict behaviours and, consequently, to intervene in potential problem areas. In this instance, systems theory perceives cities not as complex but as complicated, thereby contravening, negating or neutralising their exact nature. Cities, as systems, in addition to demonstrating complex behaviours, exhibit complex relationships among the individual components of the system. The systemic view of cities is critical in managing urban systems utilising the complex adaptive and social-ecological systems’ perspectives.

Jacobs (1961, p 440) observes that cities have “problems of organised complexity”, on which the planning perspective attempts imposing a simplistic order, thus abnegating an accurate comprehension. In recent decades, research into cities as CAS has expanded dramatically. The

concept of cities as complex adaptive systems has been deemed an innovative and novel research frontier and has been widely accepted (Allen & Sanglier, 1981; Allmendinger, 2009; Batty, 2008; Batty, 2007; Du Plessis, 2008; Innes and Booher, 2010; Portugali, 2011; Salat and Bourdic, 2012; Sanders, 2008). Cities are considered as CAS, as they exhibit similar properties or characteristics to those commonly present in this type of system. The ensuing section clarifies the CAS characteristics of cities.

Rief (1973) contends that cities are composed of a variety of constituents that cannot be studied in isolation, indicating that to understand an element in the city requires the consideration of other related factors. Essentially, in order to accurately comprehend and depict the city requires the crucial consideration of interactions and relationships between elements, not merely focusing on the components of the system exclusively. Cities are composed of an extensive set of agents, which operate concurrently and interact with one another, resulting in unpredictable behaviour. This phenomenon of complex behaviours is considered self-organisation (Batty, 2005; Barthelemy, *et al.*, 2013).

Self-Organisation: The ability to self-organise is a defining characteristic of cities. Self-propelled structuring and operation in cities constitutes the capacity of individual agents or elements to spontaneously organise without any upper-tier instructions. This implies that system organisation, based on decisions and relationships, is engendered by the lower agents or components, rather from the higher hierarchy (Gunderson and Holling, 2001). The individual determinations and resolutions rendered by agents within a city creating complex events and patterns, for example population migration; and urban morphology and form (Salat, 2011). Frequently, planning practices have not fully comprehended or considered the self-organisation facet of cities, imposing top-down positivist interventions which may result in unintended consequences. Control-based planning interventions reduces the role of the individual, while the power remains in the bureaucrat's domain. More communicative and participatory theories (bottom-up) have replaced and substituted prior positivist planning models,

inclusive of the critique lodged by Jacobs (1961), as well as alternate and additional constructs of modernist planning proposed in the 60's and 70's (top-down) (Batty & Longley, 1994). This trend embraces and accentuates the ability of individuals to enact extensive changes, from local to global contexts (behaviour).

Emergence: The transformation in global behaviour is termed emergence. Emergence constitutes the macro-outcomes of micro-interactions between elements on lower, more local levels. Batty (2011, p.3) categorises emergence as *"multiple decisions from the bottom up often give rise to unexpected, innovative and surprising behaviours"*. In the context of a city, this may be exemplified by driving and road utilisation factors. An individual driver undertakes decisions on how to arrive at their destination, with certain rules governing the journey, for instance speed regulations, personal and societal rules etc.. This individual joins a multitude of other drivers, who have made similar determinations, thereby creating a traffic jam (gridlock); thus a *"separate and distinct entity emerges from those individual behaviours"* (Bonabeau, 2002, p. 2). Rocklin (2008) contends that traffic jams commence spontaneously, with unexpected behaviours occurring, for instance traffic slowing down or stopping for no apparent reason. Alternate exemplars of emergent behaviour in cities include the spontaneous processes of sprawl and suburbanisation; and alterations in urban morphology and form over centuries (Salat, 2011).

Adaptation: The capacity to adapt or adjust to changing conditions is a significant and crucial characteristic of CAS and, by extension, cities. Adaptation occurs at the lowest level of individual agents, rather than at a system-wide level, comprising an essential function of CAS self-organisation. Adaptation refers to acceptive, free and reactive modifications to the greater context, as well as to other agents in the system (Sanders, 2008, p. 276). The system's constituent agents are constantly learning, acquiring and incorporating new information, which facilitates reactive and responsive changes. Commonly, small adaptations by individual factors do not exclusively effect local changes, but can culminate in major, system-

wide transformations. In a city, incremental adaptations by individuals can be explained by land usage changes. The invasion-succession theory delineates the process wherein a particular incursive or 'invading' land use is initiated in a locale, as the characteristics of that area have the greatest potential for investment return opportunities (Ogungbemi, 2012, p. 902). Subsequent to the assailing usage of land permeating and dominating the area, succession occurs, wherein the character of the location changes (Barlowe, 1978). This is seen in reputable, advantageously located residential neighbourhoods that, through individual decisions on land use, demonstrate initial alterations to its character and attributes. These individual changes can comprise the relocation of commerce, wherein one home is converted to office space or rebuilt as an office block, from which a trend ensues, transforming into a business-oriented area. Similarly, the conversion of a single home stand to a multiple family unit plot may engender the construction of several flats or townhouses, increasing the population density. This demonstrates how individual decisions have the influence and power to alter subsystems, as validated by the preceding examples of neighbourhoods, or even entire cities.

Hierarchy: Cities consist of a multitude of naturally forming hierarchies of systems, which interact. Simon (1974) was the originator of the interpretation of the adaptive attributes of hierarchal structures. However, stratified compositions do not only delineate larger scale, higher tier control (top-down) but incorporate potential lower level determinants (bottom-up) arising from the smaller scale of a system (Allen, *et al.*, 2014). The hierarchical structure of a complex system can be studied, facilitated by the ability to decompose it into smaller subsystems (Meadows, 2008; Conant, 1991, Simon 1962). Gunderson and Holling (2001, p 392) assert that hierarchies are composed of *"semi-autonomous levels [that] are formed by interactions among variables that share similar speeds (geometric/spatial attributes)"*. Du Plessis (2008, p4) extends that the interactions of similar variables form *"sub-assemblies, which in turn are connected into a subsystem of a higher order"*

CHAPTER 2: THEORETICAL UNDERPINNING

The entire system is, thus, comprised of subsystems, which infers the bottom-up nature of complex systems. Subsystems are frequently referred to as nested systems, as those on the lower level are embedded or nested within the total larger system (Gunderson and Holling, 2001). Batty and Longley (1994; p.4) aver that “*subassemblages may be [the] replication of the same form at different scales*”. This conception of self-replication at different scales substantiates the conjecture of hierarchies creating redundancy. Hierarchical systems can only comprise a limited variety of subsystems, arranged in assorted combinations. This denotes that when a particular subsystem decomposes, collapses or fails, the system has the adaptability to replace it with alternate, germane and similar subsystems (Meadows, 2008; Simon, 1962).

Gunderson and Holling (2001) categorise the interactions among subsystems, within a system’s assorted hierarchical scales, as the aforementioned concept of panarchy. Panarchy constitutes a conceptual framework, utilised to explicate the modes by which different complex systems interact and are spatially and temporally structured (Allen, et al., 2014). The concept contends that systems are in constant and dynamic flux, experiencing and exhibiting various sequential phases of change, termed the adaptive cycle. Gunderson and Holling (2001) assert that alterations in or on one level of the panarchy can create cascading effects on higher or lower systems.

Concerning the comprehension of urban complexity, an enduring episteme of the significance of hierarchies in cities has emerged, evolving and developing over the preceding decades. This concept of hierarchy within cities has been adopted by planning, especially within the field of urban geography. Christaller (1966) classifies, as hierarchal, the distribution of the factors within cities, incorporating population, function and connections. This author’s Central Place Theory describes the hierarchal distribution and

structure of settlements (Christaller, 1966). Similarly, the other elements within cities form a stratified structure. For example, Salat (2011) and Salat et al. (2014) in investigating the relative perimeters of parks in Paris and New York, reveal that there are very few large green areas, with a higher frequency of those considered medium in size, and a predominance constituting smaller communal gardens. In addition, this can be observed in alternate city functions, for instance healthcare facilities; shops; and leisure activities, which are “*distributed within the urban fabric according to inverse power laws*” (Salat, et al., 2014, p. 80). This phenomenon may be alternatively termed ‘rank-size distribution’, as well as Pareto’s frequency distribution or Zipf’s law (Batty & Longley, 1994; Newman, 2006; Salat, 2011). Salat (2011) asserts that, for the urban fabric to be resilient and efficient, a complex structure is requisite, in consort with it being structured in a hierarchal fractal manner. The resilience of hierarchal structures is contained in their capabilities to adapt and gain complexity over time, through self-organisation, “*so as to absorb fluctuations, to transform the currents of the waves of history and time into a constructive rather than a destructive force*” (Salat & Bourdic, 2012, p. 65).

Co-Evolution: The concept of co-evolution in CAS represents the interactions between a system and the larger environment, which renders the simultaneous development of both. CAS comprise open systems, able to interact and influence, in consort with being affected by, the greater, external environment (Chan, 2001). Essentially, this means that both the system and the environment can transform through their interactions and, in concert, mutually and concurrently evolve, i.e. co-evolution. Within a city, this process is demonstrated in the multitude of interactions among city functions and the rest of the environment, exemplified by the impact of changes in land usage on the larger milieu.

Diversity: The diversity of elements is conspicuous and evidenced when studying cities and other complex systems. Fundamentally, diversity is an attribute of a system (i.e. complex systems) “*whose elements may be apportioned into categories*” which directly associate its value to various fields from ecology to economics (Leonard & Jones, 1989, p. 4). Diversity can “*provide insurance, improve productivity, spur innovation, enhance robustness, produce collective knowledge, and sustain further diversity*” (Page, 2011, p.3).

Redundancy¹: CAS have intrinsic subsystems with various interconnections, which have the potential to ameliorate and enhance their competencies and capabilities in the management of erroneous behaviour and mistakes (“error management capabilities”) (Eidelson, 1997, p. 47). As previously noted, the hierarchal structure of CAS engenders a channel whereby a disturbance or collapse on one level can be contained and not disseminated, causing ripple effects, or cascading repercussions, although these are possible. Secondly, the presence of a variety of several feedback loops² reduces the potential for repeating a specific mistake. Finally, the system has assorted and varied constituents, which can replace other components in the event of a failure occurring (Kelly, 1994; Eidelson, 1997). Redundancy in cities is revealed in the provision of infrastructure systems that are able to intervene if a component malfunction, disruption or termination transpires, substituting it with an alternate element. This is exemplified in electricity infrastructure, wherein a plurality of power sources facilitates redundancy and fortifies the electricity grid. This ensures that the power supply is uninterrupted, through interchanging a source component that is depleted or in crisis with an alternate, effective reservoir.

Cities as SES: A linked social and ecological system, an SES, exhibits complex behaviours and can, thus, be classified as a CAS. The preceding dilation reveals that “*cities are...par excellence complex systems*” (Batty,

¹ Redundancy is often associated with inefficiencies, but this relates to complicated rather than complex systems. In complex systems redundancy is vital to a healthy and resilient system (Davis & Sumara, 2006).

² A feedback loop is a circular process where a system’s output is fed back into the system as an input. Two feedback loops exist reinforcing (positive) and balancing (negative).

2008, p.770). Globally, rapid urbanisation and the growth in the awareness of the significance of cities' overall impact on the environment and world, renders conceptualising cities as SES progressively important and consequential. Anderson and Elmqvist (2012) aver that it has been recently recognised that urban systems not only influence and guide ecosystem change, but are, additionally, constituents of an integrated system. Du Plessis (2008) and Schewnius et al. (2014) extend, categorising cities as SES. Significantly, however, Holling (2001) asserts that human systems or human-dominated systems, for instance cities, are composed of unique characteristics, intrinsically arising from the humanity factor, which incorporates mankind's cognitive abilities; foresight; communication; and technology. The principal import of perceiving cities as SES comprises facilitating the analysis of their innate, complex characteristics, in consort with comprehending how urban systems respond to external perturbations, viz. the system's resilience (McPhearson, 2013).

The foregoing explication of CAS and SES characteristics contributes a basis for understanding the facets of complex, and socially and ecologically inter-connected systems. The following section considers resilience, focussing specifically on urban resiliency.

2.3 Resilience Theory

This division explains the evolution of resilience, which has progressed from engineering; through ecological; and finally, to urban resilience. The section is intended to reveal the causal agents rendering a CAS and a SES resilient and concludes with revealing the determinants of resiliency, with specific reference to diversity.

2.3.1 Evolution of the Concept

Resilience comprises multiple forms and applications, exploited in several, diverse fields, ranging from engineering to the contemporary utilisation within the social-ecological systems context, and is presented in the ensuing text. The concept is veritably multidisciplinary; evidenced by the

progressive and extensive propagation of its conceptualisation, from its originating fields, e.g. ecology, through to contemporary applications in diverse disciplines (Cutter et al., 2008; De Bruijne et al., 2010; Turner, 2003). The essential, core characteristics and determinants of the term will be clarified, specifically considering diversity, which constitutes a crucial factor in ensuring adaptive capacity. Cloete (2012, p.2) contends that resilience is frequently confused with similar and related concepts, for instance *“sustainability, adaptability, transformability, resistance, equilibrium, stability, durability and robustness”*. The succeeding subsection, taking this into account, explains the concept, along with associated fields of study.

The etymology or origins of the term resilience derives from the Latin *resilire*, meaning *“to leap back or to rebound”* (Martin, 2012, p. 4). Resilience was introduced as the capacity to persist in when contending with change after C.S. Holling's 1973 influential paper, wherein he proposed that *“resilience determines the persistence of relationships within systems and is a measure of the ability of these systems to absorb changes of state variables, and parameters, and still persist”* (p.17). The succeeding subdivisions contribute a succinct overview of the accretive application of resilience in particular, diverse fields, viz. Engineering; Ecosystem/Ecological; Economic; Social/Human; and Urban disciplines.

2.3.2 Engineering Resilience

The engineering discipline defines resilience as the degree to which a system (or structure) can return to a baseline state after being disturbed (Holling, 1996). A system (or structure) regaining a prior status quo, subsequent to a disruption is deemed extremely consequential, considered a critical property of materials and substances utilised in construction (e.g. bridges). Central and essential to this is the stability or elasticity of a system, i.e. the duration it requires to restore equilibrium. Systems geared towards engineering resilience attempt to anticipate disturbance, frequently focussing responses towards those disturbances, potentially rendering the system vulnerable to unforeseen disruptions.

Certain limitations of this definition are inherently apparent in terms of its emphasis on returning to 'normal', creating latent prospective detrimental effects to longer term resilience. For example, the on-going unrest in the Darfur region, where regaining the prior or 'business-as-usual' state is unsought and undesirable, as these original, existing conditions provoked the perturbation or upheaval. The disruption requires the establishment of a new 'normal', which mitigates and ameliorates the causal agents thereof, viz. the abdominal situation in which the destitute population subsists, comprising one of the most impoverished inhabited areas on earth. Cities which have been stricken by a natural or man-engendered disastrous or monumental events exhibit changes and differences thereafter, for example New Orleans after Hurricane Katrina in 2005, which does indicate less resilience. These transformations can, in actuality, denote increased resiliency to future events, as in the exemplar, where the hurricane exposed inadequate and ineffective city management and infrastructure, as well as intense inequality, thus demonstrating that change is not necessarily negative. Fundamentally, resilience rationality constitutes embracing change and alteration. Reacting to change is deemed normal and optimal, with resistance to modification having the potential to undermine the resilience of an entity or system (Martin-Breen & Anderies, 2011; Zolli & Healy, 2012).

Despite the constraints and limitations inherent in engineering resilience, it continues to be valuable and beneficial when considering various systems where stability is crucial, including, *inter alia*, construction materials and engineering services. Innovative, new engineering system designs have been formulated to render these systems more adaptive to changing environmental and social conditions. This is referred to as green engineering or infrastructure where the inherent resilience of the system is exploited to reduce vulnerability. These approaches take advantage of particular system properties, inclusive of diversity; efficiency; adaptability; and cohesion, to ensure more sustainable and resilient infrastructure, which is able to respond with greater flexibility to changing circumstances. This can be attained through designing infrastructure or systems synchronised

with fluctuations occurring in nature, for instance planting wetlands rather than artificially purifying water (Anastas & Zimmerman, 2003 & Fiksel, 2006, p. 15). Conversely, engineered safe systems are designed to limit the risk of catastrophic collapse thereof, although this does not entirely eliminate the possibility of this occurring (Allenby, 2005).

2.3.3 Ecosystem and Ecological Resilience

Progressing from the concept of equilibrium in engineering resilience, Holling (2001) focuses the application of resilience theory onto complex systems. Ecological resilience is applied to bionomic environmental systems, characterised by complex behaviours associated with non-equilibrium behaviour (Gunderson & Holling, 2002). Ecological resilience is delineated as the maximum disturbance a system can absorb before changing to another stable state, controlled by a disparate set of variables and characterised by a different structure (Brand & Jax, 2007). Walker et al. (2006, p.2) define ecological resilience as *“the capacity of a system to experience shocks while retaining essentially the same function, structure, feedbacks, and therefore identity”*.

Equilibrist thinking is superseded, with the attention and emphasis on the system properties of persistency; adaptation; variability; and unpredictability. The facets demarcating ecosystem resilience encompass: 1) the amount of change or stress a system can endure while retaining control of its function and structure; 2) the system's capacity for adaptation when reacting to pressures; 3) the system's ability for self-organisation and learning in the pursuit of long-term objectives (UNESCAP, 2008, p. 6; Walker & Salt, 2006, p. 4; Carpenter et al., 2001). The adaptive capacity of ecological and social systems is constituted by their capability to survive, adapt and grow when contending with unanticipated disturbances or disruptions. Adaptive capacity is considered significant and central in ensuring a resilient system, as it facilitates the possibility of new, supplementary or multiple equilibriums (Fiksel, 2006).

2.3.4 Social/Human Resilience

Throughout mankind's historical chronicles change has been a continuous constant; however, the manner by which societies and ecosystems contend and cope with change varies, depending on the context, as well as the ability of the system (ecological or otherwise) to adapt to the dynamic and altering circumstances. Adaptation has comprised a perpetual and persistent facet of human and ecological sequesters, since the commencement of life on our planet. This is revealed in the process of evolution, theoretically originated by Darwin, wherein the survival, speciation, and development of living organisms was generated and effected through short-term adaptive behaviours, augmented by the diversification, specialisation, anamorphism and adjustment of physical characteristics to environmental circumstances over extended durations, constituting natural selection, contributing and developing attributes which generated certain species that were and are advantaged and flourishing (Pilbeam, 1972, p. 24).

The saga of modern man is one of survival and resilience. Only infrequently has there been full apocalyptic societal collapse, rather alterations and modifications to political and/or cultural dispensations have occurred either gradually or with partial destruction or depredation (McAnany & Yoffee, 2010, p. 5). Despite classic versions of alleged collapse being popularised, these essentially comprise epitomes of resourcefulness and adaptability, evidenced by the continued existence of descendants of ancient cultures, for instance the Mayans (McAnany & Yoffee, 2010, p. 11). McAnany and Yoffee (2010) describe resilience as the human response to extreme problems and change, arising from environmental or human origins. Analogously, Smit and Wandel (2006) classify the human dimension context of adaptation as the process, action or outcome in human systems, enhancing the manner with which to cope, manage and adjust to disturbances, alterations and changing circumstances. Although resilience is an aeonian component of human and ecological evolution, denoting the capacity to adapt to changing circumstances, it should not be considered automatic, certain or inevitable. World-wide, certain processes, inclusive of Globalisation; Industrialisation; and Urbanisation, have created a global

domain that has infringed, encroached or crossed critical environmental thresholds. This, in conjunction with economic uncertainty and social challenges, has prompted the attention and awareness of the significance of resilience to the sustainability of urban regions.

Social Resilience research focuses on both individual and community level resilience. Conrad (1999) considers the psychological context of resilience as exploring the *“developmental differences in people's response to stress and adversity”* (Conrad, 1999, p. 16). Resilience, along with responsiveness to challenging circumstances, is frequently extrapolated to the field of disaster management. In disaster management and reduction, the resilience of individuals and communities is cardinal. Reich (2006) identifies three principles of resilience reoccurring in disasters, viz. Control, the coordination of activities and actions; Coherence, the processes and procedures instituted to reduce uncertainty; and Connectedness, the systematic coordination of efforts (Reich, 2006). These three principles, utilised together in a disaster management strategy, engender 'resilience's efficient response' (Ponomarov & Holcomb, 2009, p. 127).

Rodin (2013) asserts that we cannot predict when the next disaster will occur, nor the form it will take, but we are cognisant that it will materialise at some point, and that *“our poorest and most vulnerable will bear the greatest impacts”*. This author continues that resilience is not an innate ability in humans; it has to be learnt and instilled and, through this acquisition and assimilation, over time, an individual can develop, enhance and reinforce it (Rodin, 2013).

Campanella (2006) investigated various cities impacted by disasters, particularly focussing on 'post-Katrina' New Orleans. He asserts that the recovery process and resilience does not only concern the infrastructure that is damaged; the significant factor comprises the individual inhabitants of cities, who are the source of resilience. This author advocates that post-disaster reconstruction consider the social fabric and connections affected, continuing that *“a city is only as resilient as its citizens...resilient citizens have enabled urban resilience throughout history”* (Campanella, 2006). This

can be seen in the minimal number of urban areas which have been totally annihilated or destroyed by disasters.

The assessment of urban resilience, or the capacity of urban regions to withstand unexpected environmental or man-made perturbations, is requisite to ensure equity, environmental justice and fairness for future urban development. The following sections will discuss the application of resilience *vis-à-vis* the urban context.

2.4 Urban Resilience

Contemporary debate and discourse on resilience includes cities and their respective impacts and resiliency. As a component of the global social-ecological system, the resilience of cities is deemed crucial for continued existence of all human life, gaining significance in the circumstances of spreading urbanisation (Ward, 2007). This section explains the concept of urban resilience, including its application and a general critique.

2.4.1 Cities, Vulnerability and Resilience

Urbanisation is deemed one of the most powerful processes that have moulded human development, in addition to the entire biosphere of the planet. Virtually all future population growth will occur within urban areas, although in small to medium cities and not megacities or major metropolises. These urban areas offer the potential for opportunities; however, there are negative elements and challenges too, including poverty, pollution and disease (Resilience Alliance, 2007). In city management and planning, urban vulnerability is becoming an increasingly important factor, particularly in regard to the unpredicted or unprecedented disruptions, with which cities currently contend. These challenges render the progressive consideration of the importance of resiliency or urban resilience. Urban resilience may be deemed the antithesis of vulnerability, as it represents a neighbourhood or city with the capability to adapt to changing circumstances, repositioning and reorganising, rather than collapsing or failing. Fiksel (2006) asserts that cities are inherently resilient,

historically evidenced by the limited number of cities that have been abandoned, although there are increasing concerns over urban vulnerability and resilience.

In academic and city management domains the urban resilience concept is gaining major traction, with several organisations incorporating a variety of associated objectives. This illustrates the alterations in conceptual trends, with familiar terms, for instance ‘sustainable urbanism’ shifting to urban resilience. A certain degree of confusion arises from the links and connotations of the concepts, especially in urban governance policy, illustrated by the City of Tshwane’s interpretation of urban resilience, which focuses on renewable energy and sustainable water management, but neglects other critical issues, as explicated below (City of Tshwane, 2011).

2.4.2 Defining Urban Resilience

The simplest definition of urban resilience is the ability of a city or citizens to rebound from a shock or threat, returning to the original status (Burton, et al., 2013). This is predominantly associated with engineering resilience theory, although it has gained nuance and additional facets with the advent of ecological and social-ecological resiliency conceptualising. Urban Resilience is described as the capacity to survive, adapt and grow (Evans, 2014; Wilbanks, 2007; Resilient City, 2014; Rockefeller Foundation, 2014) when contending with multi-hazard threats (Wilbanks, 2007) or uncertainty (African Centre for Cities, 2014; Asian Development Bank, 2013), with the competency to continue maintaining essential system functions, structures and identity (Resilient City, 2014; Rodin, 2013) effecting, when circumstances require, transformation (Rockefeller Foundation, 2014; Godschalk, 2002; Walker et al., 2004).

In the preceding definition of urban resilience, a few core considerations warrant increased clarification. Firstly, it is essential to incorporate the capacity or capability of individuals, communities and the overall city. In this instance, capacity pertains to possessing essential knowledge (information) of, and in, the system (or the individual components) to facilitate coping with,

and recovering from, any disruptions or shocks, or alternatively, being able to persist thereafter (Gallopín, 2006). Additionally, this may be constituted by spare capacity, which acts as back-ups or substitutes if a vital component fails. Furthermore, capacity extends to the post-disaster arena, centred on the re-establishment of functions (Rockefeller Foundation, 2014). Capacity is further supported and buttressed by urban governance, which can enable and develop the capacity of citizens and the city to “*withstand shocks, and use experimentation and innovation in the face of uncertainty*” (African Centre for Cities, 2014). The subsequent crucial component comprises the ability to survive, adapt and grow (Rockefeller Foundation, 2014). The first priority in a disaster situation or in general unpredictability is the capacity to survive, while adaptation and growth focus on the capability to evolve beyond survival, to actually navigate change and transform to a less vulnerable state for the city. Adaptability is “*characterised by the ability of a system to move thresholds, change the resistance to external inputs, move the current state of the system and to manage the cross-scale interactions*” (Holling, 1973).

Cities need to be protected and shielded, in consort with requiring the facilities enabling it to be able to endure a variety of threats, inclusive of environmental and man-made catastrophes. Exacerbating these threats is the form of urbanisation occurring predominately in developing nations, which renders their populations particularly assailable or vulnerable to threats or perturbations.

Vulnerability has two primary components, viz. the degree of exposure to a threat (living next to a river in the floodplain in an informal dwelling) and the capability to respond thereto (resources, experience and social networks etc.) (Buckle, Mars, & Smale, 2000). The multitude of diverse threats or hazards to which cities are exposed, around which the contemporary resilience debates are centred, encompass, *inter alia*, global warming or climate change (NYC.gov, 2014; ISET, 2014; Leichenko, 2011); social unrest, violence and terrorism (Kilcullen, 2012); urbanisation and migration (Pelling, 2007); scarcity of water, oil and electricity (Mortimer, 2010; AGWA,

2012; Newman et al., 2008); drought and flooding (Liao, 2012); health, infrastructure and transport problems (Sustainability Resources, 2013); economic collapse; and poverty and inequality (Rodin, 2013).

Currently, unpredictability and unpredictable threats have received minimal consideration and representation within existing, available literature and resiliency strategies, with the focus thereof centred on precise, particular and predictable threats and specific resiliency tactics. In the context of unpredictable or unforeseen threats, less significance is concentrated on the type of disaster, with the emphasis revolving on the important factors to protect (or remain in control of) in an urban system, i.e. essential functions; structures; systems; and identity (Resilience Alliance, 2010; Resilient City, 2014; Rodin, 2013). These essential functions, structures and sub-systems contribute towards what renders the system (in this case urban system) identifiable; and if a certain amount of these are lost (or an associated threshold crossed), the system modifies into a different state, which may not be able to support the inhabitants or activities as before, for example the transformation of healthy coral reef systems to barren urchin-dominated systems (Elmqvist, et al., 2003). Finally, Walker et al. (2004) contend that, in certain circumstances, a system is required to advance towards becoming something completely new in order to survive. Particular initial conditions prior to disaster may be less than optimal, effectuating the requisite for a new 'normal'. Walker et al. (2004, p 2) terms this transformability, defined as *"the capacity to create a fundamentally new system when ecological, economic, or social (including political) conditions make the existing system untenable"*. Furthermore, urban governance is deemed a significant facet in a situation requiring a transition, which facilitate the capacity for cities to navigate change (African Centre for Cities, 2014).

As previously explained, there are four principal approaches to urban resilience, viz. urban hazards and disaster risk reduction; urban and regional economies; governance and institutions; and urban ecological resilience (of which this project is an example) (Leichenko, 2011). A majority

of urban resilience's practical applications relate to targeting specific threats, wherein the intent is to *"invest in risk-based approaches and make better use of the technology and tools available to manage disaster risks"* (The World Bank, 2014). The Institute for Social and Environmental Transition (ISET), collaborating with ARUP, formulated an Urban Resilience Framework, which recognises that urban populations exceed the supportive capacity of their immediate environments, thus rendering them reliant on extended, external and greater social-technical systems to supply goods and services (i.e. larger levels) for their survival and overall wellbeing. This expands the realm of urban resilience beyond city borders and takes into account the larger system(s) affecting the urban region. Additionally, this includes the assorted scales of people and institutions that constitute cities, ranging from individuals and communities through to governmental organisations. This is in accord with the panarchy logic of interacting elements, which comprise major foundational components of social-ecological and complex adaptive systems (Gunderson & Holling, 2002; Simmie & Martin, 2010; Resilience Alliance, 2010). In addition to the evolution of the concept of urban resilience, there are serious issues concerning the ethics and purpose of urban resilience, with the following section explaining the principal critiques and commentaries pertaining thereto.

2.4.4 Critiquing Urban Resilience

A major contention relates to resilience frequently being considered a positive term (triumph over adversity), despite there customarily being positive and negative connotations related to its application within urban contexts (Leichenko, 2011, p. 166). Swanstrom (2008) asserts that there is a clear distinction between resilience in ecological circumstances, opposed to social or urban contexts, contending that *"human systems are inherently conflictual or political"*, denoting that it is essential to consider the distributive consequences of resilience (Swanstrom, 2008). Effecting resilience in one location may render a reduction of resilience in another or, considering this from a panarchy perspective, resilience on one scale can

mean a reduction in another (Pike, Dawley, & Tomaney, 2010). From evolutionary economic theory and regional economic resilience, the distribution of resources and capabilities are inherently unequal, which engenders the incommensurate diffusion of positive and negative resilience outcomes (Simmie & Martin, 2010).

Boyd et al. (2008) and O'Brain et al. (2009) aver that the application of resilience can actually increase inequality through existing power dynamics. These power dynamics comprise control of resources by particular groups, which renders resilience inherently conservative in social relations. The conservative nature of resilience is displayed through the habitual favouring of the status quo, as these programmes and policies are produced and imposed by those in power (MacKinnon & Driscoll-Derickson, 2012, p. 259). Resilience, as a progressive policy directive, is frequently cited by a variety of activist groups; however, this is blatantly countervailed by its orientation towards existing power structures, instead of towards transformation. Additionally, exacerbating this, is that resilience is defined as imperative by external players, for instance state agencies, and not necessarily by the associated communities, potentially producing misplaced and unpopular interventions, which often accentuate short-term, rather than long-term resilience. MacKinnon and Driscoll-Derickson (2012) advocate an entirely opposing approach to progressive and equitable social relations, recommending the term resourcefulness. Conversely, this focuses on the uneven distribution of resources, community self-determination and indigenous knowledge (MacKinnon & Driscoll-Derickson, 2012).

As aforementioned, urban resilience has extended from the theoretical realm to influence real-world decisions. Porter and Davoudi (2012, p.329) observe that *"based on a simple frequency count, resilience appears to be fast replacing sustainability as the buzzword of the moment. It may well follow a similar fate and become a hollow concept for planning; an empty signifier which can be filled to justify almost any ends"*. Slater (2014, p.140) characterises urban resilience as part of the neo-liberal urbanism in *"a sinister lineage including new urbanism, sustainability and regeneration"*.

This author's basic premise comprises various privileged groups having an interest in propelling and propagating resilience concepts, for instance rebounding post-disaster, despite the conceptualisation being their original creation. This evidence that vested interests are committed to maintaining the status quo, even strengthening their position where disasters, for example economic downturns, are characterised as natural under resilience thinking, i.e. resilience constitutes a scapegoat. This pundit emphasises that resilience's application to the urban context is similar to other neo-liberal urban interventions, for instance 'new urbanism', concealing the real travesty of the poor being excluded from decision making; as well as their dispossession and territorial stigmatisation. Slater concludes that 'resilience' *ignores every important question about the contradictions of capital accumulation and circulation, about uneven development, about enabling political structures, about state strategies of 'growth machine' branding* (Slater, 2014).

The preceding critique of urban resilience should be taken into account within the contemporary urban resilience debate. This further validates the conducting of this research masters, in its endeavour to clarify how resilience can be applied within the urban context, rather than imposing what is resilient or not. The following section considers diversity as one of the determinants of resilience.

2.5 Determinants of Resilience

The overall goal of this dissertation is the operationalisation of resilience within the urban context. Resilience is perceived as an emergent behaviour of complex social-ecological systems, rendering the measurement of the behaviour extremely challenging and virtually impossible (Berkes, Colding, & Folke, 2003). However, it is possible to measure what constitutes resilience in social-ecological systems or to utilise proxies for appraisal (Robertson & Berkes, 2010). Diversity plays a principal role in the functioning of cities; economies; ecosystems; human systems; and social-

ecological systems, as well as an essential factor in the resilience of complex systems.

This section will introduce diversity as a concept connecting the fields of interest in this dissertation, viz. urban planning and cities; economic diversity; ecological diversity; and social-ecological systems. From ecological and social-ecological theory, the concept of functional and response diversity (FRD) is expanded as a principal determinant of resilience in social-ecological system (Elmqvist et al., 2003; Mori et al., 2012; Robertson & Berkes, 2010). The application of this concept to the urban social-ecological system is subsequently elucidated.

2.6 Diversity as a Bridging Concept

Diversity, similarly to resilience, is a complex term to delineate, with definitions varying throughout various, diverse associated fields and perspectives. Each discipline, inclusive of biology; sociology; urban planning; economics; architecture and physics, categorises diversity uniquely, with the term interpreted differently by each field, although certain similarities exist. As diversity forms a major component of this study, there is a requisite for an understanding of why it is deemed important and pursued.

In attempting to transfer ecological concepts to the urban context, it is necessary to comprehend the connotations of the term in each field of interest, i.e. ecology, resilience theory and urban planning or management. This research endeavours to establish the significance of diversity in ecology, in consort with resilience related to diversity, subsequently extrapolating this into the urban context. This is critical to establish what diversity signifies through a resilience lens or perspective, towards formulating an appropriate theoretical framework to understand urban resilience. Thereafter, the term can be utilised as a connecting structure between the fields, offering a unique window into cognising cities as SES.

At its core, diversity is an attribute of a system (incl. complex systems) *"whose elements may be apportioned into categories"*, which directly associates its value to a variety of fields, from ecology to economics (Leonard & Jones, 1989). Diversity can *"provide insurance, improve productivity, spur innovation, enhance robustness, produce collective knowledge, and sustain further diversity"* (Page, 2011, p. 3). Stirling (2007) examined assorted utilisations and interpretations of diversity, in an attempt to reveal certain trends, ultimately culminating in, and informing, a general framework for diversity. The author describes three basic principles that constitute diversity, evident in the predominance of involved fields, termed *"variety, balance and disparity"* (Page, 2011, p. 2). All three of these principles are conjoint components of diversity and are insufficient properties individually.

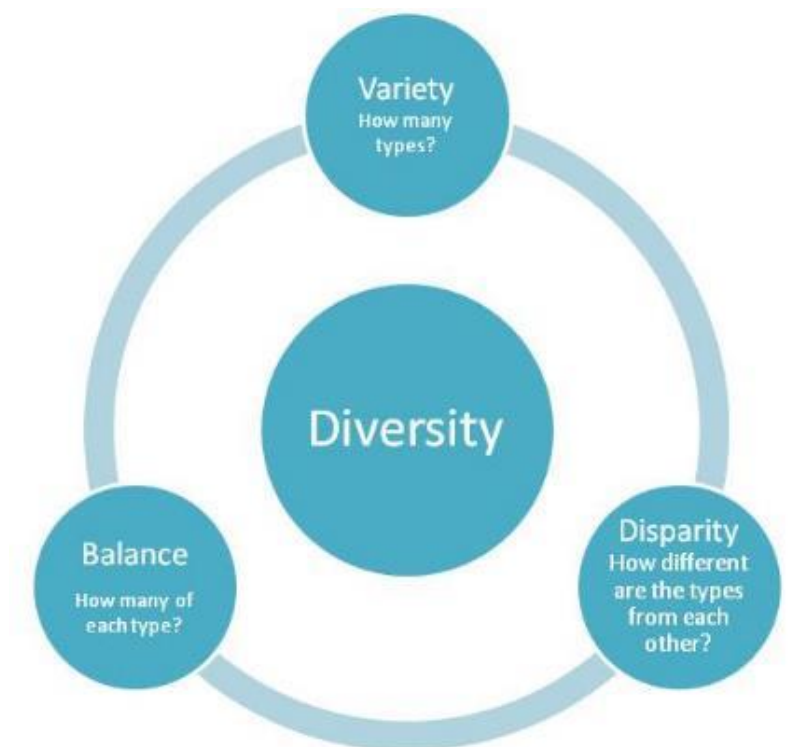


Figure 12: The components of diversity identified by Stirling (2007) as adapted from Kotschy, 2013

Variety refers to *"the number of [identity] categories into which system elements are apportioned"*, which enumerates the kinds of components within or resolves the question *"how many types of thing do we have?"*

(Stirling, 2007). Relative to ecology, the varied types of species can be identified through ecological diversity indices, assessing species richness within an ecosystem. Alternate fields utilise different criteria, for example economics, wherein inventory comprises varieties of firms and products within a sector or place.

Balance “is a function of the pattern of apportionment of elements across categories” which answers the question “how much of each type of thing do we have?” (Stirling, 2007, p. 709). Balance, in an ecological context, constitutes the distribution of species in an ecosystem, based on their relative amount or abundance (“evenness” in ecology). Generally, within an ecosystem, a few species dominate the environment, with lower proportions of a diverse, multitude of species, resulting in a hollow curve of distribution. This principle is used in various economic models that explain ‘concentration’, for instance the Gini coefficient, which demarcates the distribution of income with varying levels of inequality (Gini, 1912). Additionally, Salat (2011) exploits this natural distribution or concentration of activity, applying the inverse Power Law to the urban context.

Disparity refers to “the manner and degree in which the elements can be distinguished” answering the question “how different from each other are the types of thing that we have?” (Stirling, 2007, p. 709). This principle, *vis-à-vis* ecology, delineates the assorted ways in which individuals/species differ from each other, based on certain characteristics, attributes or aspects, inclusive of function; morphology; composition; size etc.

Analogously, similar elements of diversity are evinced in the work of Page (2011) and Salat (2011), with the primary delineation of their arguments depicted in Figure 13. Salat (2011, p.489) defines diversity as referring to “the mix and variety of objects of a similar scale, for example, the diversity of land use or of housing size on the scale of a district. Unlike spatial distribution, diversity focuses on the proportion of different objects not on their more or less homogenous location of space”. He utilises the concept of diversity to assess the complexity of urban form and successively, the resilience of thereof.

Each of the elements of diversity constitutes a crucial facet of resilience and ecosystem stability, including functional or ecosystem function resilience. For example, disparity creates the foundation of functional redundancy and resilience, as expounded later in this section.

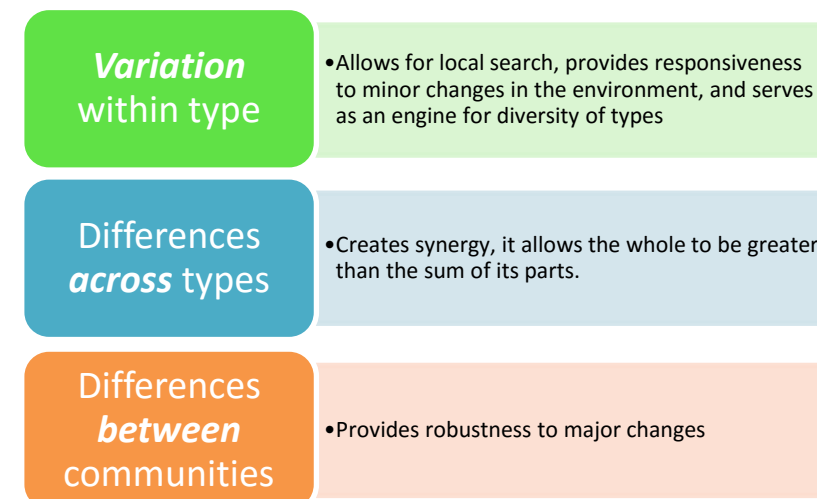


Figure 13: Types of diversity as described by Salat (2011)

2.6.1 Social or Human Diversity

Diversity within the human or social context stems from diversification or difference within and among individuals. The distribution of a variety of “attributes, cognitive functioning and beliefs” tends to fluctuate according to demographic variables, inclusive of age, race and gender (Cox & Blake, 1991). A social mix refers to assembling, in a single location, “different populations having diverse income levels, ages and origins” (Salat, 2011, p. 491).

The power of diversity is frequently analogised or equated to metaphors, axioms or sayings for instance “two minds are better than one”; however, Page (2007) asserts that the benefits of diversity profoundly extend beyond this, and are tangibly demonstrable in distinct groups, firms, schools and societies. This author’s intense and comprehensive knowledge and conceptual application of diverse groups, has rendered key insights as to the reasons for their enhanced functioning, in consort with their provision of more novel and innovative solutions. Beyond the obvious cultural (or

identity) diversity inherent in our society, the introduction of individual perspectives, experiences and life histories into a diverse group, constitutes the most important and fundamental component of diversity (Page, 2007, p. 23).

There are three primary assertions pertaining to diverse groups, viz. diverse perspectives and tools that enable these groups to find more, innovative and enhanced solutions, contributing to overall productivity; diverse groups can make more accurate projections and forecast, through the use of assorted prediction models; and diverse fundamental preferences can oppress, restrain or hinder selection or decision making processes (Page, 2007 & 2011). Organisational competitiveness can also be augmented and enhanced by diverse work groups, through improved creativity, enriching problem solving and intensifying flexible adaptation to change (Cox & Blake, 1991, p. 54).

In addition to the relatively small level analysis of the diversity of groups of individuals, the benefits of diversity are observable on a city level. Page (2011) logically indicates that cities should contain exponentially greater diversity, rendering a variety of agglomeration advantages possible. Jacobs (1961) asserts that ‘spill-over’ can occur on varying levels, whether internally within an industry or flowing across industries. In this instance, spill-over denotes the transfer of industry innovation (knowledge) to another industry due to physical or alternate propinquity or close proximity.

2.6.2 Economic Diversity

Economic diversification has an integral, enduring and continuing role in the cities’ and national economies. The significance of economic diversification is exemplified by the City of Detroit recently declaring bankruptcy following a major economic decline, consequent to the closure of an industry which dominated the area. A primary problem, evident in Detroit, and applicable to any other city or town, constitutes the overreliance on a single economic sector, for instance, as in the exemplar, specialising in automobile manufacturing, creates vulnerability, potentially dire consequences and

fragility in the event of the specific sector fluctuating or collapsing (Thomas, 2013). The diversification of activities or sector development in cities produces more robust economies, capable of withstanding a degree of economic malfunction or decrease, with the agglomeration advantages associated with cities, additionally, resulting in innovation and the reciprocal flow of new ideas, creating progressively diverse economic environments (Jacobs, 1969).

In economics, portfolio hypothesis or effect is frequently exploited in investment and stock holding practices, wherein investment diversification minimises the risks associated with volatile markets. The diversification of investment by retail conglomerates reflects this trend of 'risk spreading', leveraging funds through multiple investments, frequently in unrelated fields. The portfolio hypothesis has been employed by ecologists to reveal the relationship between stability and diversity in providing more stable ecosystem services (Tilman, Lehman, & Bristow, 1998). The principal premise of this hypothesis is encapsulated by the adage: *"don't put all your eggs in one basket"*. The ensuing division reviews the application of diversity in urban planning and cities.

2.6.3 Diversity in Urban Planning and Cities

In urban planning or management, diversity comprises a variety of forms and purpose differences. Diversity is a principal factor and concept in planning and creating sustainable, vibrant neighbourhoods (Jacobs, 1969; Talen, 2006). Diversity is distinguished into distinct categories, the primary of these comprising social, economic and the built environment or urban morphology. Frequently, diversity is utilised to refer to a specific objective of urban managers and planners, employed towards developing or re-developing an urban space to achieve a desired outcome. Issues of place diversity, raised by Talen (2006), have highlighted the debate concerning the role of design in creating diversity. Diversity is often expressed in demographic terms within the planning field as well as in 'mixed-use' areas.

Diversity is seen as a primary generator of vitality, as it increases the interaction among multiple urban components. A densely composed, ingrained diversity of practices, functions and usages provides continuous reciprocal support, with Jacobs contending that planning must become *"the science and art of catalysing and nourishing those close-grained working relationships"* (Jacobs, 1961). Occurring predominantly through modernist planning edict, the approach adopted towards the separation of land usages is deemed 'anti-city', destroying the factors which generates the energy, dynamic nature and vitality of an urban centre (Mumford, 1968, cited from Talen, 2006). Furthermore, Jacobs (1961) identifies that urban diversity is actually structured, organised and coordinated complexity, asserting that an inadequate, or deficiency of, diversity denotes a lack of order, thus a loss of complexity. In addition, this author, recognises that redundancy has a potentially crucial role in the continued provision of critical services.

The following section introduces ecological, as well as functional and response diversity, as fundamental facets of retaining environmental resilience.

2.7 Ecological Diversity through Functional and Response Diversity

The study of diversity in ecological science and biology comprises several, varied forms and dimensions. One application of diversity arises from conservation biology. Biodiversity, in conservation bionomics, relates to the quantity and extent of biological diversity in a specific ecosystem, region, country or even the overall global milieu. The popularised version of biodiversity, accentuated by Edward O. Wilson, was utilised to expose the impact of human development on ecosystems and species loss (Wilson, 1999). The author distinguishes, however, that diversity in ecosystems does not merely consider the number of species, but also in the functioning of the biological system, therefore takes into account the interaction within and among species (Maclaurin & Sterelny, 2008, p. 2). Traditional diversity measurements, for instance species richness, although important, are not

adequate measurements when appraising ecosystem resilience and stability (Mori et al., 2012). Similarly, Walker (1992) asserts that conservation practices focussing on individual species (through species richness assessments) are ambitious and impressive, but ultimately extremely challenging to implement, as these interventions may not necessarily protect related species. This expert advocates, as an alternative, an ecosystem function approach, accentuating the import of the resilience of functional groups, not exclusively of individuals. Functional group composition and dynamics (functional redundancy), together with responsiveness to ecological change (response diversity), is fundamental to ecological functional integrity (Mori et al. 2012; Elmqvist et al., 2003 & Chapin et al., 1997).

Holling (1973) deems that the control of ecosystem function is critical to an ecosystem's resilience when contending with change. As a determinant of ecological-resilience, functional response is based on the concept of functional groupings, which provide for a certain specific function, for example predators acting as consumers, their function being consumption (Elmqvist, et al., 2003, p. 489). The responses to this exemplar of a specified ecological function encompass an array of predators, ranging from lions to large birds of prey, i.e. across scales. Response diversity is categorised *"as the range of reactions to environmental change among species of the same function, [which] is critical to resilience, particularly during periods of ecosystem reorganisation"* (Elmqvist, et al., 2003, p.490) Walker (1992, p.21) contend that the more functionally similar species within a functional group exists the *"greater resilience in responding to environmental change, if those species differ in environmental responses"*. Moreover, this can be considered functional redundancy, wherein the reactions to a function fill ecological functional gaps (niches), occurring if other species are eliminated or their respective functional characteristics become suppressed.

This colligates to the biodiversity 'insurance hypothesis', as redundant species insure sustained and continued ecological functions in the circumstances of ecological alteration and uncertainty (Mori et al., 2012, Yachi & Loreau, 1999; Nyström, 2006). This is deemed essential for management practices endeavouring to protect the critical ecological functions and services on which humans rely.

Ecosystem functions typically comprise a group of species or organisms with similar functional traits. Conducting the functional trait identification of species can be challenging, as species can have a variety of attributes or their traits can overlap into other functional groups (Nyström, 2006, p.31; Chapin et al., 1997). Functional redundancy (species richness) denotes functions and functional niches fulfilled by multiple species. This expands the relationship among species richness, functional group composition and replication of function or 'functional redundancy'. Redundancy, in alternate disciplines' utilisation and application of the term, is frequently attributed with negative connotations. Conversely, this fundamentally differs in ecological scenarios; in ecology redundancy refers to duplication, with replacement substitutes or insurance, which enhances stability or the resilience of function. A functional group containing multiple species with similar functional traits is stronger, more robust and less vulnerable than one comprised of a single species. This constitutes a significant characteristic of a functional group, with a reciprocal association apparent, the greater the diversity of species the more stable the functions, rendered by the substitution, by an alternate, of an eliminated or reduced species, although the system dynamics and characteristics will differ. However, the introduction of new species for the purpose of increasing functional redundancy may render extensive unintended consequences (Folke, et al., 2004, p. 570). If an entire functional group, for instance apex predators, is eradicated there can be major impacts on ecosystem functionality, consequentially affecting ecosystem services (Walker, 1992).

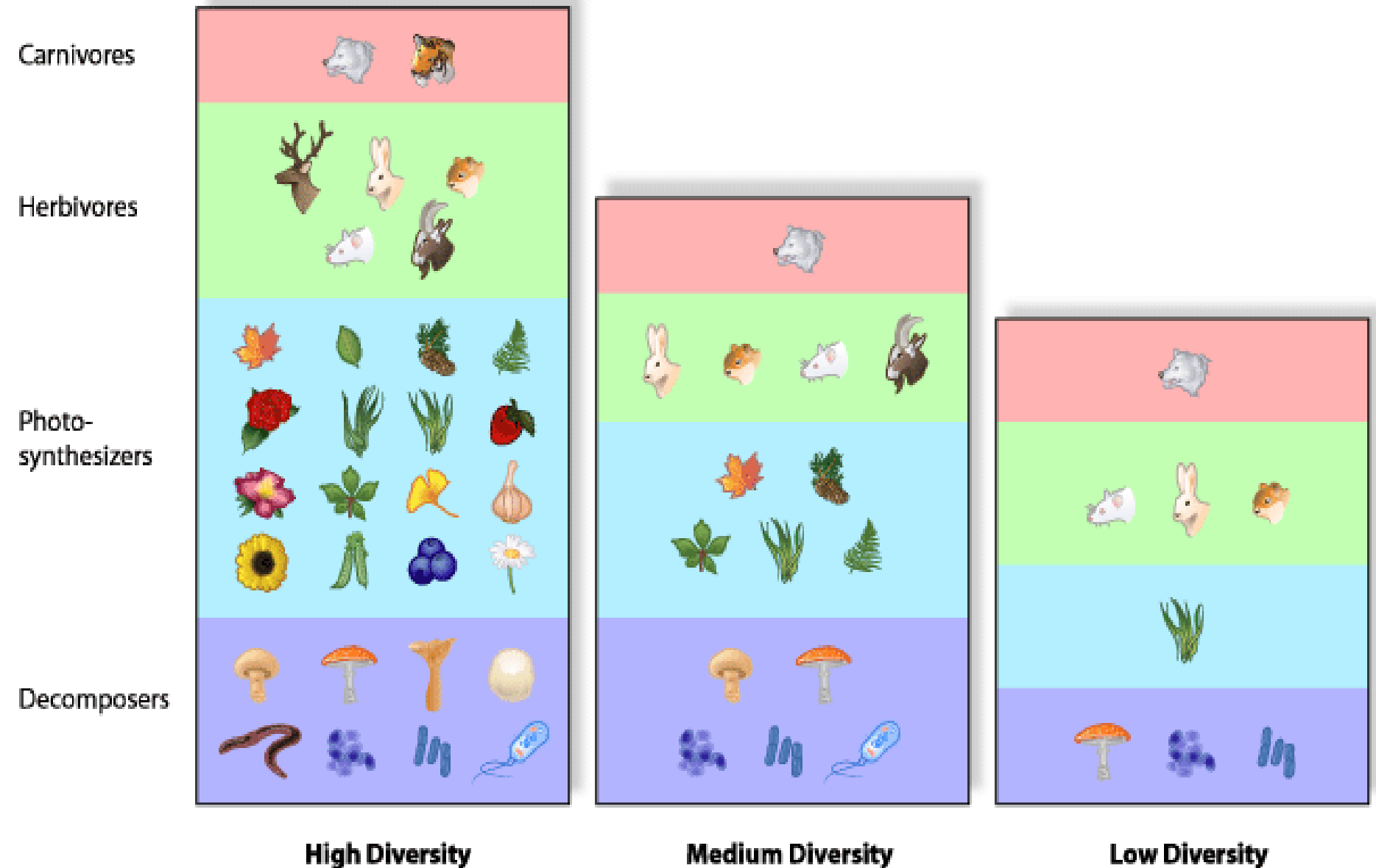


Figure 14: Functional Diversity/Redundancy and Response Diversity in Ecosystems.

Functional diversity is illustrated by the various functions on the left, ranging from carnivores to decomposers. Each function has a variety of species with similar functional characteristics. The highest diversity is to the left, influenced by both the number of functions and the species with similar functional characteristics. Response Diversity refers to how each the species responds to ecosystem change (www.crd.bcc/protection/concerns/biodiversity)

CHAPTER 2: THEORETICAL UNDERPINNING

The capability of systems to cope with ecosystem modifications constitutes a crucial concern in ecosystem management, especially in instances of massive ecosystem degradation generated by human activities.

Furthermore, elucidating and interpreting the multi-scale nature of functional groups within ecosystems is critical to management practices (Nyström, 2006). In addition to functional effect traits, species exhibit response traits (i.e. how the species responds to ecosystem change), which are affected by the level at which the species operate (spatial and temporal). Mori et al. (2012) clearly portrays this in Figure 15, averring that both trait types exert impacts and influences on the vulnerability and resilience of a functional group. In the representation, the Functional Group (FG) refers to a hypothetical functional group, with each symbol representing a different species and the symbol shape denotes the functional effect traits that a species renders. The shading on the symbols refers to the magnitude of these functional response traits, where black/grey/white respectively corresponds to high/medium/low levels of vulnerability. The species richness in each functional group determines its functional redundancy. Each functional group's order of vulnerability to environmental pressures is established from the diversity of response traits as well as species richness. The concept of time and redundancy is illustrated in Figure 15. Certain species with similar functional traits but divergent response traits may be dormant for years and then become active. This flux signifies that functional groupings will respond differently to ecosystem alteration at varying times.

Species within functional groups operate on various scales, with particular constituents of greater importance. Due to the dynamic nature of the ecosystem, this relationship is also in constant flux. As stated, certain species may be suppressed within a particular duration, becoming active, or reactivated, if the correct environmental triggers occur, increasing their contribution. This is exemplified in coral reef systems when predator species are removed or extensively reduced and urchins become

overpopulated. Ultimately, this can cause the destruction of the entire coral reefs, as urchins would ordinarily exert a less profound impact as they usually inhabit the system in limited numbers (Nyström, 2006, p. 31). The import or contribution of each species to a specific function varies over time. The guild structure³ of functional and sub functional is founded on the conception of compensatory species dynamics, which forms the basis for Guild Resilience (Mori et al., 2012).

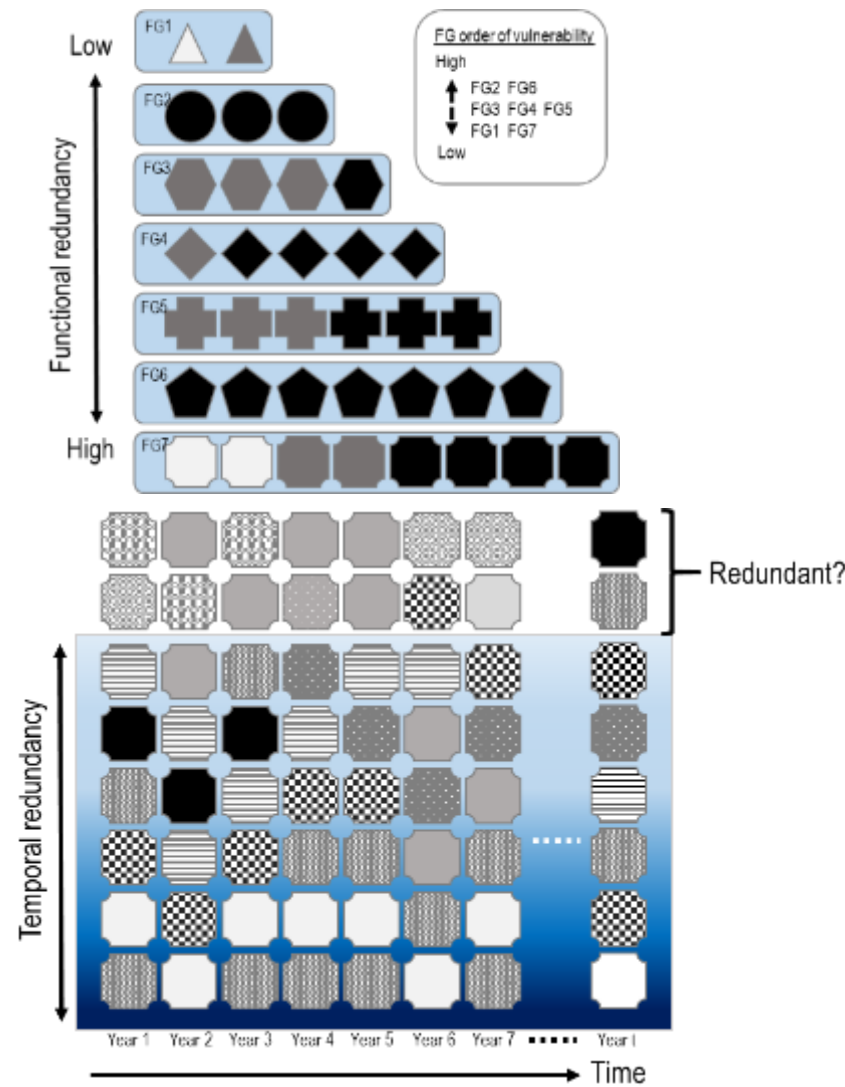


Figure 15: Mori et al., 2012 describes the difference between functional redundancy and response diversity the figure above. The concept of time and redundancy is illustrated the figure below.

³ As described by Root (1967) an ecological guild is a group of species that "exploit the same class of environmental resources in a similar way" (p.346). The species within the guild have similar ecological roles but they do not occupy the same ecological niche (Koman & Adamik, 2007).

Ecosystem resilience is reliant on whether the ecosystem can remain within the same domain of attraction or, conveyed succinctly, the ecosystem does not shift into a different regime (Figure 16). When an ecosystem undergoes a shift in regime or phase, it affects the ecosystem services produced, successively impacting the associated, dependent human systems (Folke, et al., 2004). Regime shifts due to human activity on ecosystems have been identified in various studies of coral reefs (Bellwood et al., 2004), as well as in other scrutinised ecosystems.

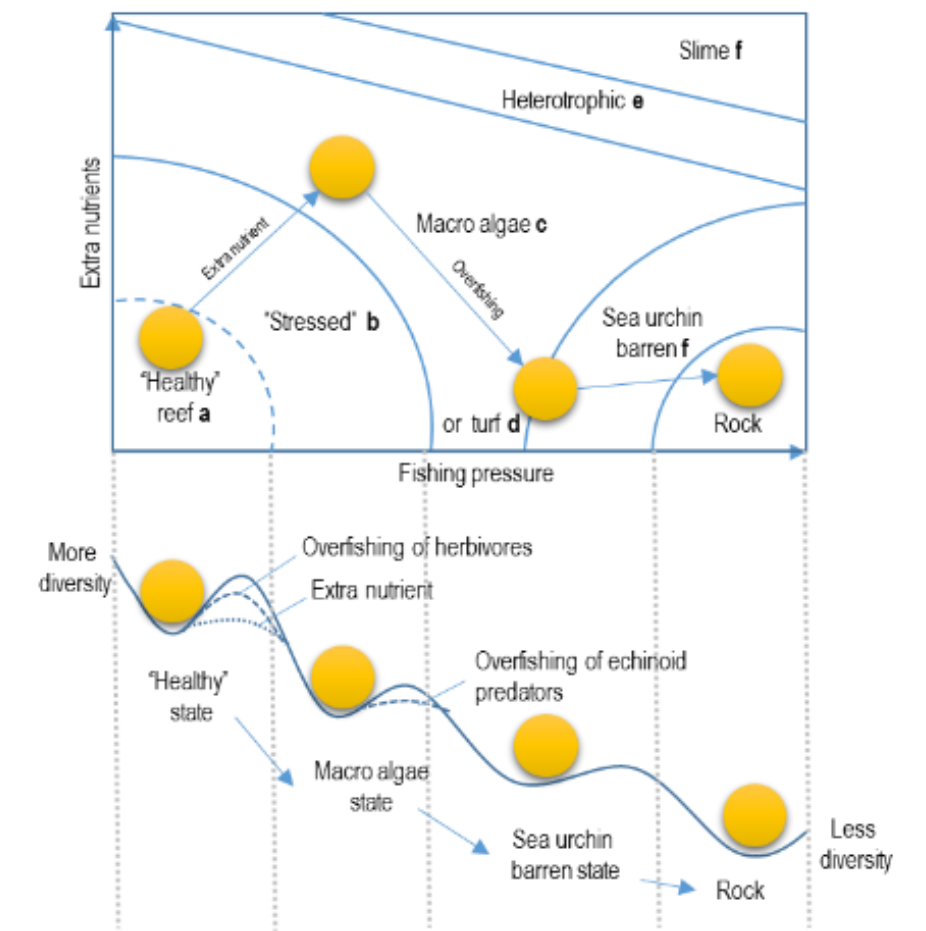


Figure 16: System states and ecosystem change (Bellwood et al., 2004).

This introduces the time and scale facets in the functional response diversity relationships of species in the same functional grouping. As delineated in Figure 17, Elmqvist et al. (2003) elucidates the spatial distribution of species

in providing functions. The protection of functional and response diversity is essential to maintain a healthy status in ecosystems.

The second component, response diversity, refers to the plethora of reactions, rendered by the individual elements, or the functional groupings, of the system, towards a perturbation or disturbance. The differing reactions, or diversity as to how the individual components respond, i.e. the adaptive response, is also crucial in situations of reorganisation or disruption. Multi-scale interactions between responses have been studied from an ecological systems perspective. Elmqvist, et al. (2003) created a multi-scale model based on the response diversity of herbivores found in a coral reef system (Figure 17). Response diversity exists because a variety of species operate at different spatial and temporal scales. Commonly, disturbances to ecological functions only affect certain responses to the function, implying that other scales are undisturbed and can persist. Allenby (2005, p. 145) contends that an increase in responses to a particular function can create resilience. He exemplifies this by describing an ecosystem in which an unexpected event has eliminated a species, but other species (one or more) are interposed to fulfil the same ecological niche. Thus, the integrity of ecological functionality can withstand the unexpected event.

2.7.1 Applying Functional Response Diversity

Ecological systems are able to adapt (within limits) to changing circumstances, and Salat (2011) asserts that the same characteristics can be ascertained in cities. The author contends that ecological theory can be applied to cities, as they have, historically, demonstrated their capacity to adapt to altering conditions. Change is a potent and compelling agent in the development and evolution of both cities and ecosystems, however, it is the manner by which this adaptation and adjustment occurs that is deemed of import and of consequence. Functional and Response Diversity (FRD), as explicated in the preceding section, can prove critical in the persistence of, not only functions, but the ecosystem as a whole.

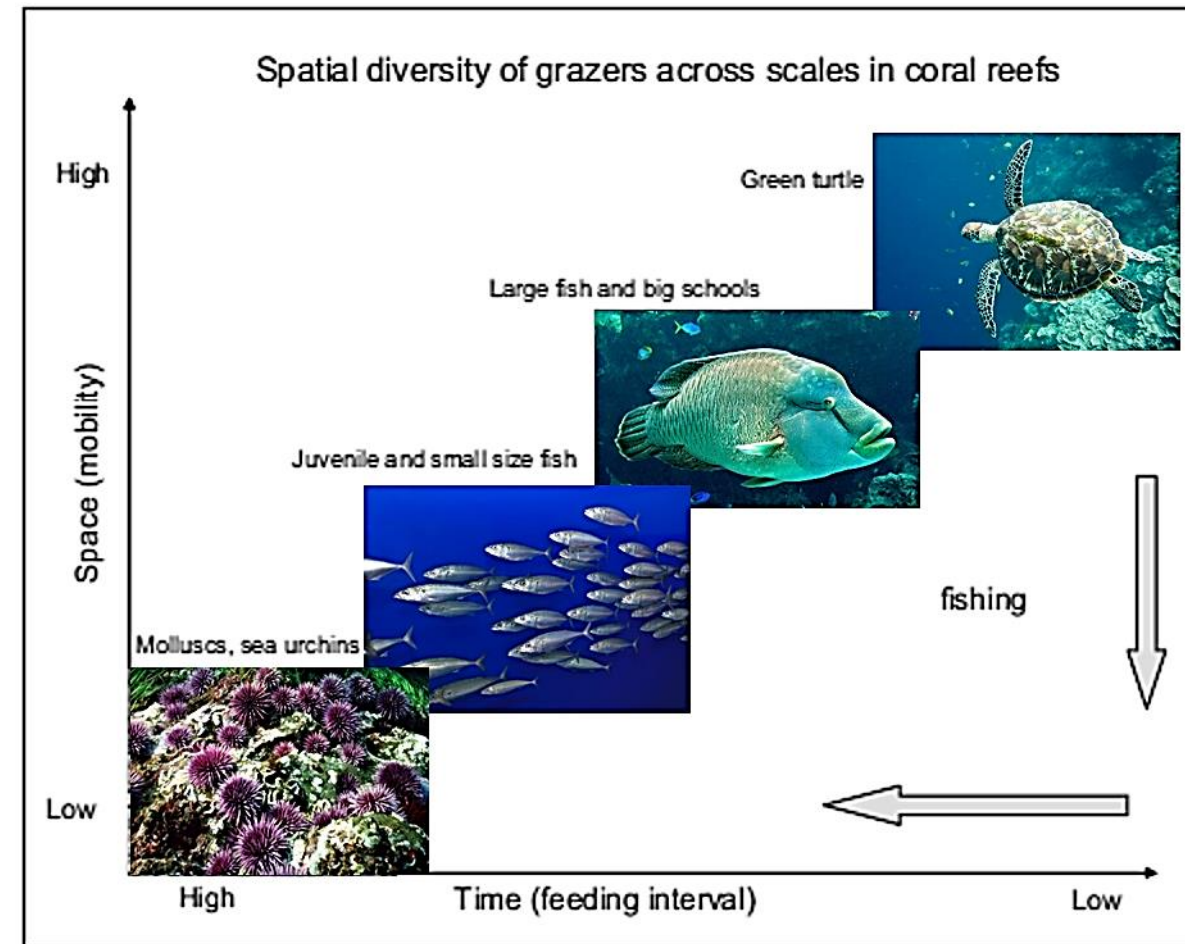


Figure 17: The multiple-scale nature of response diversity in the functional group of herbivores of coral reefs. Response diversity is enhanced by species operating over a broad range of scales. Over-fishing of large species has resulted in a situation where grazing entities have become over-abundant (Elmqvist et al., 2003).

FRD is conceptualised from the perspective of an ecosystem with various species with similar functional characteristics. However, the connotations of FRD in the urban context are unclear. As previously established, FRD is crucial in ecological system resilience and cities can be seen as SES (Resilience Alliance, 2010). Hence, the deduction from this contention could infer that FRD will be critical in human-dominated social-ecological systems. Leslie and McCabe (2013, p 114) aver that this would be valid in human-dominated systems and, in their study, focus on how heterogeneous human decision making, in terms of changing circumstances, has impacts on the functioning, as well as the resilience of social-ecological systems. This argument is put forward from the role of Response Diversity in ecosystem resilience.

Their research indicates the difficulties inherent in measuring resilience in a CAS, for instance a SES, but the elements that constitute resilience are a more effective appraisal instrument. Resilience is considered an emergent property of a complex system, rather than a directly measurable characteristic and 'surrogate' or proxy indicators are advocated in assessing resilience in social-ecological systems (Robertson & Berkes, 2010). Table 1 demarcates the proxy indicator sets utilised for evaluating resilience in two case studies on pastoralist communities, located in Kenya and Tanzania. Decision making was investigated at various scales, which extended from government intervention down to a village's land use allocation decisions, and which can exert regional social-ecological impacts (Leslie & McCabe, 2013). Response Diversity can be considered an

ambiguous duality, as the assorted, associated individual's reactions to alterations or fluctuations may be synergistic or contrastingly destructive. The case studies revealed that one actor's reaction to change can have a detrimental effect on the others' capacities to respond (Leslie & McCabe, 2013, p.120). This contributes an interesting potential research undertaking, investigating how people respond in different ways (response diversity) to change (perturbation), including across scales (through individual; household; community; to national levels).

| | Turkana | Simanjiro |
|---|--|--|
| System State (resilience of what) | <ul style="list-style-type: none"> Adequate livestock/human ratios | <ul style="list-style-type: none"> Secure livelihoods for local population Biodiversity (wildlife) maintenance |
| Perturbations (resilience to what) | <ul style="list-style-type: none"> Herd loss from drought, disease, raiding | <ul style="list-style-type: none"> Herd loss from drought, livestock disease Conservation policy (park expansion, land use restrictions) Immigration Land use/land cover change |
| Resilience Indicators (surrogates or proxies) | <ul style="list-style-type: none"> Extent of exchange networks Diversity of management strategies (species mix, movement) of families Diversity of management strategies within exchange network Expansion of family network to settlements and towns Innovative defensive formations | <ul style="list-style-type: none"> Diversity of livelihood options open to families Accessibility of resources (water, pasture/browse) to livestock and wildlife Distribution of costs and benefits of conservation and tourism Maintenance of institutions that facilitate restocking by redistribution of livestock and mobility and resource access across sectional boundaries |

Table 1: Proxy indicators of resilience for Turkana and Simanjiro social-ecological system (case studies used) (Leslie & McCabe, 2013, p.126)

Similarly, as averred by Du Plessis (2012), social-ecological systems, with humans as the dominant species, have functional categories/groupings, which are determined by the users and resources of the urban environment. These groupings or categories are crucial to the continued functioning of the system, as they represent critical functions. In a city, different functional categories can be identified, for example, *inter alia*, business and commerce (distribution of goods and services); residential (domicile/shelter); industrial (production); infrastructure (networks); social facilities (amenities); and

green users (recreation and ecosystem services). Du Plessis (2012) continues that, within these functional groupings, different responses and scales of responses can be distinguished, e.g. in the functional grouping of commerce, responses could range from an informal trader to a large shopping centre. Through incorporating the ranges and scales of responses of the functional groups, multiple redundancies are built into the system, which enhances the functional diversity within the city, sequentially improving the resilience thereof (Du Plessis, 2012). Although the functions of these two commerce responses (informal trader and major shopping centre) can be connected or at least influenced by each other, they cater for different need levels of the same function. The realm of impact or 'influence sphere' of these two responses is prominently dissimilar, i.e. the customer base of the informal trader is relatively small compared to that of the shopping centre (or businesses contained therein).

Considered from the perspective of the second component of response diversity, focussing on the adaptive responses to a perturbation or shock, the variety of reactions to the function render a set of possible responses (Elmqvist, et al., 2003). For example, as elucidated above, in a time of hardship, the smaller scale response to the function of commerce, i.e. the informal street vendor, might change location, type of product sold etc.; however, this is highly reliant on the skills level, capital available and the market to which the trader can cater. The larger responses to the function, i.e. the shopping centre, will have a different set of possible responses, contingent on whether they were previously prepared or had existing strategies for the occurrence, or if their response to the disruption was a tropism, an organic or spontaneous response. Certain people or organisations, however, evince better aptitudes for adaptation to the conditions in which they operate being modified. This capacity for adaptability to changing circumstances is a fundamental characteristic of companies, people, cities and even countries, with continuous and never-ending reinvention, towards being more competitive, simultaneously solving the challenges with which they contend.

2.8 Conclusion

The purpose of this chapter was to form the theoretical foundation of the research study. This was achieved through initially substantiating that cities are both complex adaptive and social-ecological systems. This implies that the resiliency concepts engendered by the ecological fields and studies can be extrapolated and transferred to the urban context, due to their coinciding, overlapping and similar characteristics. Resilience was identified as fundamental in the continued operation of ecosystems and cities. Furthermore, it was recognised that resilience is difficult to measure, which necessitates studying the determinants of thereof. Diversity was distinguished as one of the critical determinants of resilience. Subsequently, the specific concept of functional and response diversity was proposed as an attribute contributing to resilience in ecological systems. The chapter concludes by exploring the initial application of functional and response diversity on human-dominated systems. This chapter facilitates the construction of a functional and response diversity framework for the urban context. The ensuing chapter, in succession, will present this framework; the methodological implements and procedures; and the research approach.

Chapter 3

Towards a framework to apply FRD



The chapter presents the application functional and response diversity through a diversity framework. The chapter explains the relevant components of the framework as it relates to the urban context. The chapter concludes by delineating and reviewing the diversity framework that is utilised to operationalise resilience within the urban context.

3.1 Introduction

The intent of this study is to operationalise resilience, through the use of a functional and response diversity framework. The purpose of this chapter centres on constructing this framework, in order to apply ecological resilience theories to the urban context. The preceding chapter contended that functional and response diversity is crucial to the resilience of functional groups and ecosystems, overall. The application of functional and response diversity to human-dominated systems forms the backdrop for this particular study.

3.2 Components of the Functional and Response Diversity Framework (FRDF)

The application of the concept of functional and response diversity to the urban context requires the adherence to certain sequential steps. The basic layout of the framework is depicted on the following page and is delineated in the stages below:

- Physical boundary selection;
- Functional group selection;
- Describing the retail functional group;
- Classification through diversity framework;
- Structural Functional Diversity Model; and
- Response Diversity Model.

3.2.1 The Boundary Selection

Resilience research, similarly to the majority of research endeavours, irrespective of the topic, requires certain boundaries to be established in order to accomplish the formulated research objectives. Frequently, resilience research relating to social-ecological systems encounters issues of practicality in conducting empirical research due to margins of the investigated subsystem. These boundaries, limits or margins are of a spatial, temporal and substantive nature and, as Nyrström (2006) observes,

is based on the research question and system under investigation. Cumming et al. (2005) contends that understanding the identity of the subsystem or system is requisite, prior to any further exploration or application. The identity of a subsystem is defined by the boundaries (spatial and temporal) created by the researcher to facilitate the investigation of a system's resilience. Analogously, the Resilience Alliance advocates defining the focal system to enable a resilience assessment, i.e. demarcating the boundaries for examination (Resilience Alliance, 2010, p. 10).

This only denotes that the focus is on a particular subsystem or system, and does not mean that the selected scale of analysis is isolated from other scales, whether spatial or temporal. The focal level or point facilitates the operational step of selecting a scale of analysis to bind the study in a practical manner. Boundaries should, however, be permeable and/or flexible in order to accommodate the dynamic interactions among and within the systems or functional group(s) in this study (Resilience Alliance, 2010). Cilliers (2005) notes that boundaries in complex systems do not comprise a limiting or a separating factor, but rather, should be considered as the object thereby contained. This author adds that boundaries exist in, and are maintained by, all living systems and that these demarcations do not separate but intimately connect and complect the system with its environment. The ensuing section explains the physical/spatial and functional boundaries utilised to conduct this research study.

3.2.2 Physical Boundary Selection

The spatial boundaries selected for this exploratory endeavour are based on Salat's (2011) work on urban morphology and urban resilience. Salat delineates an 800m X 800m (640 000m²) block to utilise in the analysis of the built environment, incorporating multiple facets and categories, inclusive of, *inter alia*, complexity; diversity; mobility; and access. The standardisation of the spatial boundaries opportunities for comparisons of a variety of morphological arrangements, within the analysis parameters constructed by Salat. Contextually, in the majority of ancient European urban centres with

enduring legacies, this precisely defined 800m X 800m block area contains virtually all of the components of these cities' historical cores. Moreover, proponents of New Urbanism employ a 400m radius as a development guideline, for example to enable a neighbourhood or city to be more compact and accessible, especially for pedestrians and non-motorised transportation. Salat (2011) analysed an array of aspects, among which the complexity of urban form and, by extension, diversity, are considered imperative for creating a resilient urban form. Certain of the analysis techniques employed in his investigative research have been adapted by this study, towards explicating the space-diversity relationship, thus the adoption of the 800m X 800m block to frame or delineate the study locale.

This physical boundary selection facilitates the comparison of the demarcated section with alternate case study areas, incorporating domestic and international examples. Furthermore, this study takes into account that the selected demarcated, extracted portion, operates within, the greater urban domain, and not in isolation, ensuring permeable boundaries, which contextually situates the study area within its milieu.

3.2.3 Functional Boundary Selection

The core rationale for this study constitutes the application of ecological concepts to the urban context. This is achieved through extrapolating the concept of Functional Response Diversity and applying it to a selected urban function. For the application to be possible necessitates that this function fulfils certain characteristics, viz.:

- The function must be critical to the continued existence of the larger social-ecological system;
- The functional group must comprise a diverse number of entities;
- There must be an observable hierarchy within the functional group; and
- It is necessary that the function can be observed, measured and/or analysed with relative ease by a researcher.

CHAPTER 3: TOWARDS A FRAMEWORK TO APPLY FRD

The principal focus of this study, the retail sector, is not confined by the stipulated physical boundaries of this investigation. As previously mentioned, retailers function through consumer spending and particular market thresholds, in order to operate. This means that retailers' reliance on local consumers is supplemented by patrons travelling distances, dependent on the size of the operation, in consort with the collective drawing power of all retailers in the area (agglomeration of retail activities). This signifies that, from a functional perspective, the study's physical boundary is not limiting, as the larger context is taken into consideration. The functional delineation of the larger socio-ecological system (the city) creates critical subsystems, constituting the greater structure. Within the functional distinction of a system, most frequently the interactions, links and relationships of components are more important than the individual elements, designating that an understanding of the dynamics of the functional group as a whole is required. The succeeding section explains the composition of the retail functional group.

3.3 Understanding the Retail Functional Group

To understand the functional group, it is necessary to comprehend and interpret the constituents and composition of the group. In this research, this comprises the entities fulfilling the function, i.e. what retailers make up the larger retail functional group. Mori, et al. (2012) and Elmqvist, et al. (2003) indicate that an ecosystem function consists of a variety of 'species' (or individuals/retailers) with similar functional traits, thus performing the same functionality. This indicates that the retailers' equivalent within an ecosystem would constitute the species (discrete individuals/subgroups) with the same functional traits (functions), for example grazers in a coral reef, ranging in scales and spatial dimensions.

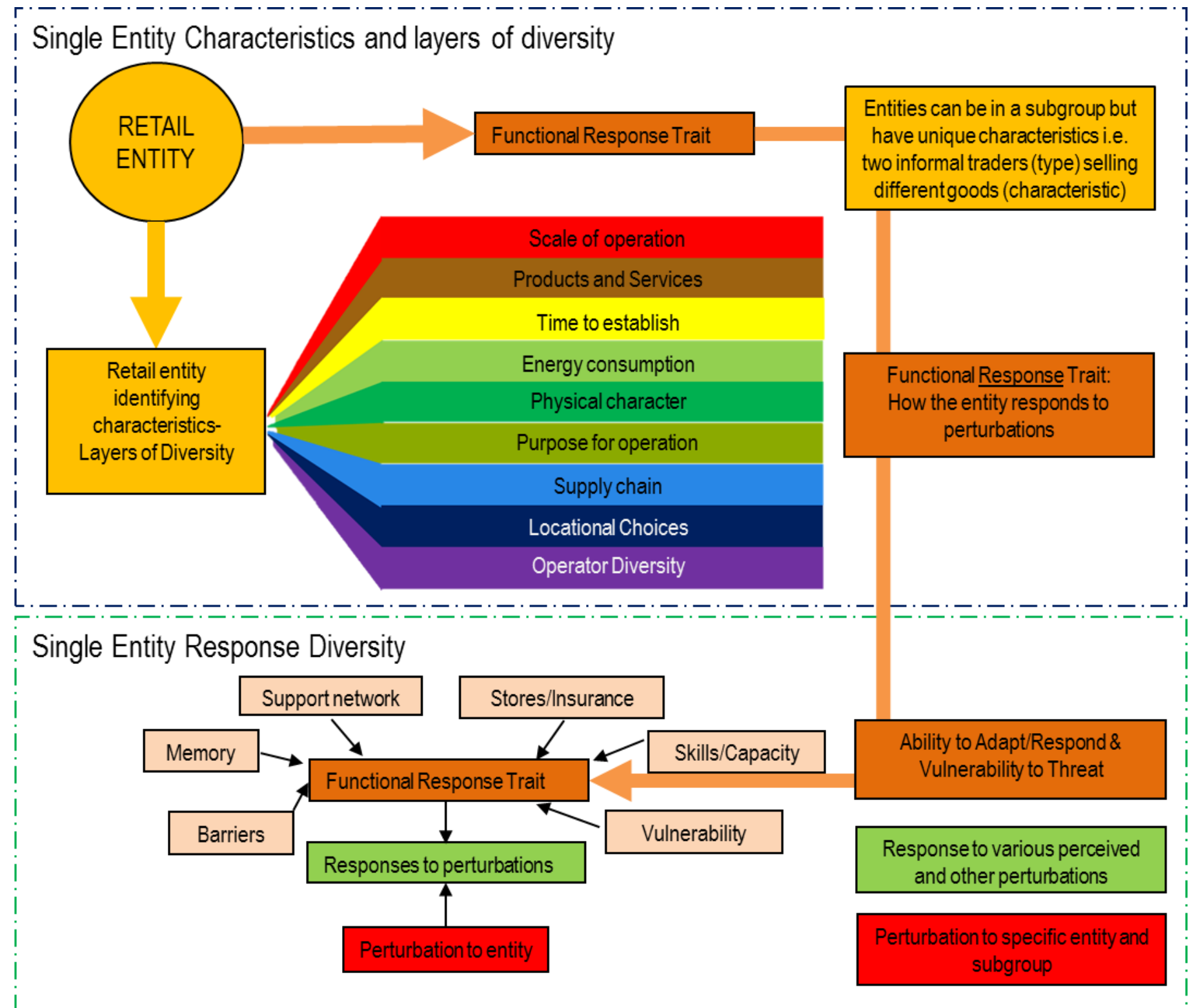


Figure 18: Functional Response Diversity as applied on a single retail entity

The first step of the application process is delineated through the identification of discrete retail entities. The second step constitutes the response diversity that each retail entity exhibits, through their ability to respond to perturbations (perceived or not). Redundancy and resilience of the individual can be 'stored' within the diversity in both categories of diversity, viz. functional (characteristics, thus exposure to risks) and response diversity.

CHAPTER 3: TOWARDS A FRAMEWORK TO APPLY FRD

In addition to “species richness” (different retailers), the interactions between individuals in the same functional group are intrinsically significant towards to construing the systemic dynamics existing in a functional group.

Each merchant in the retail functional group has certain, identifiable characteristics that define it (see Figure 18). These attributes are, however, not individually unique, because retailers share functional traits that can form sub-assemblages among them (retailer types). Within these retailer types various distinguishing characteristics provide ‘layers of diversity’ within the functional group, for instance the scale of operation of a specific retailer, location of trade etc. Thus, each retailer, concomitant to their characteristics, has a certain ability to respond to perturbations (adaptive capacity). Furthermore, the disturbance may exclusively affect only one sub-group, resulting in the overall survival of the functional group should the affected assemblage collapse.

3.3.1 Classification of Retail Activities

The initial stage step in establishing the constituents of the retail functional group involves exploring the physical manifestations of the retail activities’ function in the case study area. This was achieved through a retail count and the classification of each retail activity. Classification was based on various categories, in order to differentiate retailers in the functional group, all providing the same overall function of retail (see retail count and classification section below). The classification is utilised to investigate the hierarchical nature existent within the functional group, to facilitate the examination of the functional group dynamics, in consort with why the hierarchy exists (as well as functional redundancy).

The hierarchal structure of the functional group also gives insight into the response diversity of the functional group. Within this process, interviews with retail entities are conducted to specifically explore certain elements of the functional group, which are not necessarily physically manifested. Furthermore, the link and relationship with other functions were evaluated, through land use surveys and critical observations of retail activities in relation to the rest of the environment. The initial step contributes the basis

for the second stage, as it requires a representative sample of the population group (strata in the retail functional group) in order to deduce some explorative conclusions.

The second step in this research process entails revealing the response diversity of the functional group to perceived change and perturbation. This is founded on the capabilities, competencies and capacity of each of the retail entities, allowing them to respond to changes, whether economic, social or otherwise. The assessment of response diversity in ecology, reveals that because a multitude of species exists, operating on different spatial scales and exhibiting different characteristics, they are able to respond differently to ecosystem changes, indicating that if one species is eliminated from the ecosystem the function may be able to continue (see the functional and response diversity section in Chapter 2). Taking this, along with the preceding step of identifying the retail entities and the hierarchy/panarchy of the functional group, into account, creates the basis for the establishment of the response diversity of the functional group. This concept is developed from the presumption that each of the retail entities contend with specific, individualised and common threats and, in consort with their characteristics, are able to adapt or respond to dangers in different ways. Figure 18 portrays the process undertaken in the investigation of the retail functional group.

3.3.2 Retail Classification and Research Classification System

The existing retail classification systems have a vast, varied and extensive diversity and purpose. These range from shopping centre classification systems, which position shopping centres according to size; purpose; tenant mix; or market share, to international classification systems of individual retailers. There is minimal established information and knowledge pertaining to categorisations combining smaller individual merchants with larger retailers. The Head of the Shopping Centre Association of South Africa asserts that comparative market studies, including informal retail activities, are generally infeasible, due to the lack of available and useable data in terms of activities (Gaddy, 2013). The Business Sophistication

Measure, which characterises retail activities according to various parameters, constitutes an example of a model that coalesces both formal and informal activities (See Annexure D1). This Measure was developed by Dr Clive Corder and Prof. Jacky Galpin to classify small businesses in Gauteng. The majority of small businesses in Gauteng (82%), and by implication Tshwane, are informal and unregistered, often escaping traditional classification systems, which concentrate on businesses that are registered for tax, in consort with additional, alternate indicators (African Response, 2006).

This study proposes a simplified model of retail classification, which incorporates all the forms of retail activities and is relatively easy to implement. It utilises an identical set of parameters on all retail types, revealing the differences between the retail activities, in order to distinguish the panarchy within the retail functional group. Various existing classification systems are exploited to ground and inform this categorisation endeavour, inclusive of the aforementioned classification of shopping centres, which catalogues different centres through various criteria and factors, considering, *inter alia*, the market served; purpose; tenant mix; and location.

The retail function is contributed by multiple providers with their own unique characteristics or layers of diversity, extrapolated in detail in the following sections. It is deemed noteworthy that the function of retail activity is constructed out of individual retailers and collective groupings, exemplified by shopping centres or the non-planned city centre retail agglomerations. Within the retail functional group, broad categories are introduced that differentiate the discrete retailers in the study area. The retail classification is constructed by legal and other factors, which are elucidated throughout

CHAPTER 3: TOWARDS A FRAMEWORK TO APPLY FRD

this chapter. Individual retailers are grouped and designated into various initial groups, viz. Mobile Traders; Street Traders; Individual/Independent Shops; Chain Stores; and Wholesalers. Additionally, Collective Retail Entities are also identified, including Markets (flea markets); Arcades; and Shopping Centres. Finally, it is advanced that all the retail activities whether formal or informal, large or small, have a collective functional logic and drawing power for consumers.

3.3.3 Describing the Functional Group

The principal structuring element comprises the theory of functional and response diversity in its application on the retail functional grouping. The central logic of this study is to operationalise resilience theory, through the application of certain ecologically derived concepts to the urban environment, specifically functional and response diversity. The first component of this chapter elaborates on what was ascertained in the process of exploring the retail functional group. The second component relates to the concept of response diversity.

Throughout history, retail activities have exhibited an immense multifariousness of the assorted entities composing the industry. Retail activities reflect and correspond to the multitude of diverse tastes and requirements of humans, consequentially, manifest a great variety in their composition and locational logic. The intent of this section is to detail how the functional group of retail activities manifests in the City of Tshwane case study area. This will be achieved by exploring the endogenous characteristics formulating the group, as well as describing the external influences on the functional group. This is to comprehend the dynamics and complex nature of the group, as well as the entities constituting this group, in order to reveal the underlying hierarchical structures and relationships. This is facilitated by distinguishing the entities with a similar functional trait, i.e. retail activities, describing the various scales in which they operate. This effectuates the construction of, a functional group model, delineating the panarchy of the functional group.

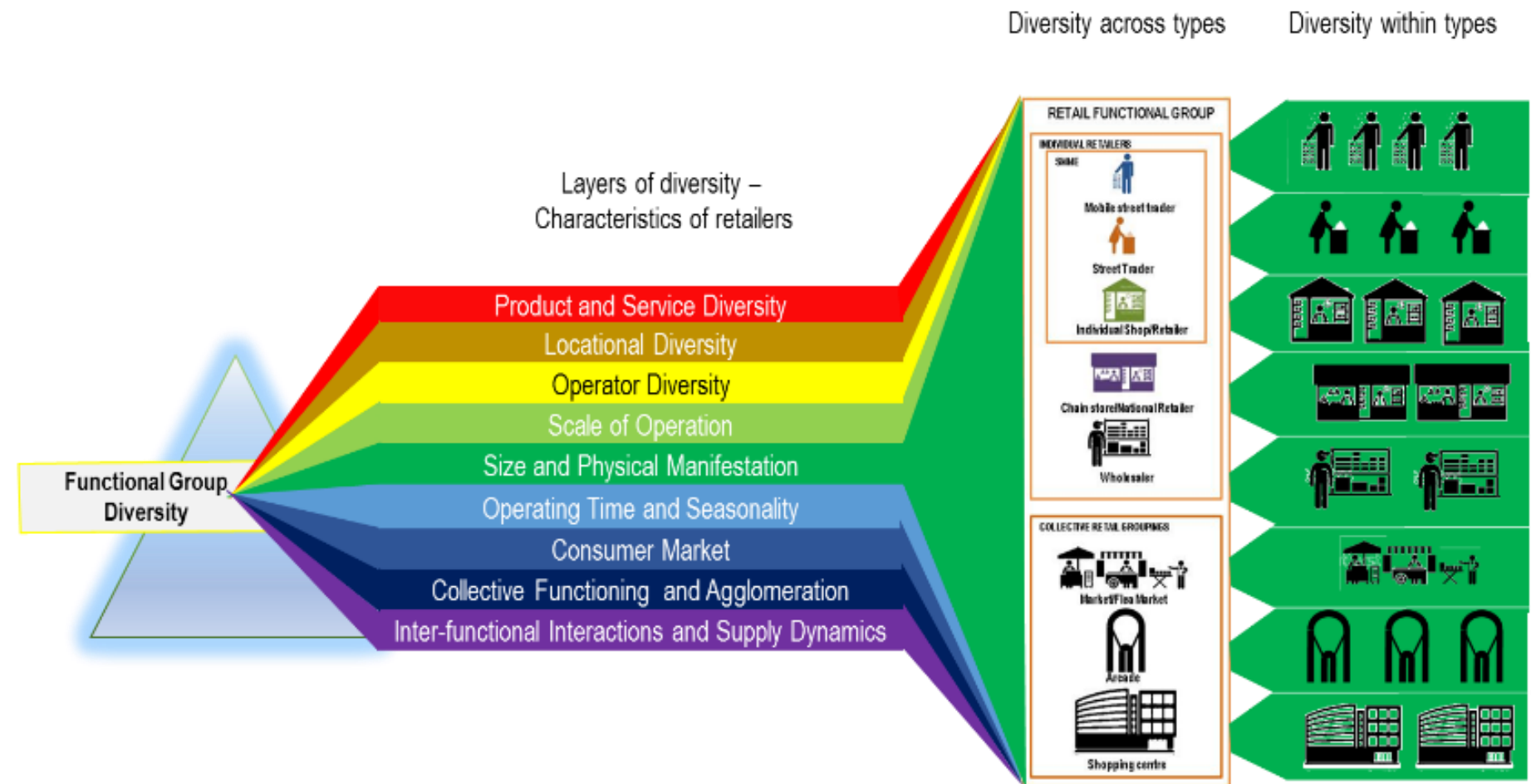


Figure 19: Functional group diversity

Subsequently, the Functional Panarchy Model (Elmqvist et al., 2003) will be employed as a framework to uncover the relationships among the entities (i.e. street traders to shopping centres), in consort with their reactive responses to perturbation and change. The fundamental premise is that the scale at which an entity operates dictates the risks and threats with which they contend. This implies that an entity, for instance, a shopping centre, operating on a large scale, is very different in some ways from a smaller entity, a street trader; thus, through their unique and contrary inherent characteristics, they are exposed to disparate, dissimilar and distinct risks or may react contrastingly to perturbation and change. Utilising ecological constructs, the framework essentially attempts to formulate a cladistics or taxonomy of the varied, assorted retail users and usages, to describe the functional group. The differences among retailers are fundamental towards identifying the niche or station they fill within the larger consumer market,

together with determining their overall competitive advantages. This is similar to an ecosystem function, in that a functional group competes for, in several circumstances the same 'energy source'; however, the rate of consumption and spatial scale of operation differs immensely therein. The adaptive capacity of each of the entities can be established from their multiple, varied characteristics, in consort with ascertaining the adaptive capacity of the entire functional group.

These attributes and traits exposit individual retailers; sub-groups; types of retailers; in conjunction with the overall retail group, and can be considered as the layers of diversity or difference between retailers. Essentially, the diversity within the retail group, in addition to describing each retailer group, for instance street traders or shopping centres, clarifies and interprets it as a complex concept describing multiple layers of diversity.

Drawn from preliminary field observations, augmented by existing classification systems, certain core characteristics can be delineated within the retail functional group.

The set of diversity layers, utilised to understand the typology of retail activities, are engendered through indicators discovered in the interview phase and field observations by the author (see Annexure A), and expounded below:

- Locational Selection and Distribution (spatiality & population);
- Magnitude and Physical Manifestation;
- Organisational Structure and Size;
- Operating Times and Seasonality;
- Scale of Operation;
- Product and Service Diversification;
- Consumer Market (size and composition of);
- Collective Functioning and Agglomeration Trends; and
- Inter-Functional Interaction and Supply Chain Dynamics.

Several distinct layers of diversity construct the overall resilience within the functional group, as well as within the overall social-ecological system. These diversity layers contribute the foundational basis for depicting the functional group's capacity or ability to respond to changing conditions or disturbances.

3.5 Functional Group Distribution (Structural Distribution)

The classification system grounds and forms the formulation a structural diversity model of retail activities, demarcating the population distribution and diffusion of trading actions in the case study. The distribution of categorised groups of retail entities enables the initial identification of existing links and relationships within the functional group. The logic propelling the population distribution into different strata and the ratio of the resulting strata arises from the Inverse Power Rule, as postulated by Pareto (Salat, 2012).

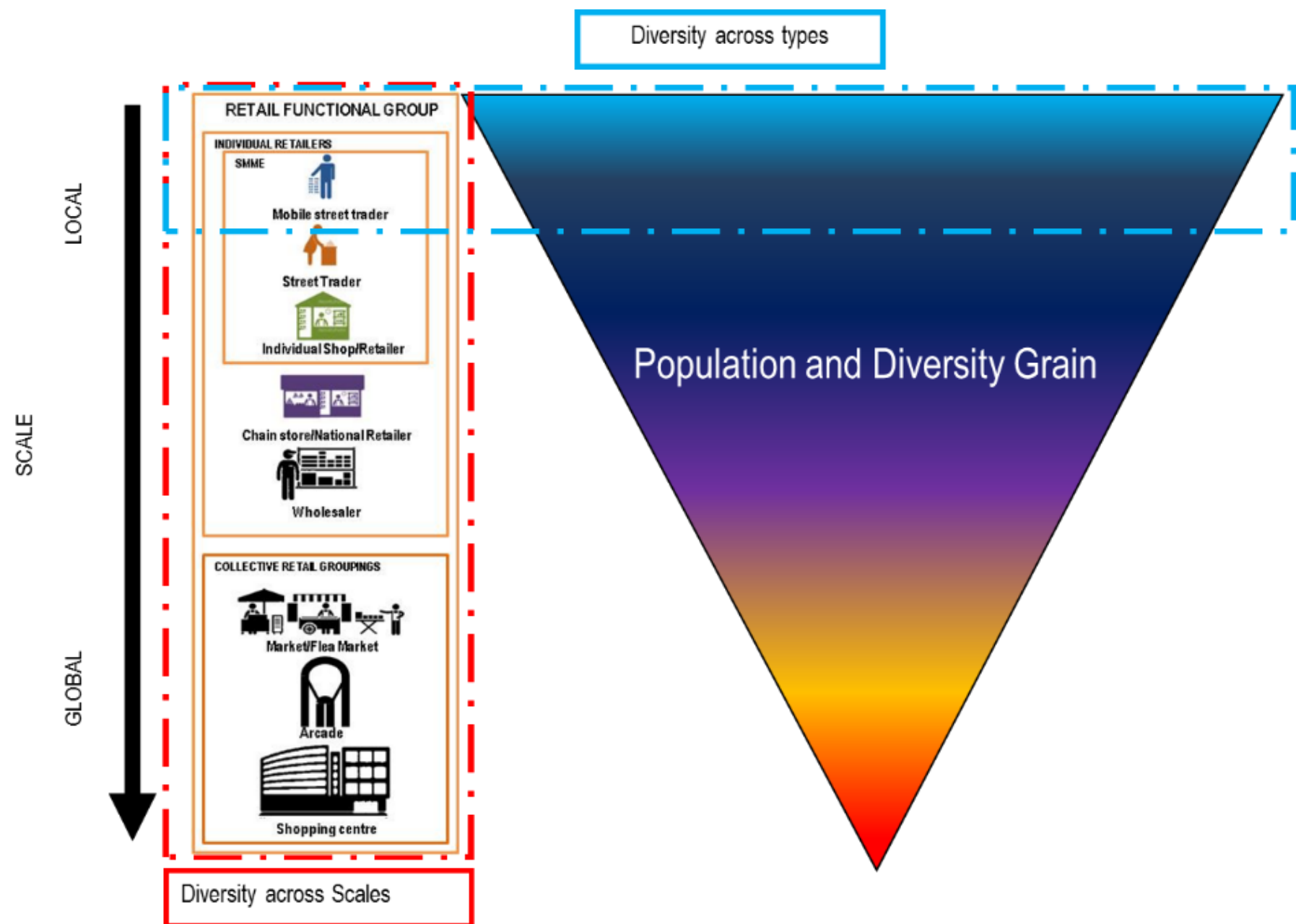


Figure 20: Structural distribution of the retail functional group

Pareto's distribution theory pertains to the spatial dispersion of elements encountered in living organisms and economic systems (Batty & Longley, 1994; Newman, 2006; Salat, 2011). The supposition originates from a basic hypothesis, which infers that larger elements appear less and smaller components are more common in these systems. For example, in the universe, there are groups of galaxies, constituted by stars and other material, descending, in succession, to a planetary level, through multiple tiers, to an atomic level. This emphasises that, cascading down the various scales, the more diminutive the element, the more there are present. Salat (2012, p. 18) asserts that this rule optimises the elements' access to energy, as well as how this is consumed, consequently affecting their resilience. This dispersion is employed to indicate the optimal distribution of related occurrences, actions or elements; exemplified in retail activities, which clearly evince fewer supermarkets than midsize shops, which are less frequent than neighbourhood convenience stores (Salat, 2011, p 495).

This theoretical aspect is employed in this study to analyse the structural distribution of the retail functional group in the case study area. This forms the basis for exploring the structure of the functional group, as well as determining the representative sample of the interview phase (Figure 22). Furthermore, the construct links to the theory of panarchy (or dynamic hierarchy), present in social-ecological systems, implicating the import of appraising it within this context, towards the apprehension of the response diversity at different scales of operation.

3.6 Response Diversity

Each identified retailer operates at a scale or level, although all influence one another. From the perspective of resilience, the diversification within their responses to functions is crucial to developing adaptive capacity in neighbourhoods. The panarchy model (Figure 21) illustrates how different retailers that form part of the function is structured according to scale, initialised by certain variables, such as scale of operation; capital needed for response; goods and services provided; survivalist vs. entrepreneurial enterprises; capital available to response actor; vulnerability;

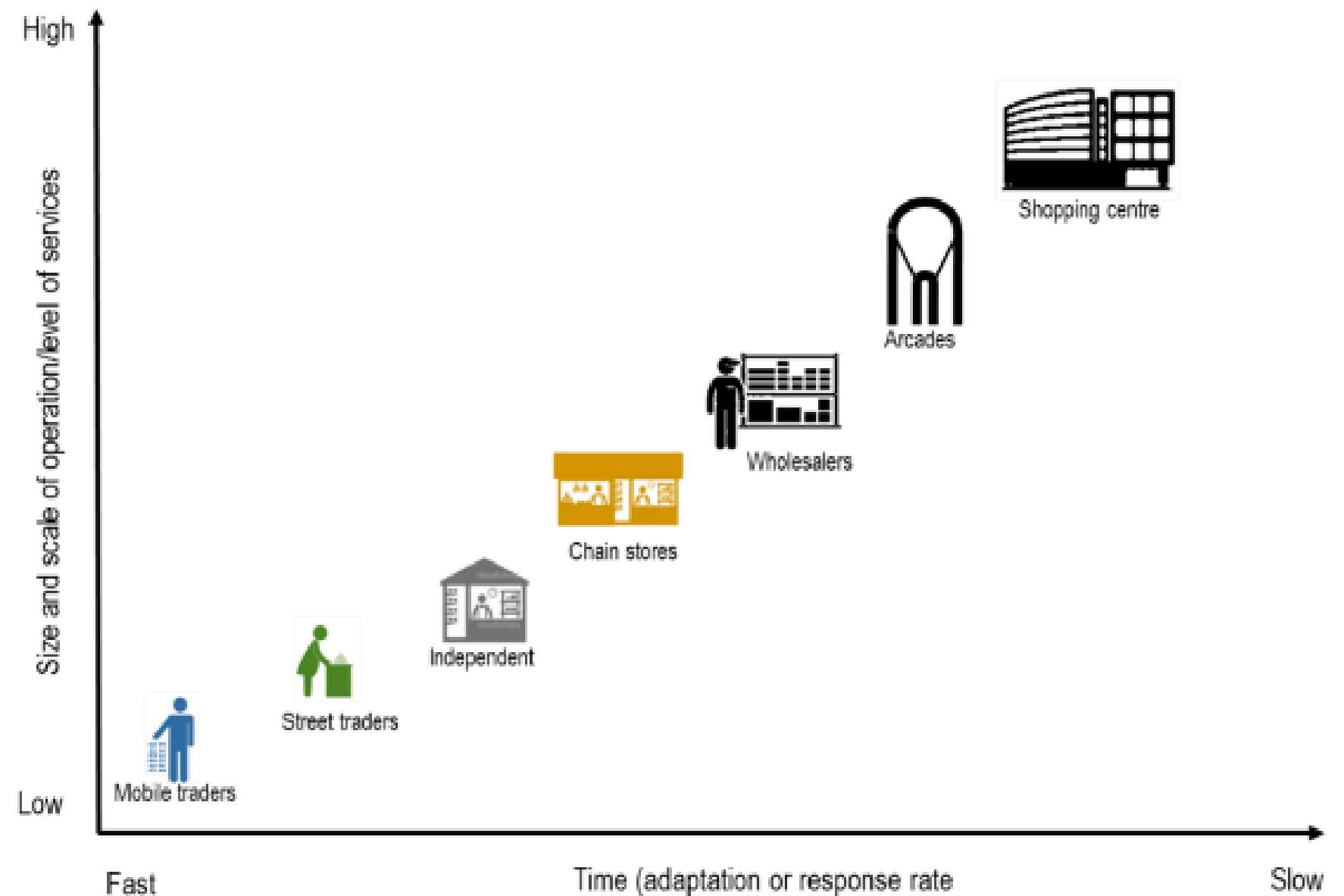


Figure 21: Conceptual panarchy model for the retail functional group

adaptability (responses to adversity and reaction time); and receptiveness to global/local economic fluctuations. Within the panarchy model, one response is not indicated as superior or preferential; it proposes that the different manifestations of retail activities (typologies) are constituents of the same functional grouping and may potentially be symbiotic and interdependent.

In the circumstances of the retail sector, response diversity designates the range of actions or reactions to environmental change among the individual retailers of the retail functional group. The resilience to environmental change or perturbation is enhanced if the individual retailers' reactions differ, resulting in continuing function (Elmqvist, et al., 2003). Response diversity may be essential to the survival of commercial enterprises on all scales, for instance it is conceivable that, at a lower tier, a mobile street trader can relocate or alter the type of product tendered compared to a shopping centre, on a higher scale, which may be slower in reacting, possibly changing or upgrading the centre or implementing new advertising strategies (Ligthelm 2008a). Although increased capital is available at the higher scale of the panarchy, the activities have greater constraints in terms of time and space. An additional factor influencing adaptive capacity comprises the comparative magnitude of the operation. Furthermore, as previously explained, entities or actors at different scales can provide responses in capabilities not accessible to other role-players, due to their unique characteristics.

3.7 Conclusion

This chapter submitted and illustrated the functional and response diversity framework that was utilised in this study. The initial stage of translating and extrapolating functional response diversity to the function of retail, comprises ascertaining and comprehending the dynamics, interactions and hierarchy within the functional group. It is deemed critical to distinguish the constituents of the functional group, through considering the discrete

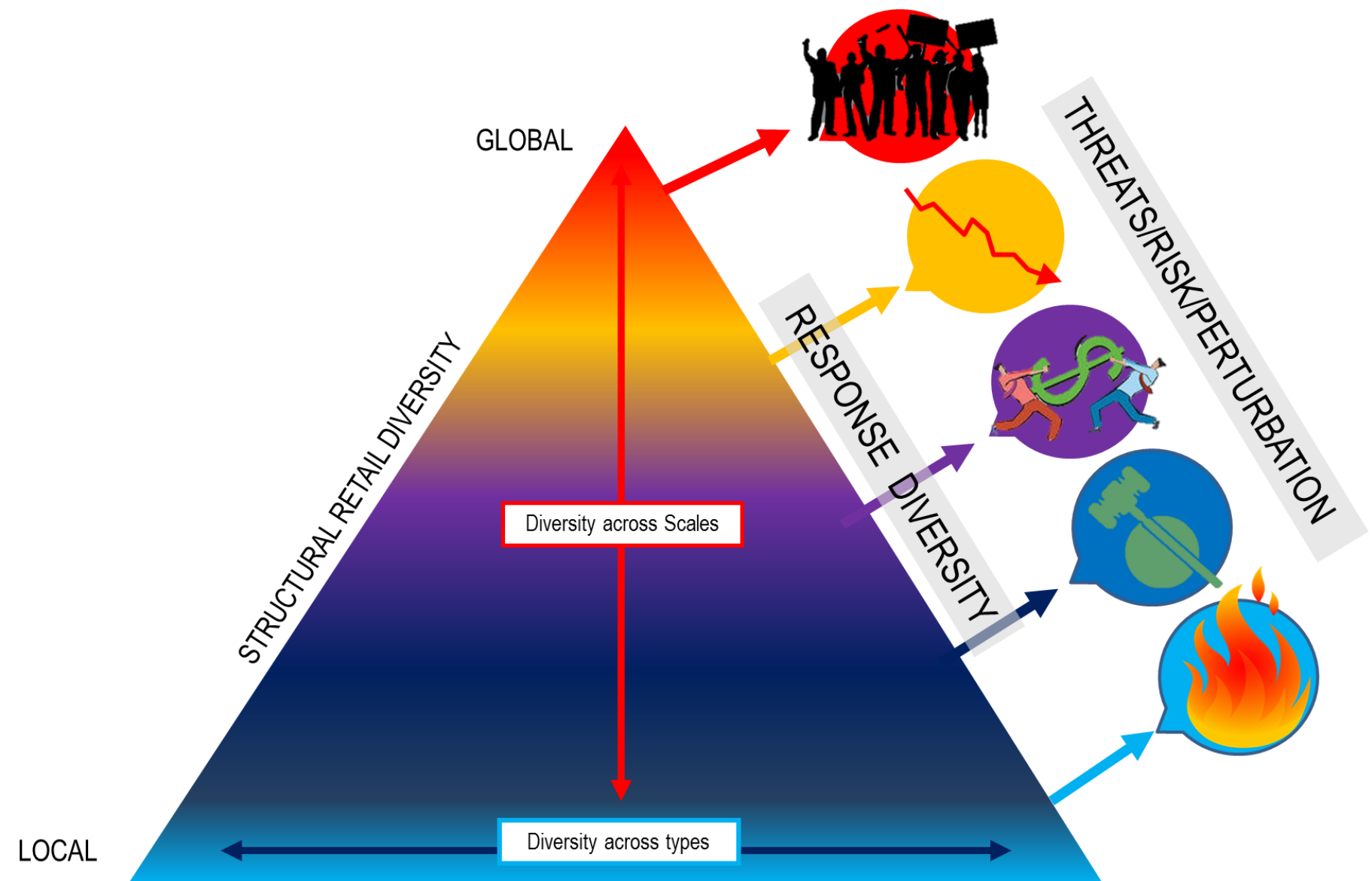


Figure 22: Response diversity in the context of structural functional diversity

entities exerting the functional trait of retail (diversity of the entities with similar functional trait – across scales and types).

This is achieved by analysing and observing the various characteristics inherent in these entities, including, *inter alia*, their scale of operation; physical size and design; operational structure; ownership; goods and services tendered; primary purpose of operation; consumer market dimensions; and start-up assets and/or initial capital required. These characteristics determine the hierarchy of retail entities and consequentially, each entity's ability to adapt (adaptive capacity). The interrelationships among entities and the distribution of the population

(physical and structural) are critical in understanding and explicating the functional group.

Subsequent to the identification of the discrete members of the functional group, the responses of each subgroup to change and/or perturbation (pulse and press) can be construed. It is deemed imperative to take into account that, due to the entities operating at various scales, they contend with dissimilar threats and may have greater or less susceptibility to certain changes due to their inherent characteristics. Humans, through their diversity; experience; skills; and cognitive capacity, are able to react to threats in several, varied ways, which engenders tractability, through a

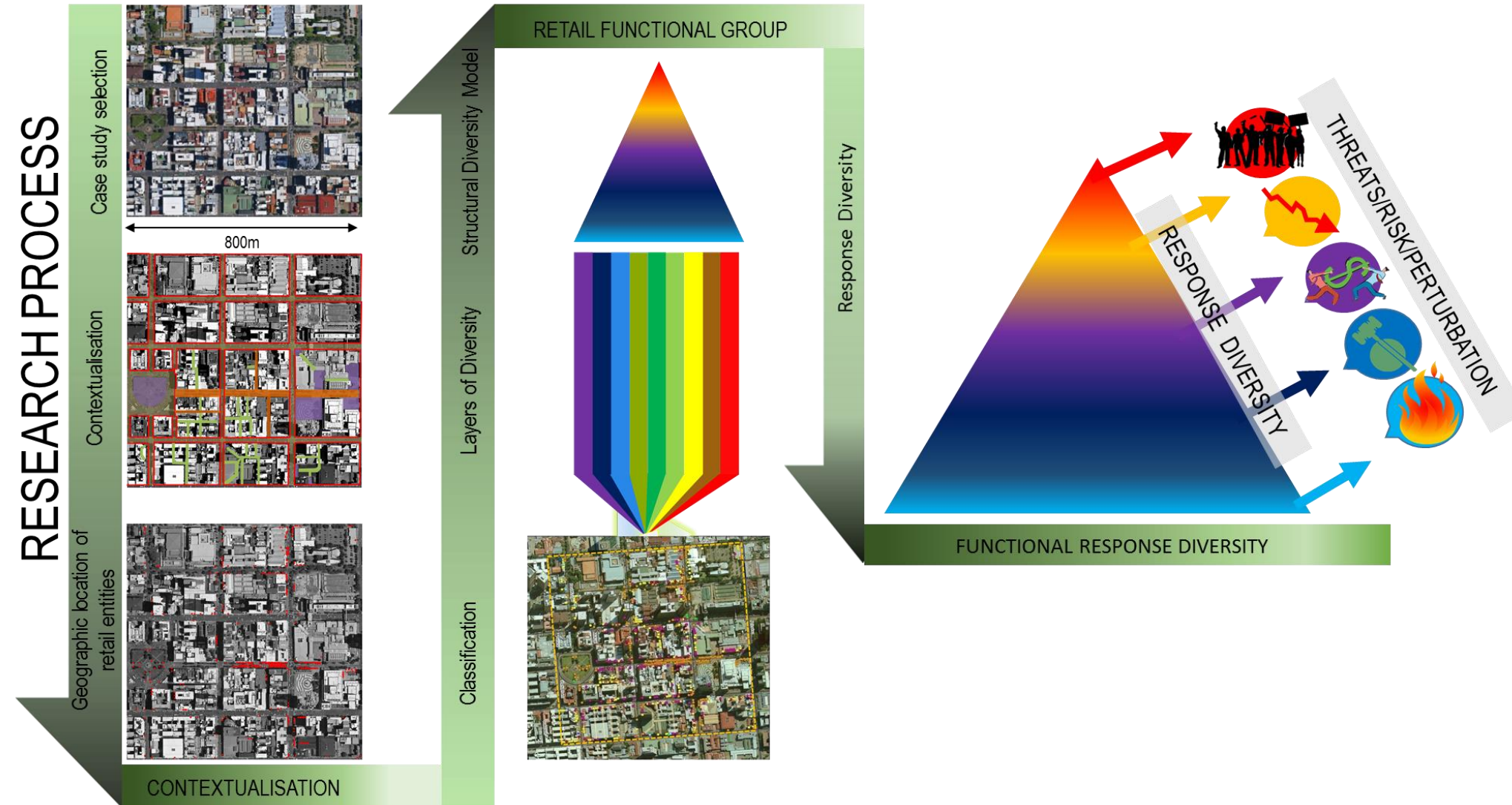


Figure 23: Research process in constructing the functional and response diversity framework

variety of responses (response disparity or diversity), in the functional group, to alterations. This accentuates and supports the contention that, because there are a variety of species and responses, the function as a whole is less vulnerable to change (perceived or not). Therefore, the resilience of the function is based on the functional distribution of species and species richness, in consort with the capacity for, and diversity of, responses to social-ecological change. This creates functions that are able to adapt to modifications in circumstances, ultimately resulting in cities capable of accommodating, transforming and flourishing in altering circumstances.

The succeeding chapter describes the methodological approach of this study and delineates the research approach, design and methods utilised therein.

Chapter 4

Methodology and Approach

This chapter describes the research design, methodologies in conjunction with the analysis approaches employed within the dissertation. The diversity framework is expounded and explicated, contributing insight into its extrapolation and translation of functional and response diversity into the urban context.

4.1 Introduction

This chapter is intended to outline the research approach of this investigation, including the research design and methodology. The prevailing objective of this masters is to operationalise resilience theory within the urban context. The issue of operationalising resilience has become a progressively significant development in resilience research. This is perceived as a primary attempt to practically apply resilience theory within the urban context, taking into consideration the rapid development and adoption of resilience constructs and concepts (Cumming et al., 2005 & Nyström et al., 2008).

Urban Resilience research is a relatively new addition to the resilience (see Chapter 2). There is minimal experience and information pertaining the application of resiliency concepts, especially constructs rendered through ecological application, for instance functional and response diversity, which has effectuated the requisite for an explorative approach, which can be augmented and supported by the few early attempts to extrapolate and translate these concepts to other contexts (Elmqvist, et al., 2003 & Leslie & McCabe, 2013). Flexibility, allowance, tolerance and an open attitude are necessary in research that is explorative and innovative (Stebbins, 2001). This logic is utilised as the basis of this investigation, exploiting, as an initiation point, the current application of functional and response diversity in ecology systems. This dissertation does not infer that ecological and social systems are identical, therefore, it is stressed from the commencement, that the research methods, design and analysis are employed as an implement to probe into the application of resilience theory within the urban context (human-dominated SES).

Furthermore, SES research warrants an interdisciplinary approach. Understanding the vast complexity of the urban social-ecological system should propel academics and practitioners to proceed beyond a 'silomental' of individual fields of interest and research towards common, mutual or shared interpretation. Urban resilience theory comprises a multitude of varied aspects traversing multiple disciplines, inclusive of, *inter*

alia, ecological science; social; cultural; urban geography; historical studies; sustainability; and urban design and planning (Basque Centre for Climate Change, 2012). This research endeavour is an exemplar of this, as it applies theories originating in ecological science; retail sector studies; urban geography; and planning.

4.2 Research Methodology and Process

As in this endeavour, when considering the selection of the method of research in a research project there are three options, viz. Qualitative, Quantitative or Mixed Method, comprising a combination of the two (Creswell et al., 2007). An explorative approach is adopted in establishing a new framework for analysing urban constructs through an ecological theoretical base. Qualitative research focuses on the empirical study of particular phenomenon in their natural environment or context ('real world') and involves capturing and observing, *a posteriori*, the complexity thereof. Layer and Asher (1998) contend that all inquiry commences in a qualitative form, especially when no or minimal existing information is available *vis-à-vis* a topic. This is particularly relevant to the application of resilience in the urban context, where thorough, rigorous and profound contextual exploration is required. It is deemed that qualitative approaches and methods correspond best to this study, engendered by the contemporary dearth of experience, limited usage and minimal information pertaining to the application of resilience theory on the urban social-ecological system, denoting it is open to new interpretations. Analogously, Leichenko avers that "*in order to ensure the term "resilience" retains its utility, there is a need for continued questioning of how the concept is used and applied to urban areas*" (Leichenko 2011, p.166). Leichenko (2011, p. 167) continues that "*diversity is a key tenet of resilience theory, and the diversity of approaches to urban resilience ... is a testament to the flexibility and adaptability of this burgeoning research area*".

As aforementioned, the primary intent of the study is to operationalise resilience within the urban context. A major concern is how to translate

ecological concepts to the urban environment, considering the existing prior limited theoretical and, most importantly, practical applications. The ensuing section introduces the overall research methodological approach to this investigation.

4.2.1 Hybrid Iterative Explorative Research Approach

The study utilises a multi-step process in order to operationalise resilience within the urban context. The initial step comprises the formulation and construction of the Functional and Response Diversity Framework, as discussed in the previous chapter. This stage abides by the grounded theory approach, whereby the framework is constructed from both a theoretical (in ecology) and applied base. The subsequent step constitutes the application of the framework to the case study area in order to determine the relationship, if any, between diversity and resilience. This process is completed through the case study methodology, which enables ascertaining the applicability of the framework in the 'real world' context. The two steps follow two distinct research methodological approaches; however, in combination form a hybrid iterative explorative research approach to operationalise resilience. The term hybrid merely denotes the coalescing of two existing research methodological approaches to suit the current study. Iterative signifies the recurring interaction among theory, the conceptual framework and the practical application thereof. Finally, explorative refers to the overall flexible, impartial and iterative approach engaged for this study.

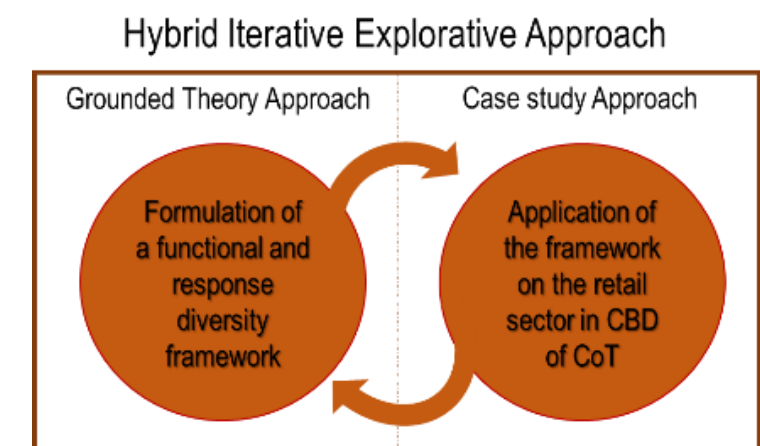


Figure 24: Hybrid Iterative Explorative Approach utilised in the research process

4.2.2 Formulation of the Functional and Response Diversity Framework

The purpose of the approach constitutes developing theory concerning a particular phenomenon. The theory is rooted or grounded in *a posteriori* observations and empirical research. The grounded theory approach is an iterative process, where an initial question is formed (generative question) to guide the process, thereafter the researcher commences amassing and assimilating data, through which the core theoretical concepts are identified (Glaser & Strauss, 1967). Subsequently, these central concepts are evolved through various iterations to a final, single core category or concept. This principal concept is a well-considered explanation for a particular phenomenon of interest (Trochim, 2006). Leedy & Ormrod (2013, p. 130) define the grounded theory approach as to “begin with data and use [the] data to develop a theory”. Its application in this study centres on the formulation or development of a framework.

This approach is deemed optimal and ideal for this research due to its explorative nature. Engendered by the limited knowledge in terms of the current empirical application of resiliency theory, empirical data together with certain theoretical concepts are utilised to construct this study. The framework employed to assess the functional and response diversity of the retail group was constructed through theoretical framing extracted from existing ecological constructs and empirical data. A variety of fieldwork techniques, including observations and interviews, assisted in formulating the framework finally applied to the urban context. Throughout this process the application of theory from different fields was utilised in a new context, in conjunction with the creation of a framework for applying resiliency concepts within the urban context. The development of the framework is ‘grounded’ in practice, i.e. through various preliminary observations, interviews and a literature scan.

The process of formulating the Functional and Response Diversity Framework constituted the following phases:

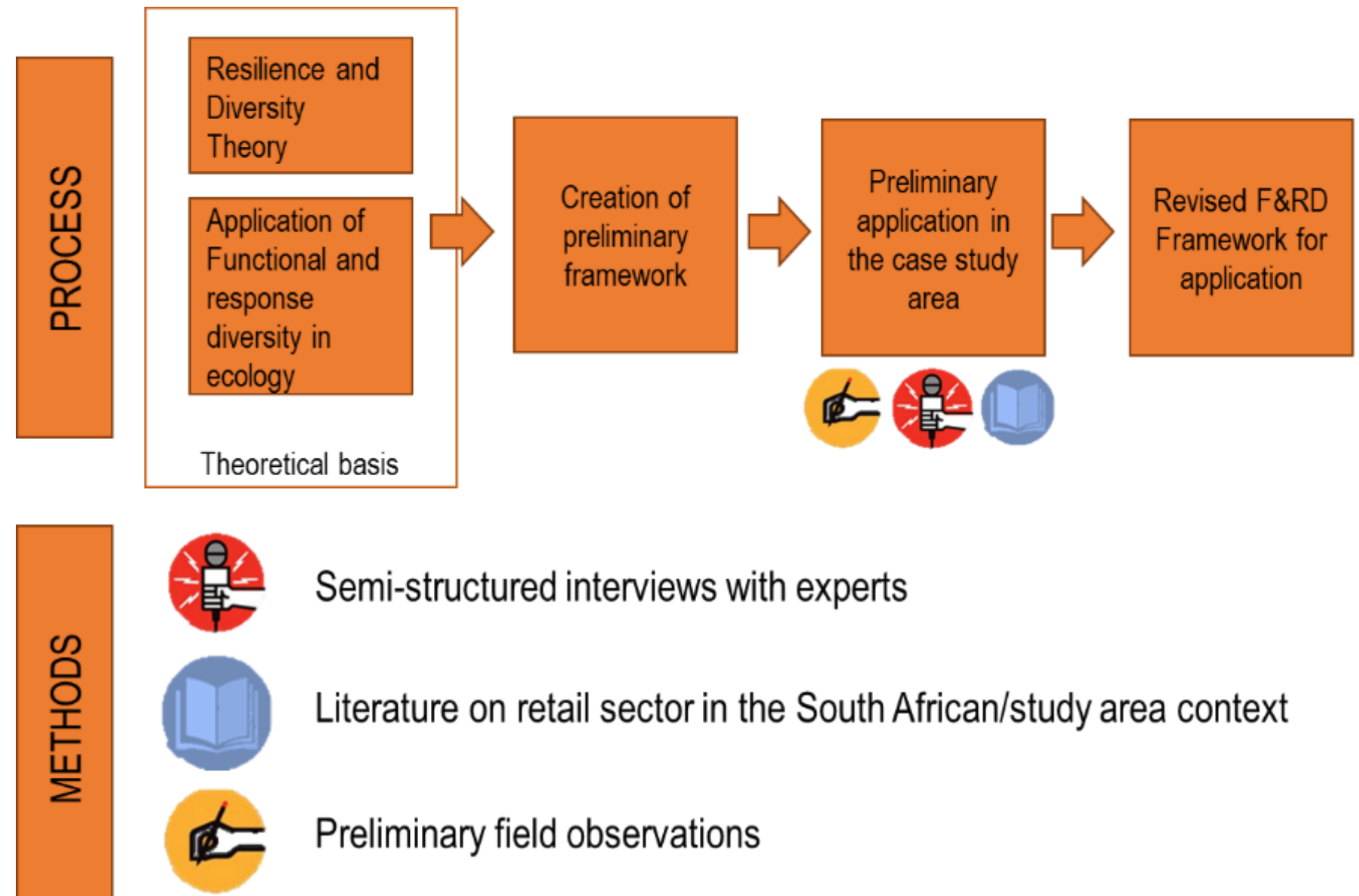


Figure 25: The process of formulating the Functional and Response Diversity Framework

- Establishing a theoretical basis from resilience and diversity theory and the application of functional and response diversity in ecology;
- Creation of a preliminary framework to investigate resilience in the retail sector;
- Applying the preliminary framework in the case study, through various explorative methods (explicated in the methods section); and
- Restructuring and formulating the revised Functional and Response Diversity Framework, subsequently fully applied in the case study locale.

The preceding process utilises the theoretical basis as the inception for the investigation, where the practical application of a preliminary framework in the case study area consequently engendered the revised framework ‘grounded’ in primary, initial contextual data. The ensuing section explains the application of the revised framework within the case study area.

4.2.3 Applying the Functional and Response Diversity Framework

The second step in the operationalisation of resilience within the urban context comprises the application of the framework. This process requires a methodology that facilitates its application, simultaneously collecting data to ultimately resolve the overall research questions and objectives.

The case study was selected as the methodological approach to operationalising resilience. Case studies originated with the advent of qualitative research in the 1960s and 1970s, where they were utilised for the *“historical or in-depth descriptive study of a phenomenon”* (Merriam, 2009, p. 39). From the 1980s, case studies, as an established and proven methodology, gained major attention within the realms of the social sciences, including, *inter alia*, education; health; and organisational studies (Merriam, 1988, Stake, 1988, Yin, 1994). Yin (2008, p.18) defines case studies as a research process, asserting that *“[a] case study is an empirical inquiry that investigates a contemporary phenomenon within its real life context, especially when the boundaries between phenomenon and context are not clearly evident”*.

Yin’s (2008) description is of particular significance to this study. The author’s first component comprises the ‘empirical inquiry that investigates a contemporary phenomenon’, in this study, this refers to resilience, or its proxy, diversity. The core of any case study based research project is the case itself or the ‘unit of analysis’. Smith (1978) contends that a case study focuses on what is actually to be studied, relegating a diminished importance to the methodology. This interjects the concept of a bounded system, or a single entity, *“a unit around which there are boundaries”* (Merriam, 2009, p.40). This designates the necessity for clear concise limits or boundaries in terms of whom and what is to be explored. Within the context of this study, various boundaries have been selected to delineate the case study, including physical and functional boundaries, as well as the phenomenon under investigation. The study investigates the phenomenon of functional and response diversity in the retail sector (functional boundary)

in an 800mX800m block of the Tshwane CBD (physical boundary). Furthermore, Yin (2008) avers that a case study can contain nested units within the principal unit, which is advantageous in analysing the retail sector, as it consists of single retailers and subgroups.

This study employs a single case study, effectuating a holistic and in-depth analysis. Single case studies have been criticised as limiting the panoptic element or extent of generalisation potential rendered by the study. Frequently, this critique is projected at case study research overall, contending that statistical generalisation is complicated and challenging. Conversely, Flyvbjerg (2006) counters this, asserting that formal generalisation is often over-valued, while a single case example is underestimated. He affirms this, averring that single cases have been utilised to illustrate several theories, citing prominent academics and figures, including Einstein; Darwin; Freud; and Newton, who advanced their respective fields through this practice. Eysenck (1976, p.9) is in consensus with this perspective, stating that *“sometimes we simply have to keep our eyes open and look carefully at individual cases – not in the hope of proving anything, but rather in the hope of learning something!”*. Yin (2008 & 2009) argues that single cases do not provide statistical generalisations, but rather, analytic generalisations. Analytic generalisations focus on the transferability of findings, rendered by a two-step process. The initial step comprising the development of a conceptual claim or theoretical construct, with researchers establishing that their findings *“have informed the relationships among a particular set of concepts”* and the second inferring that these conceptual claims or theoretical constructs are relevant to alternate, similar case studies (Yin, 2008 p.19).

These conceptual claims or theoretical constructs depend on the study utilising a theoretical framework *“to establish a logic that might be applicable to other situations”* (Yin, 2010, p. 22). In this regard, this study has created the Functional and Response Diversity Framework (FRDF) to operationalise resilience within the urban context through its application in

one case study, providing key insights into further applications in other contexts, albeit requiring certain contextual adjustments.

A principal aspect of case study research is the exploration of a phenomenon in its ‘real world’ context. This aligns with the research objective of exploring the application of the FRFD in investigating resilience within the urban context. In addition, this corresponds and connects to the subsequent component, involving the boundaries between the phenomenon and the context being unclear. This is revealed in the study of social-ecological systems, where subsystems, for instance the retail sector, can be identified, although the boundaries between and across systems are ill-defined. Additionally, case study research emphasises the evaluation of the relationships between the phenomenon and the context, this explores the impact the ‘environment’ exerts on the phenomenon under scrutiny (and vice versa).

The case study approach accentuates the exploitation of multiple methods to garner in-depth information related to the phenomenon. This is particularly useful to conduct pre-hypothesis research or explore novel research fields, because multiple qualitative methods contribute maximum flexibility and openness to data collection (methods discussed in the succeeding section). The exploratory nature of the case study methodology is deemed germane and beneficial to this study, as the intent of this endeavour concerns it serving a ‘prelude’ to future research (although case study investigation may extend beyond exploratory research).

4.2.3.1 Research Process to Apply the FRDF

This section contributes a brief overview of the assorted steps required to apply the FRDF to the urban context. The specific rationale and detailed explanation of each of the components are discussed in the Chapter 3.

Figure 26 portrays the research process, through various steps and associated methods, expounded in the subsequent division. The process of applying the FRDF within the urban context comprises the following steps:

- Selection of a case study area and functional group for investigation (through field observations)
 - 800mX800m block in the CBD of the City of Tshwane
 - Retail Functional Group;
- Detailed analysis of the context within which the retail sector operates (through field observations and literature scan)
 - Analysis of the built environment
 - Land usage and functional analysis
 - Design and management assessment;
- Geographic location of retailers in the study area (through field observations and GIS mapping);
- Classification of retailers into various strata or functional sub-groups (through interviews with retailers, field observations and GIS mapping);
- Detailed analysis of the various layers of diversity or difference exhibited by each retailer group (through interviews with retailers, field observations and GIS mapping)
 - The focus is on diversity within and across sub-groups;
- Construction of a structural diversity model based on the characteristics of each sub-group (through interviews with retailers, field observations)
 - This informs and describes each sub-group's capacity to adapt (adaptive capacity) and their individual vulnerabilities to certain threats, engendered by their characteristics; and
- Finally, an analysis of threats or perturbations with which each retailer sub-group contends, in consort with their specific responses to in response to identified threats (through interviews with retailers and field observations).

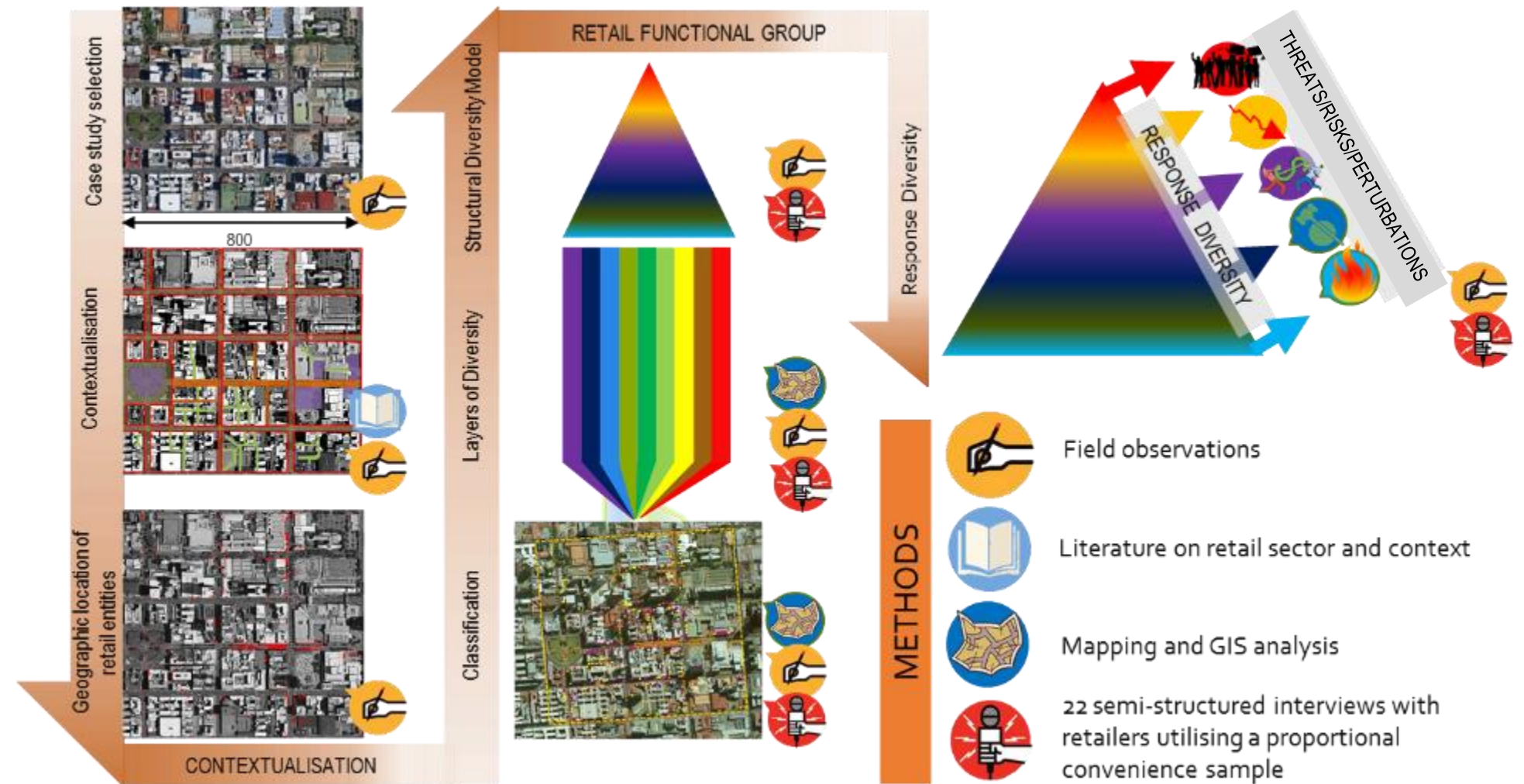


Figure 26: Applying the Functional and Response Diversity Framework

The next section introduces the principal research methods utilised in the application of the framework to the urban context.

4.3 Research Methods

Exploratory case study research frequently requires various forms of field work. This study does not differ, relying on various techniques and methods to investigate the application of resiliency theory to the urban context.



4.3.1 Interviews

Two types of interviews were employed in the process of investigating the research topic. The first was semi-structured in-depth interviews with key stakeholders in the retail sector to gain a

comprehensive understanding of the field and study area, and were utilised to frame the field studies. The interviewees included:

- Head of the Shopping Centre Council of South Africa – Mr P Gaddy (Broll Properties);
- Head of the South African National Traders' Retail Alliance – Mr E Elias; and
- Academic Director: Centre for Environmental Studies, University of Pretoria - Prof. Willem Ferguson.

The second group, of interviews were undertaken conducted with the retail entities in the field. The interviews with retailers were conducted at a convenient location for the interviewee i.e. at work, in their boardroom. An electronic recording device was employed for audial documentation of the conversation (with the consent of the respondent). Each interchange had certain initial, previously designed questions, devised by the researcher, through personal knowledge of the interviewees, as well as the organisations they represented. (See Annexure B for Interview Schedule).

4.3.3.1 Interviews with Individual Retailers

The second set of interviews was intended to reveal the relational aspects of the functional group, including the diversity of responses to perturbation. The interview methodology selected comprised a semi-structured interview, with pre-defined questions, which permitted further elaboration and

explanation, through spontaneous, ad hoc extra questions, in addition to open-ended responses, aligning with the overall explorative identity of this study. The interview was undertaken on the business premises, preferably with the owner or, alternatively, with a retail worker (e.g. the manager). An interpreter was available, enabling the interviewee to articulate responses and issues in their preferred or home language (other than Afrikaans and English). An immediate translation was supplied to the researcher by the research assistants in instances when recording was denied. The entire process was explained by the researcher, with an informed consent form signed prior to the interview commencing (See Annexure C).

The interviews covered certain important categories (see annexure B), which included:

- Business Entity and Operation
This explores what the retail entity is, through asking the interviewee to self-identify operations and activities;
- Neighbourhood Relationships and Attitudes to the Concern
This section investigates the relationships between the retail activity and the rest of the neighbourhood or area. It inquires why the retailer chose to operate in this area, what changes have occurred during its operational duration and, most significantly, evaluates the relationship between the different retail activities (and other uses in the area) from the perspective of the retailer (functional group dynamics);
- Users and Supply Chain
This elucidates the target market of the retailer (formal/informal targeting), as well as their supply chain, which accentuates the operational scale of the retailer; and
- Risk Vulnerability and Adaptive Responses
This explores the response diversity of the retailer in relation to perceived threats, revealing the adaptive capacity and strategies of each retailer.

4.3.3.2 Sample Selection

Within the study area, a representative sample was drawn from the strata identified in the retail functional group. It deemed notable that the sample cannot be used to make a generalisation of the population, as the sample size is too small and sample error too large. This is, however, not a limitation on the study, as the sample is designed to garner insights into the application of resiliency theory, and it is intended that future research explore the functional group in greater depth. The sample selection process, as shown in Figure 27, incorporates a few key stages therein. The first comprises identifying and mapping the retail activities (see retail classification system). The retail activities population is grouped into strata, with a diverse group of entities exhibiting similar characteristics, for instance shopping centres and street traders. In succession, this is utilised to calculate the proportion of activities, to enumerate the proportion of the sample. A desirable and suitable sample size of 23 in the area was chosen, as capturing enough diversity across scales, in terms of the functional group, as well as sufficient diversity within each type. It, in addition, constitutes a manageable sample size for the researcher, taking into account time and logistical constraints. The selection of interviewees was based on a convenience sample (Marshall, 1996), determined by whether the interview was possible, due to the time constraints of potential interviewees and safety considerations for the researcher.

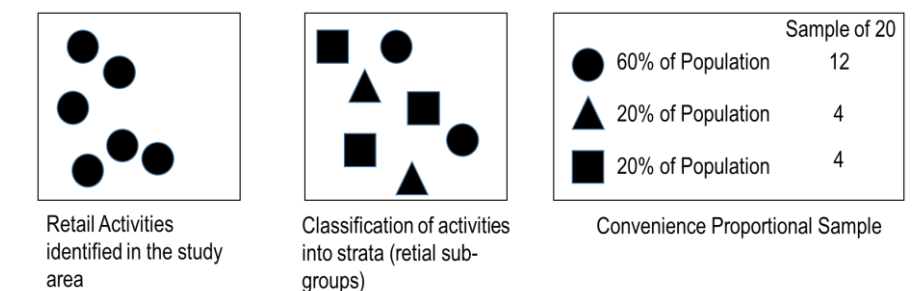


Figure 27: Proportional Convenience Sampling in the case study area



4.3.2 Mapping

Mapping is an essential element in the application of the resilience concept to the urban context. It is particularly useful in the application of resilience theory for planners and city managers, as it 'spatialises' and contextualises the concept in the built environment. The mapping in this master's study ranges from contextual mapping to mapping the retail sector.

4.3.2.1 Data Collection Process for Mapping

The process of spatialising data was subsequent to the initial data collection step in the case study area, thereafter field data was analysed, captured and mapped. The primary research amassed field data, with the aid of an assistant in the case study area. As previously indicated mapping was utilised for certain steps in the research process. For example, the contextual and land usage mapping was conducted by repeatedly visiting the case study area, where 'rough' sketches and maps were drawn in the field and, subsequently processed and spatialised on a GIS (Geographic Information System). The steps to spatialise the retail sector⁴, relative to the classification described above, are:

1. Capturing points in Google Earth.
2. Converting .kmz files to .shp files (shape files).
3. Developing separate shape files of each category (using SQL queries).
4. Creating a 50m x 50m grid of the study area.
5. Utilising a spatial join to determine the number of times a category occurs in a 50m block. The result of a join based on spatial location is a shape file containing a *count* attribute. Each category was joined to the 50m block in order to determine the number of times that category occurred in a 50m block.

⁴ The GIS digitising and analysis techniques was performed and created with the assistance Yvette Bevis and Ingrid Booysen of the Department of Geography, Geoinformatics & Meteorology at the University of Pretoria.

6. Digitising new points, with the count value written in as an attribute. Each block then had 1 point per category, with the total *count* as an attribute.
7. Merging the new points for the case study area, to ensure the scale of the proportional points was consistent.
8. Portraying the data as proportional points.
9. Processing subcategories (performed separately for each study area).
10. Extracting the subcategories from the different primary category shape files (see Step 3). Creating separate shape files for each subcategory.
11. Repeating Step 5 for each subcategory.
12. Calculating the centroids for the 50m grid.
13. Joining the *count* attribute from the spatial join to the centroids shape file. The result is one centroid shape file with the count value for each subcategory as an attribute.
14. Grouping the data.
15. Creating the pie charts.



4.3.3 Literature

Due to the overall explorative nature and research limitations, some information required for the application of resilience theory is derived from appropriate literature. In this instance, 'literature' refers to formal academic references and alternate sources, including retailers' websites. Where literature was utilised (as indicated the section above) the sources was cited and employed to strengthen the empirical sources, for instance interviews or observations.



4.3.4 Observations

Observations were conducted in the case study area, by the researcher together with assistant researchers. The observations served as contextualisation for the study, essentially discovering the 'reality', 'world' or 'milieu' in which the retailers exist. Additional observations revolve around the retailers themselves, including their behaviour; location or relative size. The observations were captured by the researcher through field notes and photographs. Additionally, the researcher utilised the element of time, where field visits to the case study area was made at varying times of the day and different points in the week, which revealed several, frequently unobserved elements.

4.4 Analysis Techniques

This study relies on certain analysis techniques, but overall the raw data and subsequent analysis depended on the application of the functional and response diversity framework. The empirical data sources were analysed broadly, utilising thematic analysis phases (illustrated in Table 2) to distinguish common themes (Braun & Clarke, 2006), with the ultimate intent to extend from raw data to a diversity framework for the retail sector in each case study area.

Spatial Analysis Techniques: Plotting or mapping of the retail activities and then analysing the latent spatial relationships between retail activities, as well as other functional undertakings, including the primary spatial structuring elements. These include a variety of road networks, public transport facilities, in consort with other landmark areas impacting on, or relating to, the retail industry.

Interview Data Techniques: The data derived from the semi-structured interviews is of a qualitative nature. The majority of the responses supplied

by interviewees were generated from open-ended questions resulting in non-prescriptive answers. Although there is sizable diversity in the responses, certain themes can be identified within each of the categories.

| Phase | Description of the process |
|---|--|
| 1. Familiarising yourself with the data | Transcribing the data |
| 2. Generating initial codes | Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code |
| 3. Searching for themes | Collating codes into potential themes, gathering all data relevant to each potential theme |
| 4. Reviewing themes | Checking if themes work in relation to the coded extracts (level 1), and the entire data set (level 2), generating a thematic 'map' of analysis |
| 5. Defining and naming themes | Continuous analysis to refine the specifics of each theme, and overall chronicle rendered by the analysis, generating clear definitions and names for each theme |
| 6. Producing the report | The final opportunity for analysis. Selection and compiling of extract examples, final analysis of selected extracts, relating the analysis back to the research question and literature, producing a scholarly report of the analysis |

Table 2: Phases of thematic analysis (Braun & Clarke, 2006)

4.5 Conclusion

This chapter explicated the research methodology and framework for exploration requisite for evaluating the functional response diversity of the retail functional group within the case study area. This portion of the discourse explained the necessity for an explorative approach to the research. A grounded theory approach is utilised to construct and apply the Functional and Response Diversity Framework, through an iterative research process. This chapter colligated with the framework creates the basis for applying the functional and response diversity framework. The following chapter presents the application of functional and response diversity framework on the retail sector in the CBD of the City of Tshwane.

Chapter 5

Findings: Application of FRD Framework



The findings of the case study area is divided into three sections viz. area contextualisation; description of the retail functional group (structural and geographical diversity including the “layers of diversity”) and finally the response diversity associated with each discrete grouping of retailers in the study area.

5. Introduction

The Central Business District (CBD) of the City of Tshwane is the case study area to be discussed. The area has significant legacies, historic and present value to the entire urban area. Although the role of the CBD has changed dramatically from the historical centre of the then, town of Pretoria, to the Capital Core of the City of Tshwane, it remains a critical area in terms of the urban structuring and functioning of the metropolis, specifically in relation to retail activities. Despite the area having phased through various periods of growth and decline, it has consistently functioned as an important locale in the provision of services and goods to the rest of the city.

5.1 Contextual Analysis

Prior to the commencement of an explanation of the functional group of retail activity in the Pretoria CBD, a contextual analysis is presented. The following elements are incorporated as components of the contextual analysis:

- Case study area orientation;
- Demographic profile;
- Transportation and connectivity;
- Land use composition and impacts;
- Public space quality and management; and
- Urban Morphology and related impacts.



Figure 28: A perspective on Church Square, Image above- Picture of Paul Kruger Statue on Church Square (Author, 2013). Image below- Panoramic view of Church Square (Corten & van Dun, 2010)

5.1.1 Case Study Area Orientation

The case study area is located in the central section of the City of Tshwane CBD. The case study includes the iconic public space and landmark of Church Square, incorporating a pedestrian mall leading to the Eastern edge of the area. The pedestrian mall (open high street non-motorised zone) forms the central axis of a large pedestrian-only area (indicated in blue lines), connecting various arcades and malls to the open pedestrian mall. Government functions and Departmental Headquarters are prevalent in the area, along with significant amenities, including the National Library; the National Theatre; and the North Gauteng High Court. The majority of shopping centres are to the South East of the area, including various arcades to the South of Madiba Street. Currently, large construction activities are occurring, which include the Bus Rapid System (A Re Yeng) in the CBD; the renovation of Lilian Ngoyi Square; as well as the new headquarters of the City of Tshwane Municipality.

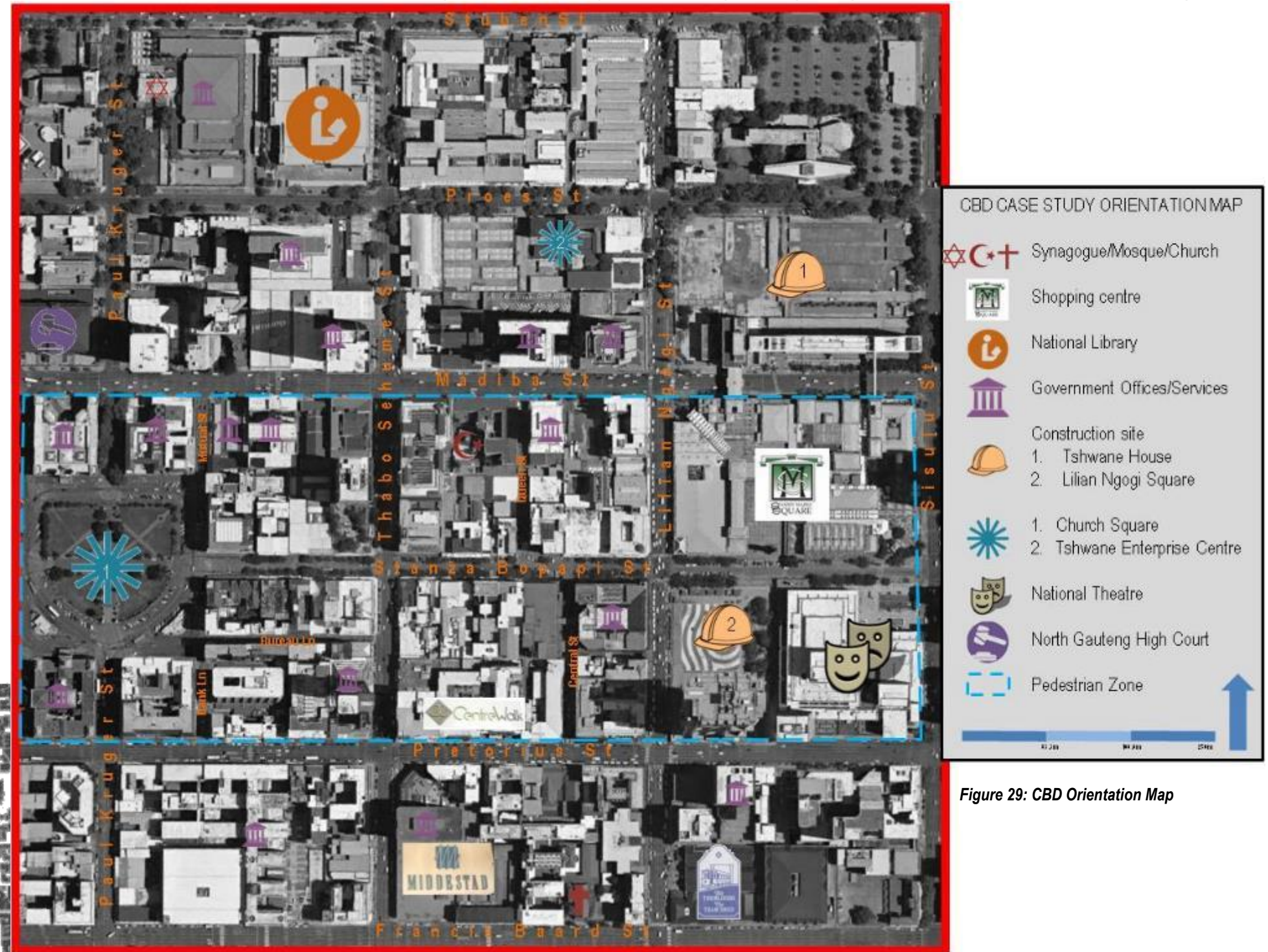


Figure 29: CBD Orientation Map

5.1.2 Demographic Profile

The demographic profile of an area is a major determining factor in retail viability and directly governs what type of retail can function in the area (Urban Studies & Planpractice, 2005). The CBD of Tshwane has undergone massive socio-economic and cultural transformations throughout its history. The most dramatic shift has occurred in the preceding three decennia, reflecting the extreme alterations across the country. The instigation of true democracy from the political dispensation of apartheid has engendered enormous changes and liberties enshrined in the Constitution, for example freedom of movement and desegregation (RSA, 1996).

The inner-city is now more representative of the South African majority (80% of national population is Black) living in, and moving through, the area. The population of the CBD has both changed dramatically and increased substantially, by approximately 5% per annum, between 1996 and 2011. The majority of people living in the area in 1996 were White, comprising 55,57% of residents, this shifted to a predominant 93,98% Black population in 2011 (Stats SA, 2011). Taking into account the area was predominately a 'White neighbourhood'; the overall characteristics of the area have modified immensely, *vis-à-vis* culture, economics and community dynamics.

The influx of population into the area (nearly doubling in 15 years) can be principally attributed to an increase in housing stock provided by building conversions and new residential buildings, driven by private companies and encouraged by public authorities. The predominance of people domiciling in the area (85%) reside in flats in multi-story buildings, rendering an extreme population density, as compared to the rest of the city, including more people per household than in the past (Urban Studies & Planpractice, 2005).

Moreover, the alteration in racial demographics rendered new socio-economic circumstances to the area, with, at first, relatively low income to a lower-medium income spread. Despite 23% of the population having no

source of income, the unemployment rate (17%) is lower than the average of 24.8% unemployment in the entire city. Furthermore, the population is young, averaging 28 years old (Cameron & Krynauw, 2001, p. 27). The shift in demographics has engendered a corresponding conversion in consumer patterns and levels. The dominant Living Standards Measure (LSM) classification in the area is LSM 5, which denotes lower to middle living standards/disposable income, although, due to an increase of government workers and higher end retail, this has shifted upwards to include higher classifications of LSM 6-8 (Urban Studies & Planpractice, 2005). The area is unique, in that high connectivity and access, through various modes of transportation, greatly increases the catchment area of retail establishments in the area. Although there has been retail development in peripheral township areas, their residents continue to visit the CBD for retail and other purposes.



Figure 30: A typical street scene in the area (Author, 2013)

5.1.3 Transportation and Connectivity

The overall distorted and dispersed urban structure of the City of Tshwane creates car dependence, and renders the provision of public transportation challenging. This limits the number of locations where a concentration of

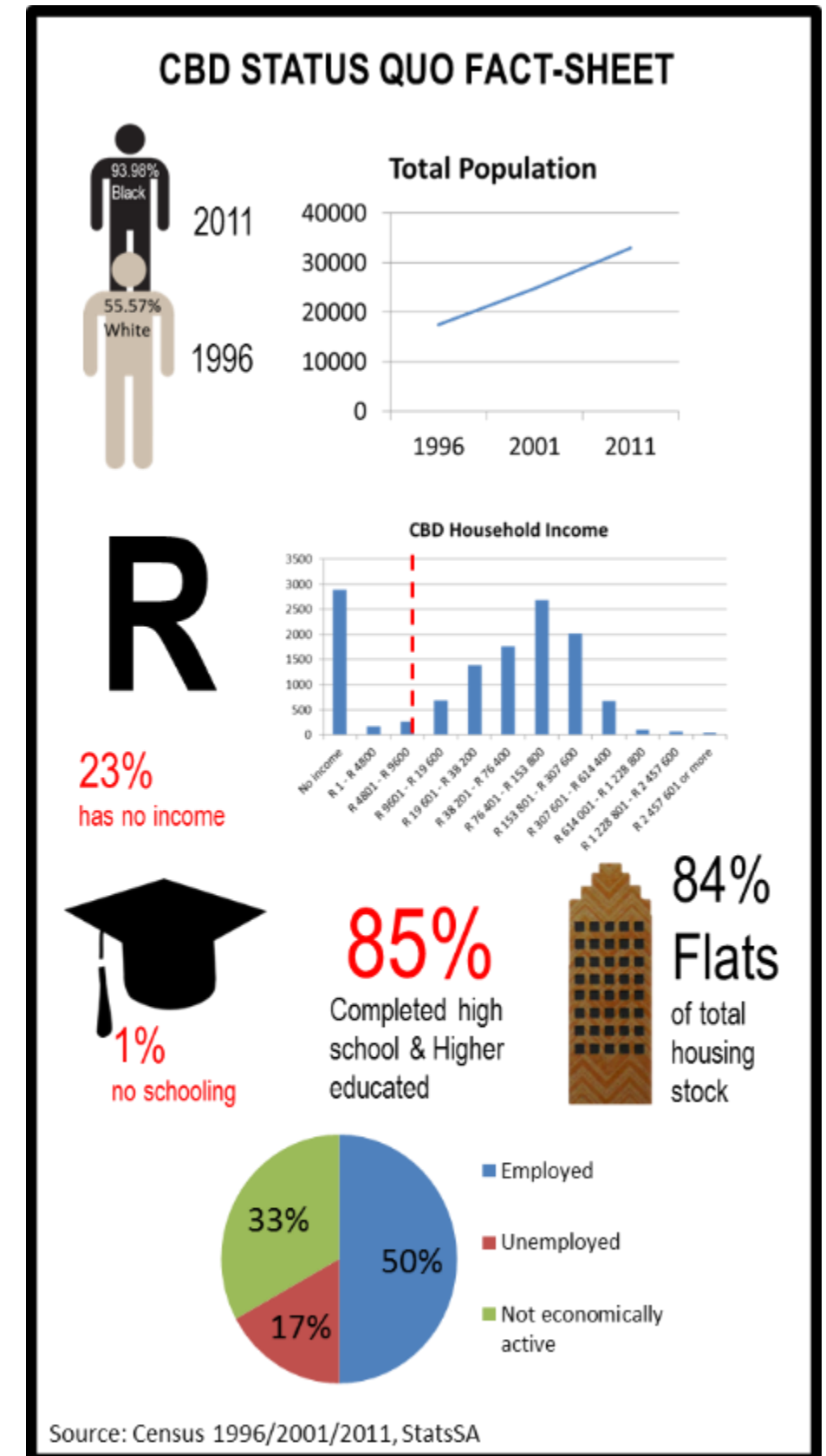


Figure 32: CBD demographic status quo

activities is possible, making access and connectivity to services problematic. The CBD of Tshwane is, as expected, well connected to the rest of the city via various transportation connections, whether road or rail systems. This connectivity and accessibility creates an environment that generates the demand and opportunities for a variety of activities. The transportation system in the area is supported by both private and public transport systems (See CBD transportation network map on the next page). The road network in the area consists of high level national and regional roads, colligating the area to the rest of the city and country.

The area is serviced by the highest concentration of public transportation in the city. Passenger rail services are provided in the Belle Ombre and Pretoria train station by PRASA/Metrorail and Gautrain passenger rail services. In addition to publicly provided transportation, options include trains and buses, in consort with taxis, a crucial component of contemporary South African cities. In South Africa, taxi services operate independently, and as a feeder system to alternate transport services. Within the study area, the taxi industry is a constant presence in the majority of streets, especially prominent in areas with increased activity, for instance surrounding the shopping districts of the Stanza Bopape pedestrian mall. Large taxi ranks and a taxi rank mall are situated to the North of the study area. The Bloed Street Taxi Rank Mall (see CBD transportation network map) combines a formal shopping structure and shops with a large transfer space for taxi operators, as well as space for informal traders. This transportation infrastructure creates a clear axis of activity (retail and other) South of Sammy Marks Square.

Pedestrian movement and networks are prevalent in the area, due to the overall high density usages in the area, in addition to the availability of public transport, as indicated earlier. This is supported by a pedestrian only movement network, inclusive of the Stanza Bopape pedestrian mall; various arcades; and internalised shopping centres around the area, especially to the South of the study area. The large volumes of pedestrians are an externality of an influx of workers from township areas, encompassing



Figure 33: CBD high activity pedestrian movement network (Adapted from Allers, 2009)

Soshanguve and Mamelodi, for employment and other purposes, many of whom are reliant on public transport (Allers, 2009, p. 24). These spaces extend the retail space available, as well as reduce travel time for pedestrians. As a component of the revitalisation of the inner-city, pedestrianisation and pedestrian conditions are critical in, as stated by the Mayor “reclaiming the city” from the car (City of Tshwane, 2013).

The transportation system is diverse in nature and forms a critical element of the overall functioning of the area. The range of transportation systems in the area impacts on the retail prospects of the area. Money spent on transportation by households effectively limits their consumer spending,

capabilities (UN-Habitat, 2013). Church Square has operated as a major bus interchange for many years, although this has been relocated to roads within the area. This relocation has influenced the quantity of people frequenting the area for transfer purposes. Certain businesses in the area have commented that the current construction of the new rapid bus system will impact their trade. The manager of one large national departmental store in Sammy Marks Square commented that the local taxis, used by the stores clientele, will be moved to other areas. This type of shift in transportation networks will affect the retail entities, with a corresponding effect on traffic and pedestrian movement patterns, positively or negatively, impacting the prospects of commercial enterprise.

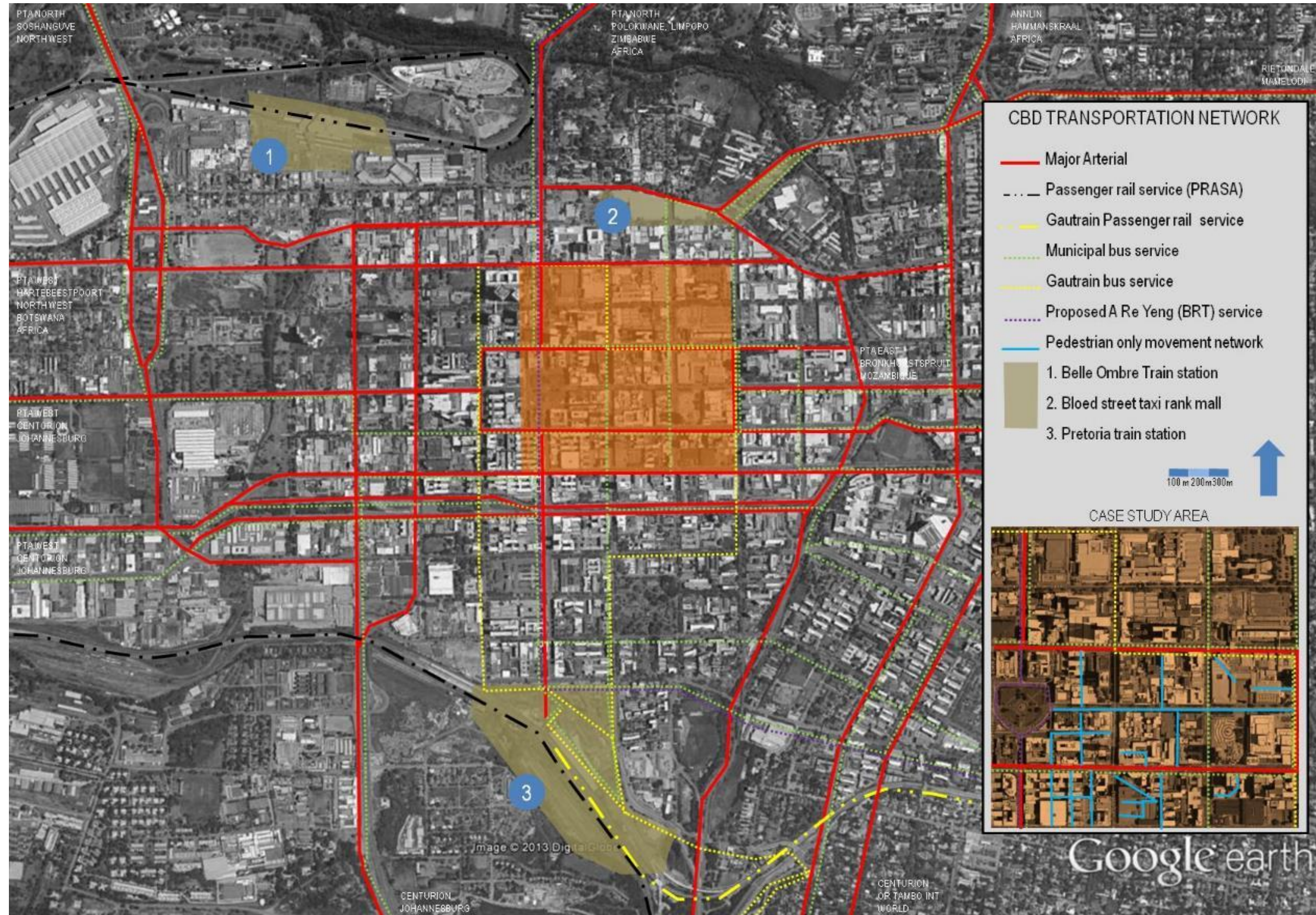


Figure 34: CBD Transportation network

The map above shows the major transportation network of the CBD area including various forms of transport from public/private motorized and non-motorised options. The case study area indicated in orange is examined in-depth to the right inside the map legend.

5.1.4 Land Use Composition, Distribution and Impacts

Land use is an essential indicator of the economic and social activities within an area. Frequently, this is decoupled from the official or legitimate real estate utilisation permitted by land use rights, stipulated by a specific area's applicable zoning statutes and by-laws. This section focuses on the diverse land usages in the selected Tshwane CBD case study area. The clarification of the nature and composition of the variety of different functions encompassed within the case study area facilitates the exploration of the relationship and cross-functional impacts of alternate property functions and utilisations on the retail sector.

Government and Private Offices: Pretoria, as the Administrative Capital of the Republic of South Africa, has, throughout its history, incorporated and maintained a large contingent of Government Departments and Diplomatic Missions. There has been the decentralisation of Government activity to the East and North of the inner-city, with this process instigated by various State programmes. Government Offices (including Provincial Government until recently) have had a major impact, not only on the physical structure of the inner-city, but on the consumer base of the area and range from Municipal, and National Departmental Offices to National Social Services.

These offices and services are in historically significant buildings, for instance those sited on Church Square, promoted by re-development/investment programmes, including Re Kgabisa Tshwane and the National Government, with other large, stand-alone, high-density, and, exclusively office-purposed structures. Moreover, there are mixed use configurations, wherein Government Offices are paired with ground level retail activity or, in some instances, internal malls and/or arcades (Southern region of the case study area). The mixed use buildings originate from the 70s and 80s with the internalisation of activity from the street space. Newer Government Office development is occurring in renovated buildings and new medium-density facilities that only house these activities.

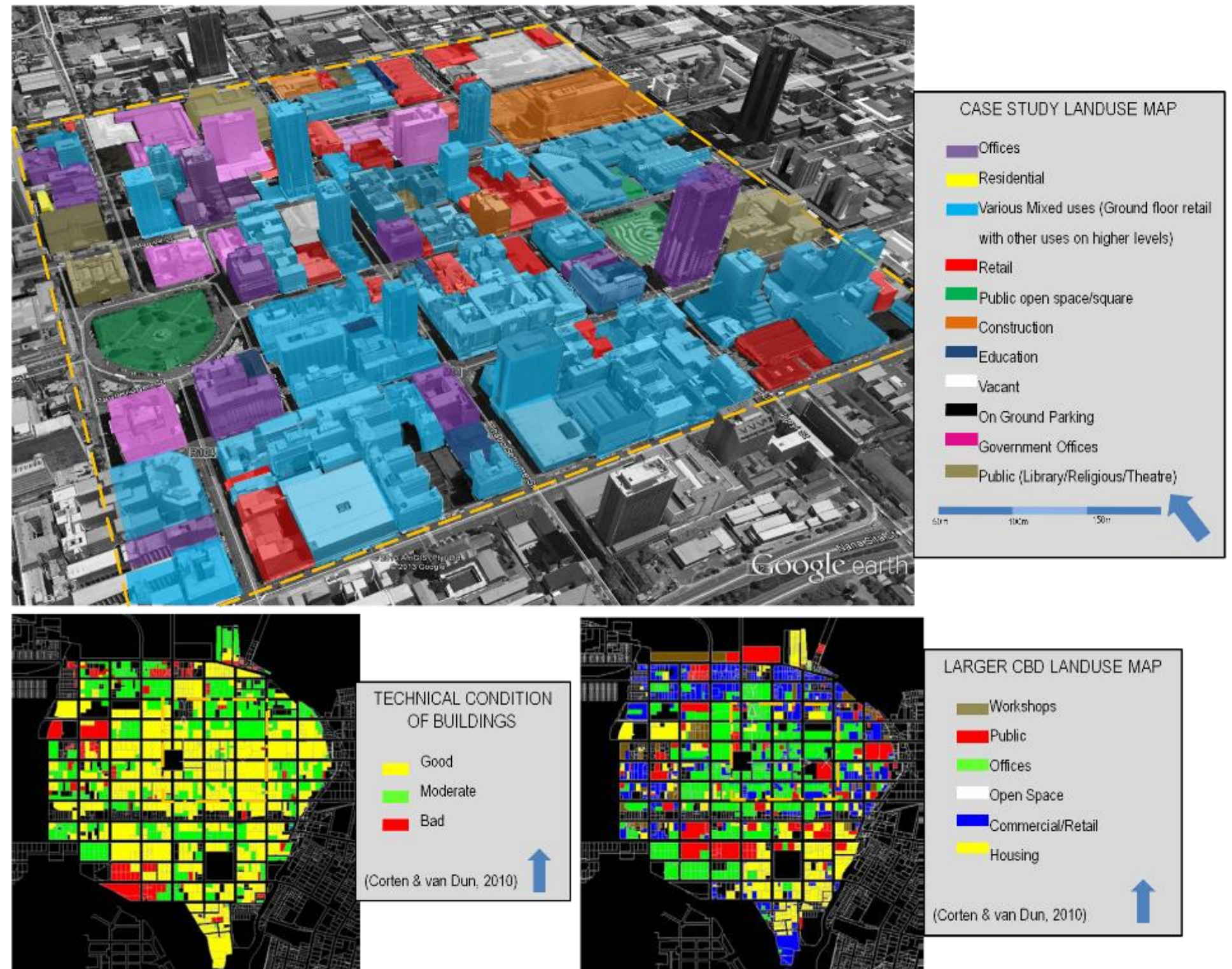


Figure 35: Case study land use map (based on observations by the Author in June 2013); larger CBD Land use map and the technical condition of buildings (Corten & van Dun, 2010).

Government Offices are located throughout the inner-city, and in the case study area are indicated in pink (Government Offices) and in certain of the light blue buildings (Mixed Use) (see Figure 35).

Government Offices and the Governmental officials working within the area are a significant component of the consumer base. The predominance of Government office workers constitute an element of the South African middle class and, in the context of the inner-city are crucial to the retail sector. The majority of interviewees in the area articulated the importance of Government workers in sustaining their trade. This perception is common among street traders located close to these offices, individual shopkeepers, as well as large departmental stores. The choice of goods stocked by shopkeepers is, additionally, influenced, for example, a respondent employed by a national departmental store in Sammy Marks Square remarked that *“the Government employees do demand higher end goods”*. The State employees generally occupy the LSM 6-10 range, connoting more disposable income, which influences their ability to buy better quality or prestigious products, whereas the predominance of alternate patrons frequenting the area fall into the range of LSM 4-6, buying the cheapest goods in order to subsist and save as much as possible.

The relocation and launching of Government Offices has impinged upon retailers, as expressed by a clothing tailor in an independent store, situated in the Northern part of the study area. He reports that the opening of the new Basic Education Department Offices across the street from his shop has generated new customers. Moreover, peak retail activity periods are conspicuously dictated by office workers. This effectuates a typically high volume of foot-traffic, retail sales and consumers in certain periods, viz. prior to 8:00 a.m., predominantly affecting street traders; with the 12:00 – 2:00 p.m. lunch hours producing increased food and general retail related transactions; and general retail shopping activities significantly accelerating subsequent to office hours, in the 4:00 - 6:30 p.m. duration, Government Office employees combine a walking, public and private transportation,

reliant on their personal travel preferences, destinations and the location of desired stores, goods and services.

| VACANCY RATES – % | | | |
|-------------------|---------|---------|---------|
| CBD's | A-Grade | B-Grade | C-Grade |
| Pretoria | 1.8% | 11.2% | 7.0% |
| Johannesburg | 11.0% | 21.0% | 29.0% |
| Durban | 20.6% | 12.8% | 24.8% |
| Cape Town | 13.5% | 7.9% | 29.0% |
| Port Elizabeth | 10.0% | 10.0% | n/a |

Figure 36: Office Vacancy rates in major cities CBDs in 2013.

The best quality offices are represented by Prime Office Space, with C-Grade the lowest Grade (Broll, 2013)

Overall, Tshwane CBD vacancy rates are comparatively lower than those of the nation's other CBDs, with the preponderance of occupancy engendered by the Government sector. Moreover, offered in the CBD inner-city, are certain, previously classified as less-attractive C-grade office spaces, which have been converted to a higher grade of business tenancy, with greater value and appeal.

Besides Governmental agencies and occupancy, there has been a consistent, enduring presence in the area of specific services, inclusive of print media offices and legal concerns (in proximity to the High Court – North of Church Square). Likewise, prominent, major banks and other service providers have been attracted to the area. The re-development and renewal of old office spaces, in consort with the re-purposing of buildings for business tenancies, by property companies, have delivered increased opportunities for the development and occupancy of small companies or organisations. The traditionally high square-footage rates for offices in the CBD, prior to decentralisation, have been significantly reduced. This has enabled smaller independent organisations to relocate thereto, encompassing, *inter alia*, minor and moderate manufacturing capabilities situating close to consumers, for instance niche clothing manufactures. In

addition, the private sector has introduced office space for smaller operator tenancy, ranging from 11m²-70m², with shared facilities, inclusive of conference rooms; toilet amenities; and, in certain instances, secretarial and administrative functions, empowering and facilitating the development and evolution of new entrepreneurs, as well as Small, Medium and Micro-Sized Enterprises (SMMEs) in the city (City Property, 2013).

Education: The City of Tshwane constitutes a prime research and education hub within South Africa, as well as the continent. The inner-city accommodates the prestigious main UNISA campus on its Southern periphery, with the CBD dominated by higher education institutions. Within the case study area, the majority of education facilities focus on business and IT training, reflective of the youthful composition of the population therein. There are constant promotional campaigns in the CBD, with loudspeakers recruiting new students to several learning entities, in conjunction with the large amounts of students arriving and leaving, and noticeable mass exodus during education breaks or holidays, rendering a pronounced decrease in activity. Schools, catering for pupils from Grade R to Grade 12 are in abundance, frequently housed in re-purposed office buildings.

The prevalence of primary, secondary and tertiary education facilities in the area, augmented by alternative learning institutions and instructional entities around the Capital, in consort with the provision of public transport, renders the CBD a popular location for student accommodation and boarding. Consequently, this impacts the retail sector, with specific consumer requirements and demands, actuating concentrations of internet cafes, and computer and technology related business concerns close to student populations. Moreover, particular activities, for example photographers operating at the National Theatre and Church Square, are dependent on this group.

Housing: Traditionally, throughout chronicled history, where mankind has domiciliated has influenced the manner and location of resource consumption and commerce. On a hierarchal scale, shelter constitutes a

primary requisite for survival, secondary only to food and water. Accommodation or housing comprises a basic, and possibly the principal, functional element of a city. The function has a large impact on retail activity as for the largest portion of urban history retail has followed the simple rule of following the roofs. This connotes that, traditionally, retail activity has had a link to where people reside and has pursued housing developments. However, this has altered to a degree with decentralised and speculative retail investments, in consort with progressive advances in technology and motorised transportation.

Major transformations in residential character have occurred within the inner-city in the preceding two decades. The CBD, as previously elucidated, is dominated by office development; however, the decline of certain buildings, along with increased investment in the 1990s, created opportunities for residential development therein. In the case study locale, the residential usage principally comprises mixed use buildings, with retail and other functionality in particular instances. This increment in residential occupancy results in augmented activity within the area after normal working hours, with consequent lengthening of business operating hours, and an increase in the demand for household items and comestibles.

Housing and accommodation availability and supply, in addition to affecting consumer demand, influences retailers in their own selection of residence. This is distinctly observable in street traders, who frequently domicile in peripheral areas of the city, with major issues revolving around transport and travel. If the vendor resides at a distance from his site, travelling can comprise large amounts of their capital expenditure, in consort with the consideration of time and sleep constraints, as they would have to wake extremely early to use public transport and get home late. Some traders arise at approximately 4:00 a.m. and return around 8:00 p.m., while only being able operate in normal business hours. The lack of affordable housing restricts their choice of residence, with it almost impossible for these traders to access housing in the area. Another significant aspect arises from the expense of storage for their stock and stalls, it is often unfeasible to



Figure 37: A new City Property redeveloped mixed use initiative in the Stanza Bopape pedestrian mall, consisting of ground floor retail with street traders in front, a second storey pre-school, with the remainder flats (Author, 2013).

transport these and the majority of the traders in the study area have to rent and pay for stowage. This inevitably has a potential consequence to the overall success of micro-business, as owners and operators are preoccupied with non-sale activities and incur peripheral expenses. On occasion, street trading is a temporary occupation, thus not warranting a residential relocation.

Public Facilities/Amenities: The CBD evinces a variety of public facilities and amenities, which service the immediate area, and the entire city, due to location and access. In addition to the aforementioned Government services, various key public facilities are located in the case study area. These include the National Theatre of South Africa; Church Square; and

several, assorted museums and public squares. These public spaces and amenities attract tourists and citizens, consequently engendering demand and requirements for particular retail activities within the area. This is evidenced by the large contingent of historic Church Square photographers; several book stalls close to the Theatre and other general retail functions in the areas' surrounds.

Construction and Vacant Land: Construction and vacant spaces form a substantial part of the study area. Vacant lots and building developments in the study region consist of empty office structures, a synagogue and historical buildings, with the majority designated for re-development. These spaces, however, impact on the viability of retail activity, rendering positive and negative effects. Benefits of these open or vacant locations that they can be occupied by street traders or even used for extra open parking (e.g. in Paul Kruger Street, next to the old synagogue); however, disadvantages incorporate negative impact on aesthetics and overall degradation. These gaps and degeneration propels the natural process of creating similar and progressive abasement challenges, essentially exerting the 'broken window effect'. The areas adjacent to the buildings become unsafe and unsightly, due to the inactivity, with increased pollution and refuse disposal and loss of appeal, together with being frequently utilised as informal taxi ranks, obstructing pedestrian movement.

The predominance of construction is constituted by the conversion and upgrading of older buildings, as well as certain large public projects, for example the BRT system; and the new Tshwane Municipal Offices (Tshwane House) on the old Munitoria site, the previous municipal offices. The demolition of Munitoria resulted in the dispersal of staff throughout the inner-city, with repercussions to adjacent businesses, currently, during the construction phase and potentially, in forthcoming operations. Retailers in the vicinity are eagerly awaiting its proposed occupancy and functionality, as they anticipate an influx of offices workers, augmenting and reinstating their consumer base.

Particular construction projects are directly related to the retail sector, including the erection of new stalls in the North of the study zone, on Thabo Sehume Street, leading to the Bloed Street Mall, which incorporates a general upgrade of the pavement. In close proximity to the new stalls, the city is in the process of constructing a market space for traders, sited below Council storage facilities in the Tshwane Enterprise Centre.

Mixed use: Currently, the mixed use buildings in the inner-city and case study zone predominantly constitute post-1960s office blocks with ground floor retail uses. As depicted in Figure 37, the conversion of old office structures generates multiple usages in a single edifice, enhancing and energising the surrounding area through the accommodation of housing, services and retail functions. Frequently, the larger office block complexes contain internal retail space, through interior malls, which were originated in the 1980s. On-street retail space is unavailable adjacent to these evolving structures, rendered by the removal of the critical street-building interface, concomitantly resulting in these expanses exhibiting diminished street activity due to a reduction in safety and dynamic flow. The primary differentiating factors in mixed use buildings comprise the type of use; density; street interface; and historical value.

Religious: Religion and religious practices, colligating with an accompanying trade, has a vast legacy of corollaries which have influenced several facets of the city's formation and development, in consort with its continued functioning; albeit possibly not to its current contextual and influential extreme. Spiritualism and its associated institutions comprise a significant element of public life in any city, with this locale no different. The contemporary amalgam of religious groups within the case study zone is considered truly representative of that of the Nation's populace, largely deemed a principal attribute of South Africa's character. Within the delineated study area, religious institutions affect and influence their surrounding environs in several ways, and not, exclusively, in a spiritual manner. This is particularly evident in the district adjoining the Queen Street Mosque, where an Islamic/Indian Quarter has emerged, with related

commercial activities, including traditional Islamic clothing and traders of the same ethnicity. Moreover, spiritual establishments, through routine religious services, community-centred practices and significant holy days/festivals, affect and stimulate the commerce and dynamics in their immediate vicinity. Consequent to these regular and special functionalities, there are periodic fluctuations in pedestrian and other traffic, with these areas crowded with passers-by, increasing activity and attracting patrons, at particular times of the day, week and year.

Public and Open Space: Jane Jacobs postulated, as one of the conditions for diversity, that public spaces are of import, potentially delivering multiple functions, from which urban populations benefit, engendering a wider choice of activity (Jacobs, 1969). Localities designated for public movement, entertainment and leisure comprise vital urban districts, enhancing attractiveness and desirability for both residents and tourists. There are several key public spaces in the study locale of the Tshwane CBD. These, include Church, Lilian Ngoyi, and Theatre Squares, effectively connected via the Stanza Bopape Pedestrian Mall, which forms a central axis in the locale, multiplying and colligating several sections.

Supplemental to these specified public spaces, are sidewalks, which fundamentally transmute to the interface between public and private expanses within the city. The study expanse's pavement stretches vary in both quality and expanse, inclusive of problematic building alteration, which ultimately impacts on retail viability.

5.1.5 Public Space Composition, Quality and Management

Places and Uses: Spaces of exchange, where cultural, personal and economic transactions occur, are vital to the health and survival of cities and neighbourhoods (Joseph Rowntree Foundation, 2007). All forms of public areas are considered, by communities and individuals, locations of exchange. The CBD evinces heterogeneous types of public space, inclusive of street and sidewalk space; pedestrian-only streets; as well as semi-public or pseudo-public localities, managed by private companies, for instance

arcades and malls. As portrayed in Figure 38, the street space, in consort with its accompanying pavement, is demarcated in the basic urban formation of a grid layout. The predominance of the area's CBD street and sidewalk space affords direct street access to buildings and activities. This may not always engender ground floor or on-site activity, for instance retail; however, it does compose a defining characteristic of formal and/or informal commercial transactions in the area. The central section of the study zone contains public squares (Sammy Marks and Church Squares), colligated with the East to West pedestrian zone. The central and Southern regions enable the approach and entrance to an extensive arcade system and malls, effectively contributing enhanced access and increased permeability. Particular centres and arcades are more successful, attributable to their location and cosmopolitan shop variety, in consort with elements of aesthetics, security and maintenance.

Restrictions and Control: Public space is often considered as zones with no access constraints nor any ethnic, physical or other segregation; however, certain (or all) individuals may be excluded through design and location. The public possesses diverse sets of knowledge, experience, time and money, which determine their ability to access public areas (Joseph Rowntree Foundation, 2007). A variety of groups may potentially be excluded through design omission and missing elements, for example parks without benches, thus excluding the old, or those that prohibit children or particular individuals, including prostitutes, beggars or the homeless. Additionally, security issues are a concern, with safety factors discouraging the utilisation of the locale, especially after dark.

The study area has a range of controls and restrictions, differing accordingly with who manages the space and location. The majority of the research area's public space is composed of the streets and sidewalks, which are under municipal authority. Regulatory control is enforced by the SAPS and Metro-Police, for example the removal of informal traders and other 'non-desirables' in certain areas. There is a limited quantity of electronic

surveillance of street sections, effected by video cameras at traffic intersections and on private businesses (Pretoria News, 2013). Police stations are located to the West of the study area, with a mobile SAPS office on the corner of Thabo Sehume and Bloed Streets.

The older malls and arcades have less security and electronic monitoring, potentially permitting unobserved passage. The newer centres and arcades employ more security officials and closed-circuit surveillance. In one centre the researcher was asked to refrain from taking pictures in the mall space. The centres, with one exception, actively refuse hawkers entrance to their premises, displaying signage on the access doors.



Figure 39: Metro Police enforcement in CBD

In the image Metro Police are talking to an informal trader in CBD. The officer to the right had removed illegal advertising in the street preceding the conversation. (Photo by Author)

In addition to municipal and police enforcement, the area exhibits various forms of self-governance and organisation. In the course of the researcher and assistants conducting field observations, an informal vendor expressed trepidations concerning the survey of street traders, indicating that malicious groups in the location engage in similar activities.

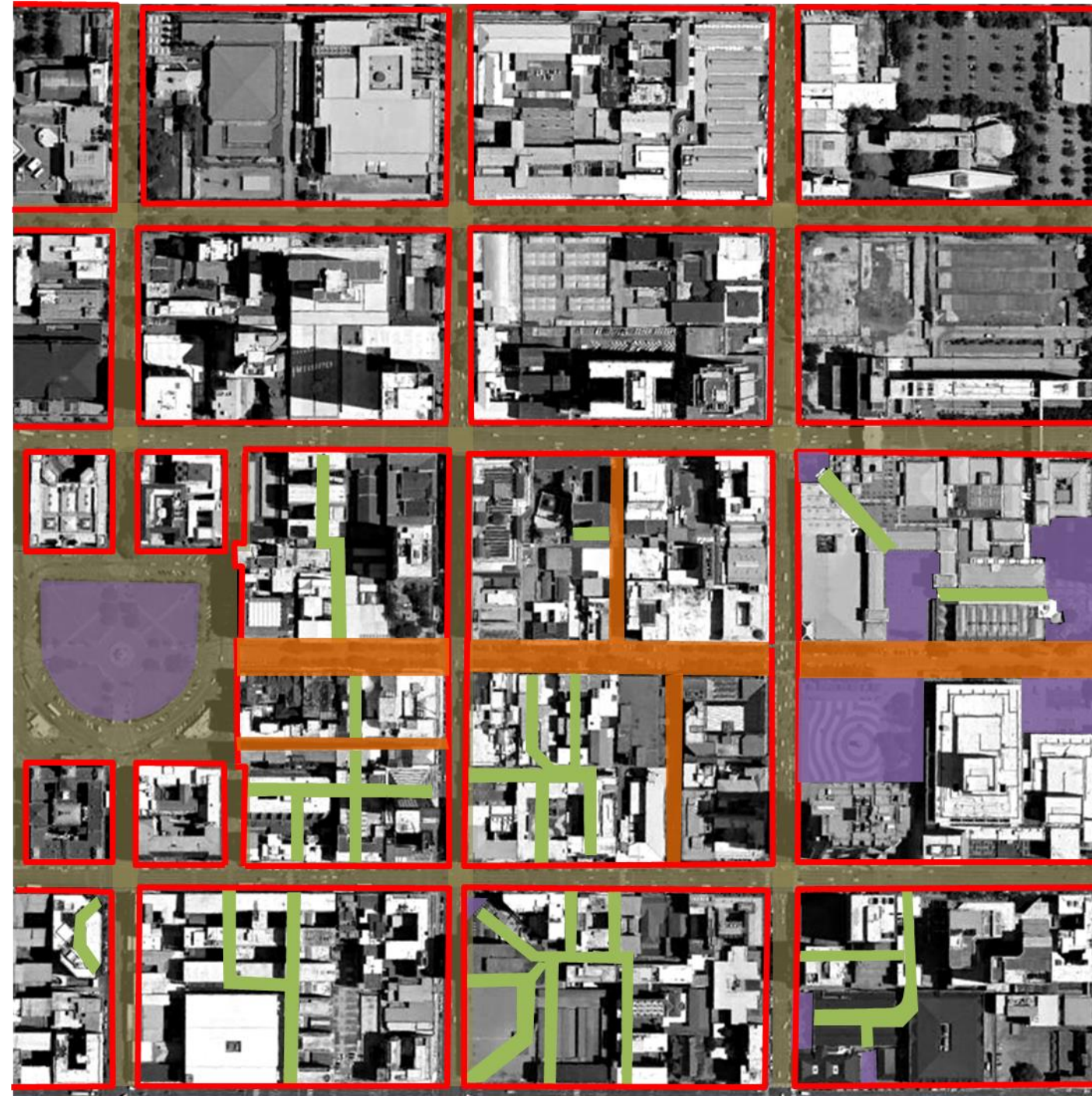


Figure 38: CBD case study area public space

The figure above constrains the location and composition of public, semi-public and private space.

The vendor elaborated describing mafia-like organisations, vying for extortion money from traders in a protection racket.

CBD PUBLIC SPACE*

- Sidewalk
- Arcade/Mall
- Pedestrian Mall/Open Arcade
- Public Square**
- Street Space

- 18km building front***
- 11km sidewalks
- 5.5km roads (17% of area)
- 2km pedestrian mall
- 2km arcade/malls****

*Public space includes some spaces that is also in control of private entities but still functions as public space
 ** Public Squares include municipal (Church Square etc.) and private maintained spaces (Public area in front of mall)
 *** Possible building front as provided by direct access to a pedestrian way (sidewalk, arcade etc.)
 **** Only refers to ground level distance. This space is private but seems public (pseudo-public space)

The traders connect in, several transactions of negotiation, barter and accommodation among themselves, ranging from locational choices to general assistance with operations.

Private Firm Management in the Area: As aforementioned, large private firms have major property portfolios within the CBD area. These organisations, specifically and notably City Property (see <http://www.cityproperty.co.za>), have undertaken a participatory, deliberate and active role in re-developing buildings, as well as the sidewalk space fronting them. This additional expense is considered an extension of the total building investment, ameliorating the general area for their customers, the residents and, by extension, the ordinary, incidental passers-by. City Property and other enterprises have invested in cleaners and security; however, clear distinctions exist in the assorted companies' management quality, with distinct deviations therein, within the mall and arcade space. Particular centres and/or arcades lack upkeep, with high vacancy levels, consequently are frequented less by consumers. Auxiliary services, for example ablution amenities, are of a very poor quality or non-existent in certain areas, augmenting poor general aesthetics, design quality and experiences. These mall spaces are designated for re-development, with interest shown the area's arcade system. Private security firms are present within the environs, principally serving small individual businesses.

Public Sector Management: In addition to the previously elucidated privately subvented endeavours, which occur in partnership with Municipal Government, there are numerous, assorted programmes and publicly-driven initiatives in the study area. As components of the municipal service provision commitment, several services are rendered in the area, inclusive of cleaning; waste removal; security; and maintenance. Furthermore, under the Extended Public Works Programme, the city, in consort with the Department of Public Works, has employed security and cleaners in the CBD. Municipal security is effected by police and by private firms in the area's assortment of Government buildings.

Commencing in 2012/13, major construction work was undertaken to ameliorate and enrich sidewalk space in the CBD, specifically in Lillian Ngoyi Street, with pavement upgrades and the erection of street trader structures. Additional streets to the North have received sidewalk enhancement, although there is still a persistent maintenance issue, with sewage/water seepage and a damaged walking surface. Municipal dustbins are distributed throughout the area; however, in certain districts pick up and distribution are neglected or inadequate. The existing public toilet facilities in the area (next to Tshwane House construction site) were, at the time of fieldwork, out of order, leaving street traders and passers-by without access to public ablution amenities. Inevitably, people requiring these facilities are forced to utilise the private amenities of businesses or the sidewalks.

Production Value of Public Space: Public space, including street areas and sidewalks, comprise the lifeline for any city, facilitating access to major activities. Streets and pavements potentially create conditions for economic growth and productivity, but their overall design is crucial. Streets with high activity and production value *"harness the benefits of agglomeration economies, improve access to productive advantages (knowledge, quality of the environment, etc.); they provide sufficient public space for circulation of goods and people and deploy adequate infrastructure; they encourage polycentric urban development; they allow synergies between centres and sub-centres; and they intensify urban nodes and corridors to maximize the benefits of concentration"* (UN-Habitat, 2013, p. 37).

Generally, cities that reduce traffic congestion and intensify pedestrian access are more productive. This connectivity and access translates into higher volumes of consumer and business spending, which, through accretion, attracts a greater proliferation of business and consumers, thereby increasing property values. Higher property values create a larger pool of property tax, which can be employed by the city to enhance service delivery. Streets fulfil a direct economic role within the city, through an assortment of activities, for instance street vending.



Figure 40: CBD productive public space

From the top: CoT formalised stalls on Lillian Ngoyi Street; two rows of street traders on the sidewalk next to a shopping complex in Lillian Ngoyi Street; 'Dead street space' in front of Government Department building in Proes Street (Photos by Author)

The retail transactions of shops are ordinarily contained within a building, with direct street entry, whereas street trading is conducted in between shop fronts and the street. This effectively expands production value and employment opportunities, although this may be transient or temporary. The overall contribution of street vending and trading to the economy is potentially substantial, especially in developing nations. However, despite the positive benefits of street trading, its negative impacts on public space are blatantly apparent. This is exemplified by the added risks to passers-by, who may be compelled to walk in the road, due to the reduction of pedestrian space (UN-Habitat, 2013, pp. 37-38).

Certain city management strategies force traders to relocate or may totally remove them, evinced in recent tactics employed by the City of Tshwane and the City of Johannesburg. The overall economic impact of these relocations in those cities, to the traders and to the overall production value of street spaces, is seldom recognised. These negative externalities of trading, can through accurate and proper management, and especially, correct design, be reversed. The accommodating of both trading and pedestrians promotes high economic functionality within an area. Design measures, for example traffic calming and pedestrianisation, can result in increased numbers of passers-by, with the ultimate corollaries of enhanced property values, similar to proximity to public gathering spaces (parks and squares) rendering escalations therein (UN-Habitat, 2013).

Within the study area, public spaces, including streets and squares, are employed for multiple activities, e.g. street trading. This, as previously mentioned, extends the generative or retail space into the street from the usual building fronts. The sidewalks are commonly occupied by street traders, in formalised and informal structures. Mobile traders and hawkers also transact in the street, selling their wares to people in cars and/or taxis.

Additionally, 'dead spaces' are created on blocks with buildings possessing limited street frontage or little ground level activity, especially to the North of the study area.




| Block Type | Location in Study Area | Characteristics | Impact on traders and environs |
|--|---|--|--|
| Government model Block size: 210mX140m |  | <ul style="list-style-type: none"> • Single Usage & Isolated • "Sterilised" Periphery • Not permeable & Car orientated • Little Pedestrian movement and very concentrated at certain points • Large plots taking up most of the block • Important functions for community and adds consumers to the area | <ul style="list-style-type: none"> • Not creating space for trading • Unsafe areas • Impedes movement • Difficult to repurpose • Government workers important consumers in the area |
| Small and Permeable model Block size: 100mX140m |  | <ul style="list-style-type: none"> • Small blocks • Multi functional (edu, retail, gov) • Permeable and accessible • Pedestrian orientated • High intensity & medium density | <ul style="list-style-type: none"> • Creating economic space due increased pedestrian movement and interface • Formal and Informal in unison |
| Arcade and Shopping model Block size: 210X140m |  | <ul style="list-style-type: none"> • Opens up block for pedestrian movement • Creating more retail space • Multi functional (edu, retail, gov) • Management is key | <ul style="list-style-type: none"> • If managed well traders and other activities very successful |

Table 3: CBD Block Types (Author, 2013)

Potential retail and other space is reduced or not available on the street level next to large retailers, malls and Government buildings, with passing pedestrians confronted only by walls, rendering the space less productive and safe. These spaces could be considered for future re-development by the public and private sectors.

5.1.6 Urban Morphology and Related Impacts

Urban form or urban morphology is a crucial component of the built environment, significantly affecting how the city functions. The fundamental basic elements of any neighbourhood comprise the blocks, housing plots, and various land usages, which are connected via streets. In historical, through to contemporary cities, urban form has determined how space is, or may be, utilised, as well as dictating the capacities and facilities the built environment possesses in terms of adapting and responding to changing circumstances. Salat (2011) conducted wide-ranging studies investigating the factors rendering amplified resilience in certain urban forms; revealing particular basic urban configurations, for instance the Roman block (70mX70m), still persisting in modern European cities. The Roman block, as well as alternate models, evince greater complexity than several modernist urban configurations, which oversimplify the structure to accommodate cars, with large plots, diminishing the overall capacity of the built environment to adapt and function.

The complexity of urban form is central to the resilience of the built environment, in consort with being directly correlated to the potential diversity and activity intensity.

The principal structuring urban form element, clearly observable in the study area, comprises urban blocks. The 240mX140m block was utilised from the origin of the city in the mid-1850s. However, the road hierarchy and land usages have changed dramatically, culminating in the contemporary status. Although the standard block configuration is present in the majority of the study area, various unique types are distinguishable.



Figure 41: Block typology on various scales (Author, 2013)

This typology is based on field observations in June 2013, conducted by the author and research assistants

The designation of block types is critical in elucidating their unique implications in influencing and affecting retail viability.

The grid layout of the metropolis, as in other cities, has manifested as reasonably resilient, with the capacity to adapt, due to minimal alteration of its underlying structure. The Tshwane block sizes are, however, comparatively large, in relation to international and local examples. The area's blocks are of a magnitude between two and four times greater than those of New York and almost 6 times larger than those in the Roman Grid Model (Salat, 2011). Comparatively, the local block sizes of the Johannesburg CBD are half those within the case study area. This equates to a less walker-friendly and permeable built environment in the Tshwane CBD, consequently effectuating diminished available retail space, engendered by a reduced amount of street frontage. Marabastad to the North West of the study location, displays a smaller block configuration (70mX60m), similar to the Roman block. This accommodates expanded pedestrian access and an enormous concretion of potential formal and informal retail activity.

The preceding table indicates the principal block types in the Tshwane CBD, in conjunction with the location of each unique exemplar thereto, and its typical characteristics. Finally, the impact, on the retailers and the general environment, of the aforementioned urban form is portrayed. Significantly, it is apparent that the specific block type influences whether a location is preferred by retailers and alternate activities.

The first block type, the Government model, is predominantly located to the North of the study area. Although additional Government investments and developments exist in the area, no other archetype exerts the equivalent dramatic effects on its surrounds. This block variant principally comprises large plots occupied by Government Offices (active and vacant), as well as important community services, including the recently-built National Library. With the exception of the library building, the majority of this building type is set back, a distance from the street, with gates, walls or large expanses of parking on the periphery of the plot. This results in empty sidewalks and

minimal street activity, effectively sterilising the outer boundary. The production value of the space is decreased for retail and other possible activities. From Figure 41 it is evident that retail activity is limited, with only three street traders on the Southern corners of the block.

The subsequent block type, the small and permeable model, splits the standard block size in half, through pedestrian-only streets and arcades (Central region of the study area). Open arcades and smaller blocks, with small plot divisions, vastly intensifies the conglomeration of land use variation. Formal and informal retail trade are positively affected, actuated by the agglomeration advantages and heightened pedestrian movement facilitated by the block type. The overall diversity and intensity of trade within the central area can be observed in Figure 41, in the Southern section, where the preponderance of street traders is located (in the Stanza Bopape/Church Street Pedestrian Mall). Within this pedestrian corridor, high street retail is represented, with mixed use buildings above and street traders fronting of the retailers.

The final identified block type constitutes the shopping or arcade model, located in the central and Southern sectors. This study region incorporates prominent street retail; street trading, internal malls; and arcades. There is a general amalgam of land use, including ground floor retail. The Southern blocks, of 210mX140m, are permeated by arcade systems and internal malls. As previously stated, how they are managed is critical; if their supervision is sufficient and effective, then both formal and informal activities can be successful.

5.2 Understanding the Retail Functional Group

The inner-city of Tshwane constitutes a premier activity core, attracting individuals and retailers from throughout the city. The case study area, within the CBD environs, evinces the greatest comprehensive range of retail activities, from shopping centres to street traders. This is deemed essential for evaluating the retail sector in its most diverse forms, critical to this study. The ensuing section will describe the assortment of retailers and their associated 'layers of diversity', inclusive of:

- A Regional Retail Overview;
- An Overview of Retail Typology;
- The Layers of Diversity Observed and Explored; and
- The Structural Diversity Model of the Retail Functional Group.



Figure 42: A perspective of retail activity in the study area (Author, 2013)

5.2.1 Regional Retail Overview

The CBD area is a principal retail destination in the context of the City of Tshwane. Although the CBD has undergone major transformations, it remains a critical retail terminus on a regional, metropolis-wide level. Augmenting the street and informal trade activities in the area, the CBD incorporates a variety of shopping centres. Within a regional context, the CBD/Sunnyside area, in 2005, integrated 16 retail centres, equating to 221 000 m² retail space (comprising 15,4% of the entire, total retail centre supply of the city, second only to the Eastern region of Tshwane). Each sector within the CBD/Sunnyside area has specific characteristics. The CBD and Hatfield areas typically focus on external consumers from outside the area and internal residents, whereas Sunnyside and Arcadia concentrate only on the latter.

The area experiences an inflow of patrons from the greater urban metropolis, especially the township areas on the periphery of the city, resulting in an oversupply of retail space relative to the capacity of the local inhabitants. Major retail centres in the case study area include Sammy Marks Square; The Tramshed; 'Die Meent'/Central Place; Sanlam Centre/Middestad; and the Bloed Street Mall. The centre sizes range from 8 000 to 30 000m², with magnitudes extending from neighbourhood to small regional centre. The agglomeration of these centres connotes high trading densities, due to, *inter alia*, the connectivity of the area to the larger city expanse and the high density environment.

Retail trade within the case study area should, however, consider, significant, in addition to retail centres, high street and informal trade. As similarly characterised by the majority of global urban centres, high street commercial activity comprises a major component of the area's overall retail trade. Superior connectivity, in terms of public transport and pedestrian flow, together with buildings with excellent street interfaces and a safe environment, effectuates a milieu in which high street retail can flourish. This is, additionally, exploited by assorted shopping centres, as well as informal commerce within the case study area.

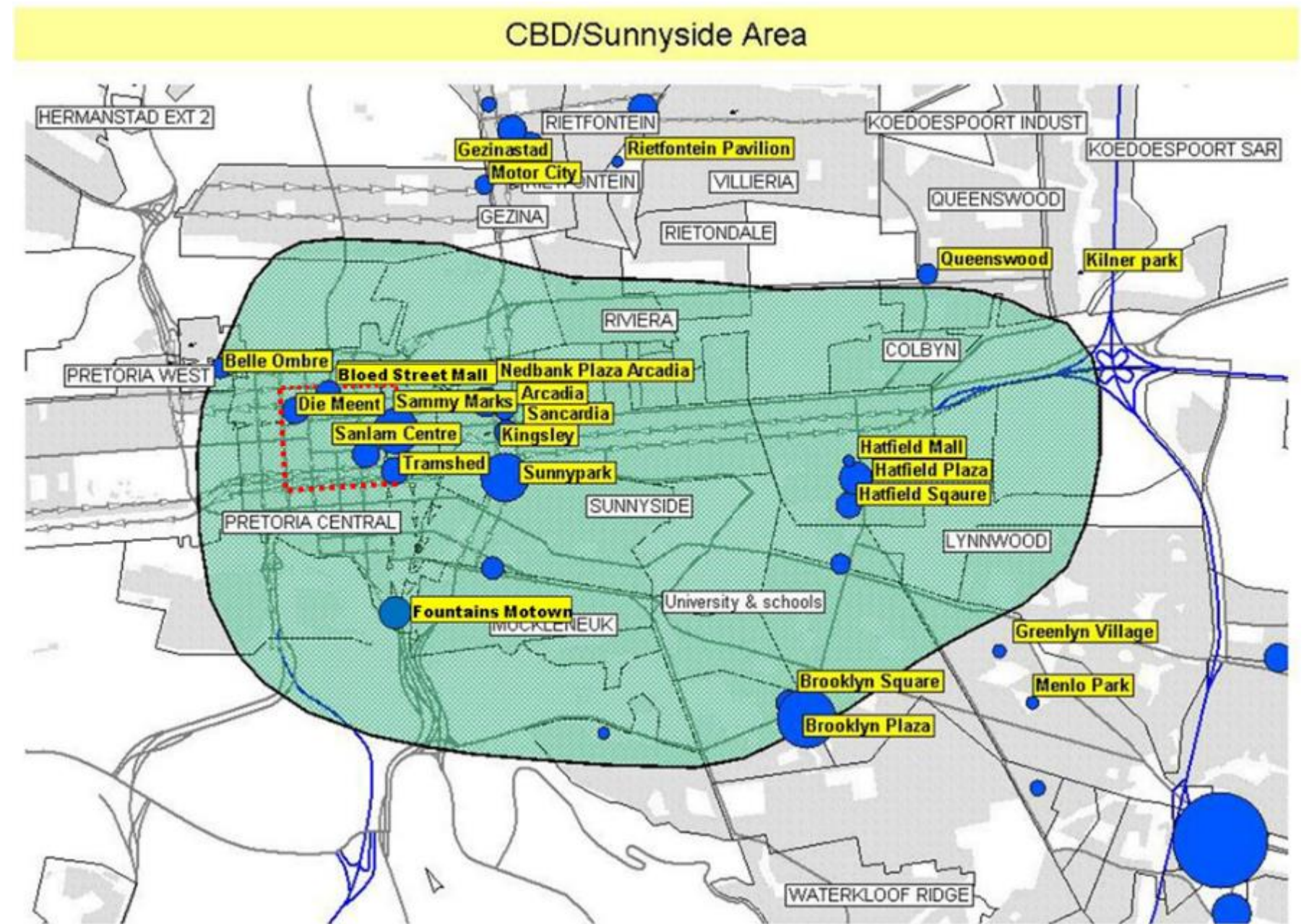


Figure 43: Major retail developments in the CBD/Sunnyside area and surrounds in 2005 (Urban Studies & Planpractice, 2005)

The green area is considered the direct catchment area for retail activities in the locale, with the circumference of the blue circles indicating the size of the centres relative to one another. The case study area is indicated in red.

Informal trade along major transport and pedestrian movement networks is one of the primary characteristics of the Tshwane CBD. Informal vendors garner major agglomeration advantages through trading in the area, as suppliers and consumers coalesce in many instances, for example the proximity of the City of Tshwane's Fresh Food Market to the West of the area. Additionally, a major wholesale and informal trade area, Marabastad,

is located to the North West of the investigated region. Marabastad has an enduring history of trade, continuing as a principal destination for vendors and consumers, via taxi or train transportation routes and through the supply of multiple trade items.

5.2.2 Overview of Retail Typology

Multiple retailers are located in the Tshwane CBD, ranging from street traders to shopping centres, each exhibiting a variety of characteristics, with an assortment of populations. Overall, the 800mX800m block selection incorporates 915 retailers, with a proportional balance between the diverse broad categories of merchants. The figure to the right illustrates the relative distribution of retailer type. The construction of retailer types, as explained in Chapter 3, comprises a component of an iterative process, revealing the unique characteristics of each discrete group.

Commencing from the top, the diagram demarcates that the least represented retailers constitute the mobile street traders, with only 10 observed (illustrated in blue). Due to their questionable legal status, in consort with their mobile nature, this figure should be regarded as extremely conservative and equivocal. The ensuing group, street traders (347), exhibits the second highest frequency, in relation to the enumeration of individual retailers (illustrated in orange). As these vendors may, in certain instances, frequently and/or periodically relocate (at different times of a day, daily or alternate intervals), this enumeration should also be considered moderate and adjustable, although to a lesser degree than that of mobile traders. The 368 independent retailers compose the single largest retailer group in the CBD (indicated in green and blue). The blue independent retailers refer to niche retailers, indicating a certain degree of commercial 'maturity' in the area. The subsequent group constitutes the national retailers or franchises, contributing 171 entities of the entire retail sector (illustrated in purple). The remaining merchants are considered collective retailers, comprising arcades (11) and shopping centres (5). These collective retailers, although low in number, consist of multiple commercial enterprises, thus exerting a substantial influence on the retail landscape.

The overall distribution exposes a relative balance among the different retailers in the area. This does not, however, imply that each discrete group possesses the same position or ranking, *vis-à-vis* consumer spending; collective bargaining power; etc.



Figure 44: Total number of retailers per type in the case study area (June, 2013)

5.2.3 Retail Locational Choices and Distribution (Spatially and Population)

The retail trade represents a primary land use within the CBD area. The CBD supports an assortment of retail developments, from street traders to shopping centres. It is logical to expect that all retail entities desire to optimise their profitability within their own capabilities and resources. Taking the profit motive into account, it can be assumed that the retailer emplacements within the study area reflect coveted and desirable retail locations (although limitations exist, as elucidated later). The majority of retailers are driven to gain and sustain profitability or, at minimum, endeavour to garner sufficient profit for survival. Certain larger organisations can, however, afford to be unprofitable for a duration or, may, for competitive purposes, maintain an unprofitable branch, with the possible exception of franchisers. Typically, small enterprises, for instance, individual retailers and street traders, cannot afford these tactics or long periods of unprofitability, as their stocks, insurance and capital are rapidly depleted, smaller or non-existent.

The built environment, in the circumstance of the CBD block and street layout, provides the environmental enclosure in which the retail sector evolves and matures. Within the CBD area, the basic building element constitutes the grid layout, along with the extant and varied block configurations. The general functional distribution, with the exception of arcade and shopping centre activity, is cultivated around the blocks. Building frontage to the street, next to the sidewalks, attracts street traders and formal retail activity.

A specific or individual retailer, depending on their size and composition, is more mobile and can easily move premises. Street traders (including mobile traders), with no permanent structures or demarcated spaces, can relocate to areas with foot traffic. This is, however, impeded by municipal by-laws and enforcement, which frequently inhibits free relocation. The demarcated areas may evince sufficient foot and vehicle traffic at a certain point in time; however, passer-by and motorised traffic volumes are differentiated and

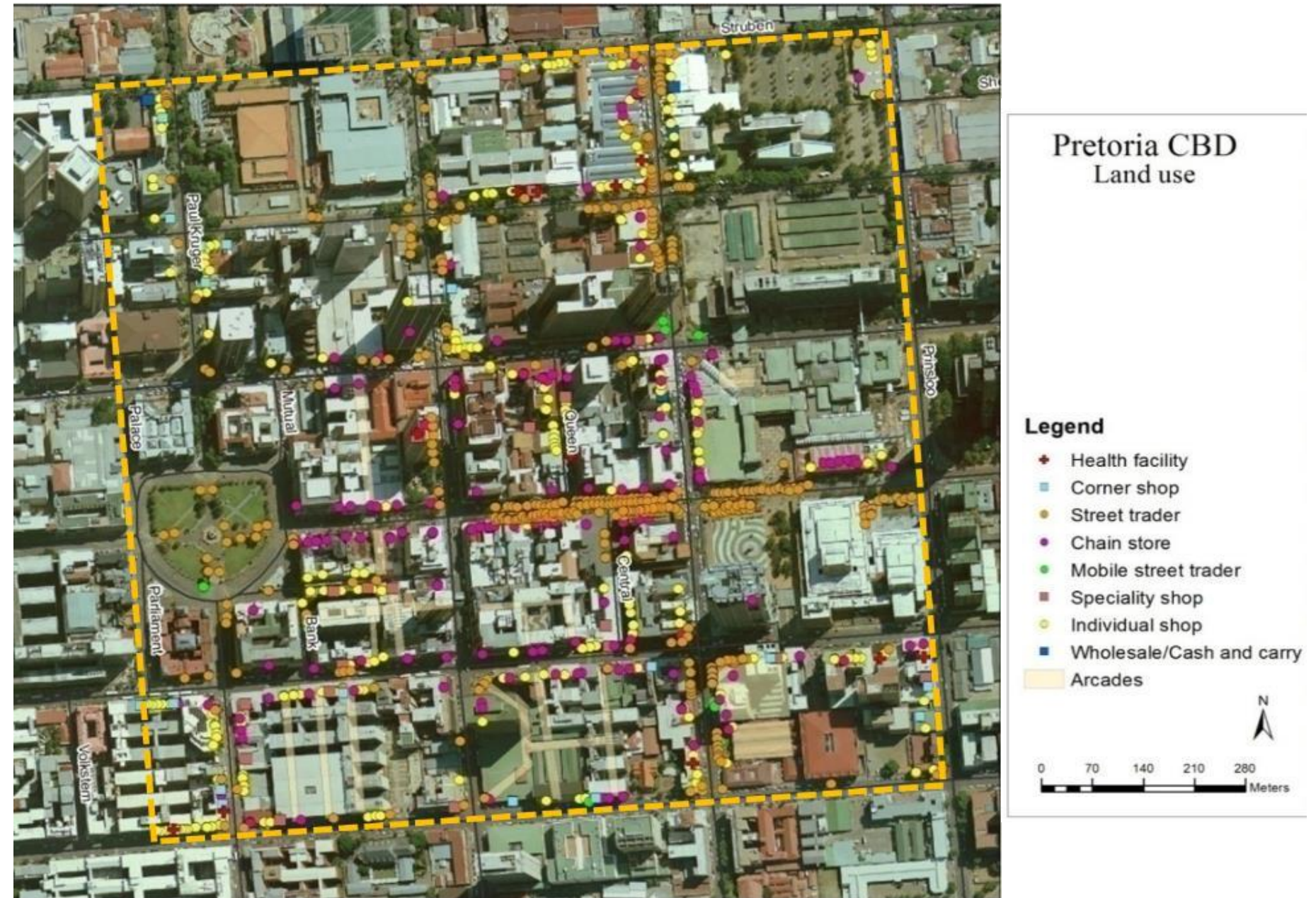


Figure 45: Retailer locations in the case study area

influenced by various factors, including, *inter alia*, the introduction of new public transport modes (BRT); alterations in safety and aesthetics; design of transportation infrastructure; new amenities; and employment opportunities. The restrictions on street traders are observable in the pedestrian mall towards Church Square, where traders are not allowed (or are, at least, formally barred).

Substantiated by field observations, pedestrian volumes drop dramatically in that specific section in the walkway. With this stretch of mall exhibiting

similar characteristics to the remainder, it can be deduced that foot-traveler momentum and street traders are directly correlated, with each attracting (or influencing) the other.

Overall Retail Locations: The dispersal of retail activity within the study area is irregularly distributed and unevenly spread, consequent to a multitude of aspects. These elements factor in rendering certain zones more attractive to retail development, in consort with limiting retail location choices, incorporating, *inter alia*, management; design; and controls. The majority of retail activity is within, and connected to, street space, whether comprising street traders or retailers with direct street access. Intensified concentrations are discernible in the central area, in the pedestrian mall (Stanza Bopape/Church Streets), along with key roads leading North-South. As indicated in the contextual analysis of the area, critical transportation interchanges exist to the North East/West and South, inclusive of train stations and taxi ranks. This propels pedestrian movement to the North and South, especially noticeable in Lilian Ngoyi Street towards the Bloed Street taxi rank mall. The Southern sector has an assortment of internal shopping centres and arcades, which facilitate escalated retail activity in this section, including areas surrounding the entrances. Sundry retailers in varying concentrations are attracted to intersections, as well as to public spaces, for example squares (i.e. Church Square). Certain specific blocks and additional localities exhibit lower levels of activity, determined by multifarious factors, including public space management and design. Considering the overall retailer locational placements and dispersal, it can be deduced that certain locales and sites are shared by a mixture of traders. The central region displays agglomerations of all types of retailers, with chain stores and street traders dominating the pedestrian mall. The Northern region is dominated by street traders and independent retailers, although some chain stores are sited therein.

Street Trader Locations: Street traders, as their nominative description indicates, are situated in or next to the street, predominantly reliant on activities occurring within the public and private realm adjoined to the sidewalk and street space. The most substantial assemblage of street traders is in the Eastern region of the pedestrian mall, towards the Sami Marks and Lillian Ngoyi Squares. Alternate significant localities include intersections, especially in terms of mobile traders, who transact with

passing cars and taxi commuters, together with street traders, who amass in these vicinities, due to the concentrations of passers-by and vehicles.

Lilian Ngoyi Street accommodates numerous vendors, particularly within the newly erected formal trading structures extending towards the Bloed Street taxi mall. Church Square has specific, designated formal trading zones, located at each entrance. In addition, certain traders transact in shopping centres, specifically the Tramshed Shopping Centre to the South East of the area. The environs fronting shopping centres have appeal for both street and mobile traders, frequently sited on street corners in the South Eastern sector of the study area. Furthermore, street traders often situate alongside retailers who afford convenience and tender smaller quantities of goods to passers-by, blatantly evidenced in the pedestrian mall area of the central sector.

Independent Retailer Locations: Independent retailers are comparatively equally dispersed throughout the area, as opposed to other merchants, e.g. chain stores. Independent retailers are preponderantly situated on ground level sites in mixed use buildings, which generally incorporate office space. These individual merchants also locate in arcades and shopping centres throughout the sector. A specific type of independent traders, the convenience or corner stores, typically operate outside normal business hours, some remaining open after 10:00 p.m., catering for residents, night-shift workers and people frequenting the bars and nightclubs in the vicinity. It was articulated by Independent retailers that there is limited availability and supply of commercial space, which constrains and reduces the selection of trading locations.

Chain Retailer Locations: The central sector is dominated by chain store retailers, which includes the various arcades and shopping centres in which they are contained. A strong linear axis of large chain retailers is evident in the central pedestrian mall. Large retailers constitute a critical attractor or anchor tenant function in the greater structures they occupy. Their brand

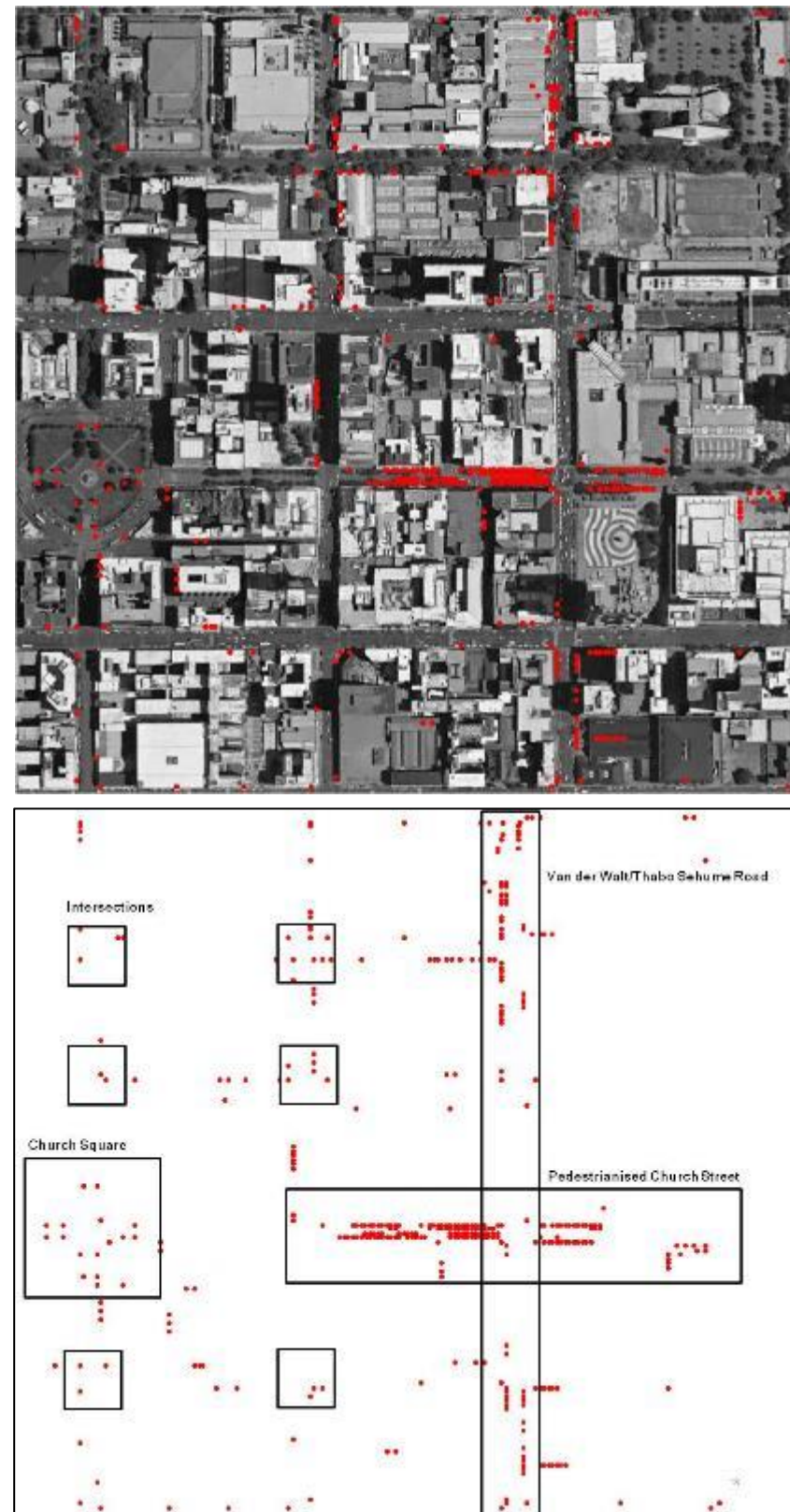


Figure 46: Locations of street traders

The top map indicates all of the locations of street traders in the CBD, while the second map indicates and identifies agglomerations such as intersections, pedestrian mall, major streets and public spaces.

recognition, buying power and lower pricing produces a burgeoning influx of clientele, which accordingly attracts smaller retailers, wishing to benefit from this, into and around these accommodating centres. It can be elicited and elaborated from the presence of multiple branches of large national retailers that an extremely profitable and vast panoptic consumer base frequents the area, this is particularly prevalent in the central region.

Collective Retail Locations: The central and Southern regions are dominated by arcades and shopping centres that are conterminous, accommodating chain stores, independent shops and, in certain instances, street traders. As previously explained, the area's network of arcades and shopping centres, contributes, in addition to, supplemental, augmenting retail space, enhanced accessibility and permeability, particularly within the central sector.

5.2.4 Product and Service Diversification

The products and services tendered by retailers basically constitutes the core element of any retail business. Products may be defined as any article or substance that is manufactured or refined for sale to the general public (The Economic Times , 2015). This categorisation may be expanded, extending it to wholesalers, acting as intermediaries, selling products to other retailers. Products are tendered in response to a certain consumer need or, alternatively, to create a need or desire for the product within the consumer market. Services may be deemed products, however, for the purposes of this study, services are considered separately, facilitating increased elaboration in investigating retailers. Services are intangible professional, practical or alternate activities, offered and sold, and consumed by the end-user (public), requiring no further processing. Services include, *inter alia*, banking; accounting; repairing clothes; or providing access to the internet for clients (Business Dictionary, 2015).

Products and services differentiate retailers from one another. Product and service diversification, pricing and the amount or supply are additional secernating factors, which may afford certain retailers a competitive edge.

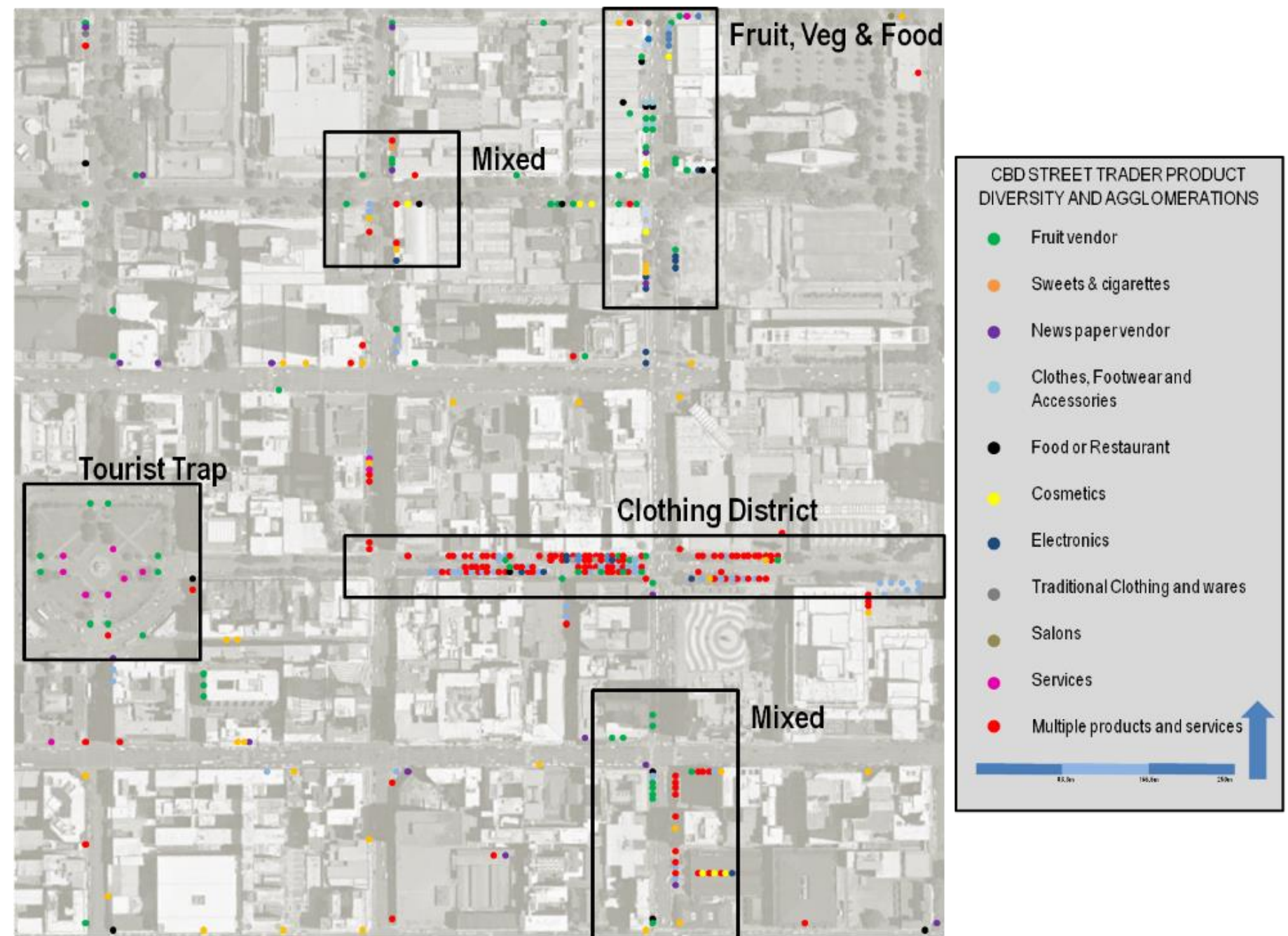


Figure 47: Street trader product type, service diversification and agglomerations

A resilience paradox occurs in product diversification. More products (within limits) can provide redundancy (such as change of consumer needs), conversely product concentration in specific retailers or geographic locations can cause vulnerability, due to particularised locational threats (discussed in later sections).

The succeeding division expounds the overall product and services diversification, in relation to physical location within the study area (each retailer group will be discussed in succession).

Street Trader Product and Service Diversification: Typically, street traders only offer a few products and services, although these vary. Figure 47 demarcates the location of traders, with each point representing a trader, and the colour of the point indicating the product and service. A preponderance of street traders specialise in specific products and services, for instance fruit or cosmetics. Certain traders are heavily influenced by the built environment, as in the circumstance of traders taking photos of tourists near historic buildings and statues (in Church Square or the 'tourist trap'). Traders locate near large concentrations of people, as evidenced in the central axis (pedestrian mall), which can be considered the clothing district, as vendors specialise in garments and related apparel.

Other agglomerations exist, for instance the mixed zones in the South Eastern and North Eastern regions of the study area. To the North of Lilian Ngoyi Street, a fruit, veg and food vendor district develops, servicing the transport users (especially taxis). This expanse, additionally, demonstrates the greatest changes in what is traded at different times during the day (traders transfer in and out of the area during the day).

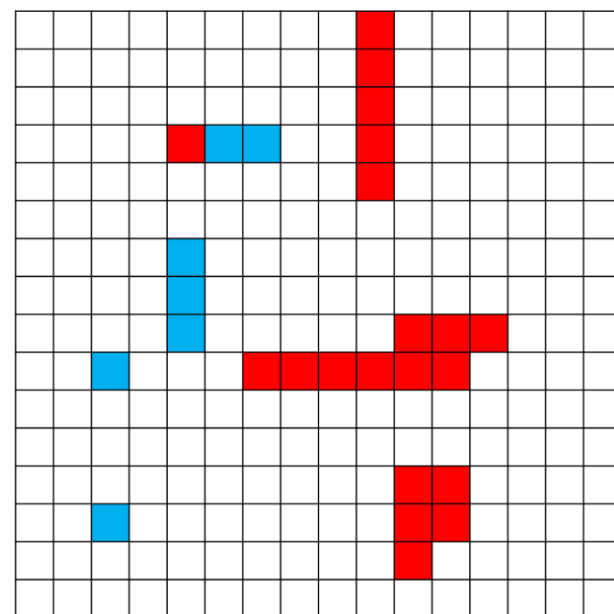


Figure 49: Most diverse street retailer locations (Red = products; Blue = services)

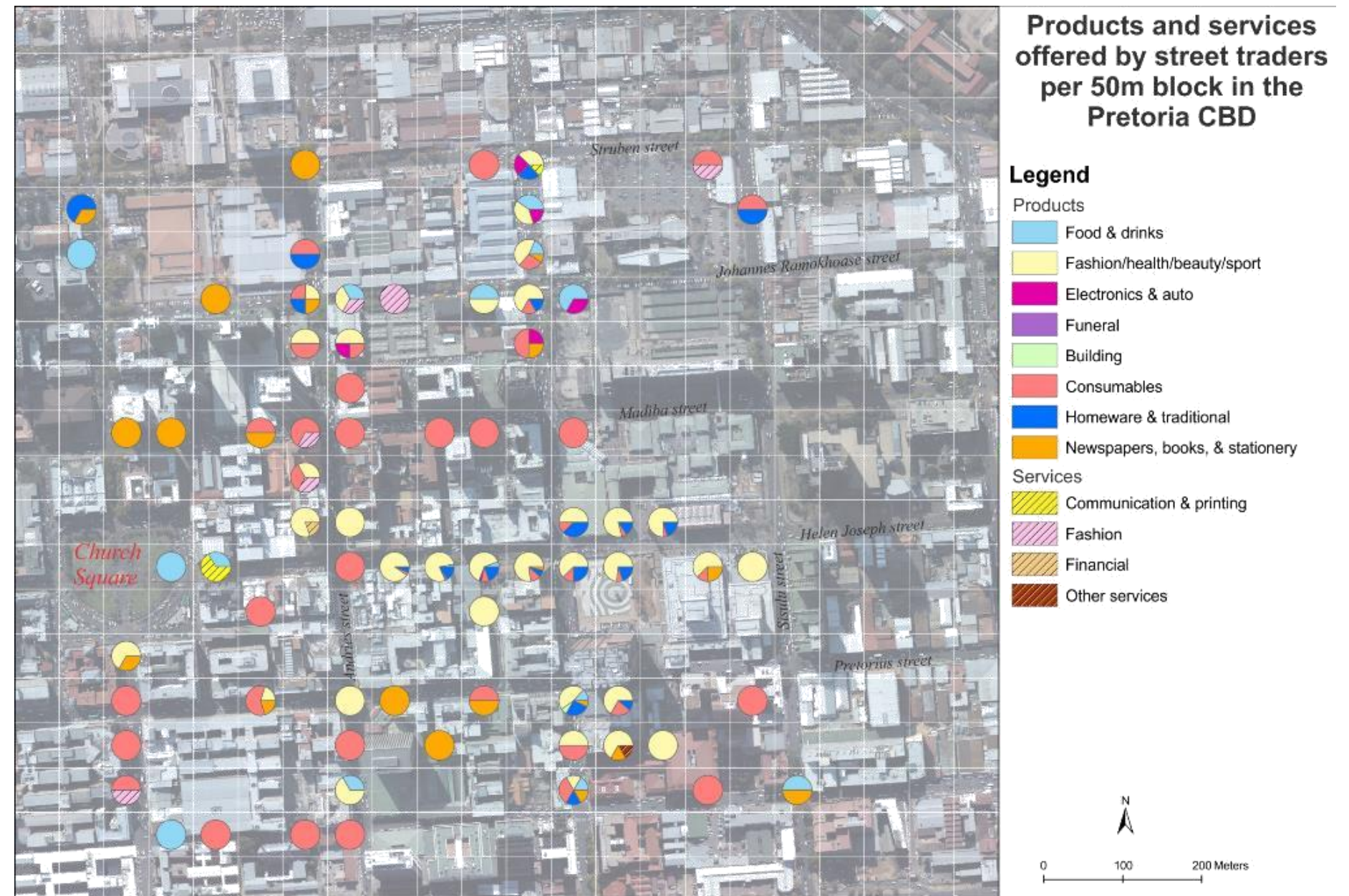


Figure 48: Products and services offered by street traders per 50m block in the PTA CBD

The map portrays the product and service distribution in the area, delineated into 50m grids (see methodology chapter). The pie-charts essentially indicate the relative product and services diversity in a specific grid; however, the number of traders is not incorporated. This renders an interesting insight into the localities where the most diverse street trader composition occurs. It can be elicited that the locations and concentrations of traders exerts a significant impact.

The central axis, as indicated above, incorporates a preponderance of fashion related products, however, additionally accommodates alternate products, including homewares and traditional products, which demonstrates the highest concentration, overall. The most diverse areas of trade are seen to the central Northern area, along Lilian Ngoyi Street, as well as to the South East. The Northern sector's diversity occurs within one block of intense pedestrian movement and trader concentration.

The South Eastern sector's diversity is concentrated around shopping centre entrances, demonstrating a link between retailer groups or types. The relative diversity is depicted in the figure above. Services are also present in sections with the greatest product diversity, as well as in other areas to the West of the study area.

Independent Shops Product and Service Diversification: The independent shops are the most represented retailers in the CBD and, from the overall distribution, the most dispersed. Independent retailers accommodate the greatest volume of diversity related to stock and services per individual retailer, with this far exceeding that of any other group. The distribution of products and services evinces that the Southern sector has the highest population of independent retailers, who form the basic constituents of the area. This sector has the most internal arcades and shopping centres in which these retailers operate and are accommodated. The South Western sector is particularly diverse, apropos both products and services. Furthermore, the South Eastern region exhibits strong diversity, especially in the shopping centres. The area experiences a concourse of pedestrian movement through the arcade systems and shopping centres.

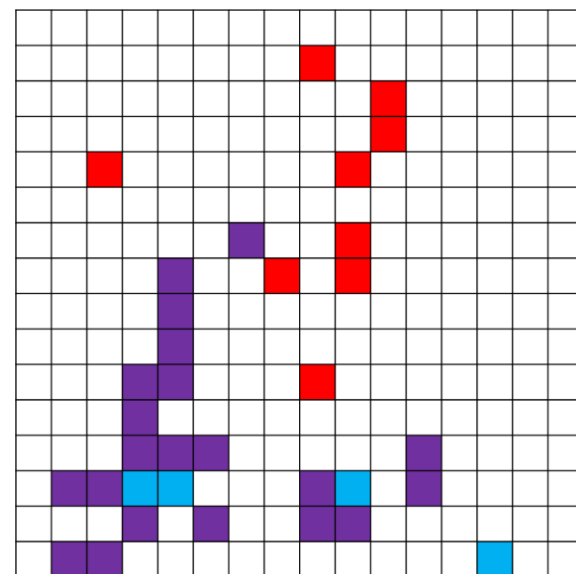


Figure 51: Most diverse independent retailer locations (Red = products; Purple= combo; Blue = services)

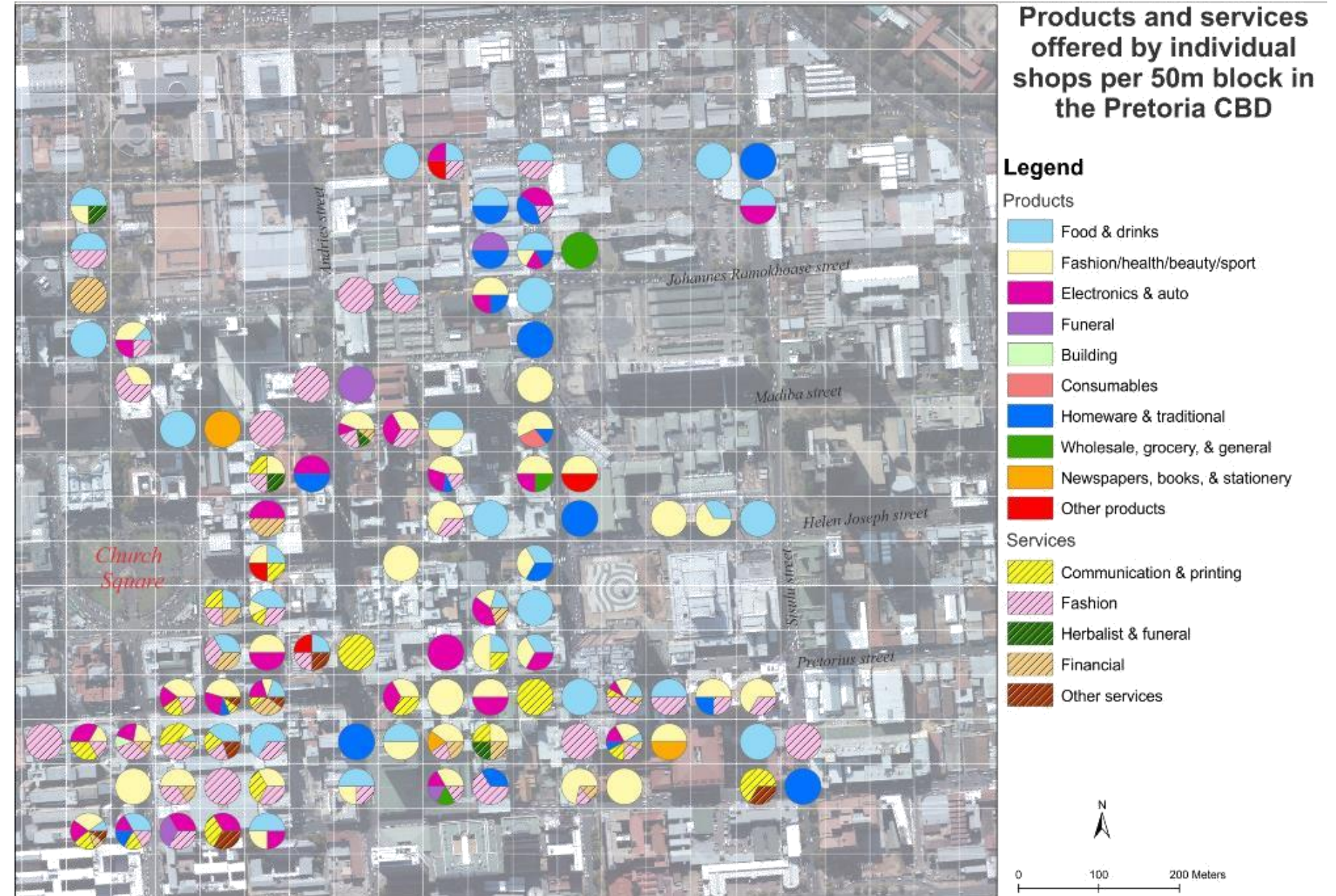


Figure 50: Products and services offered by independent shops per 50m block in PTA CBD

Agglomerations of fashion shops and fashion related services are common, with food and drink related retail situated towards the Northern region. Limited independent grocery and wholesalers are sited towards the North, while electronics retailers, and communication and printing (internet cafés) services tend to accumulate to the South East, in areas where students typically are present. Block corners exhibit particular diversity, vis-à-vis products and services, which correlates to the impact contributed by the intersection of movement networks and the accordingly generated related trade.

Specialised Independent Retail Product and Service Diversification:

Specialised independent retail outlets furnish specialised products and services, which may indicate retail maturity in the specific area. The majority of these retailers are located to the South of the study area, exhibiting an increase in diversity to the South East, similarly to the independent retailers.

Chain Store Product and Service Diversification:

National and/or International retailers or chain stores compose the third most represented commercial group in the CBD. The product and services diversity map to the right evidences that their overall diversity is limited. However, it is noteworthy that their products quantity and diversity is a great deal more concentrated (sometimes thousands of products in a grocery store). Retail banks constitute the principal component of services, and are concentrated in the central and Southern sectors. National clothing retailers dominate the area, closely succeeded by fast food outlets. Multiples of the same retailers exist in close proximity, for example a national and/or international fast food chain has 3 outlets within a 100m radius. Retailer groups are well-represented, with multiple of the company's stores operating in the area. Characteristically, these retailers locate on busy pedestrian routes, for instance the central axis, as well as shopping centres and arcades.

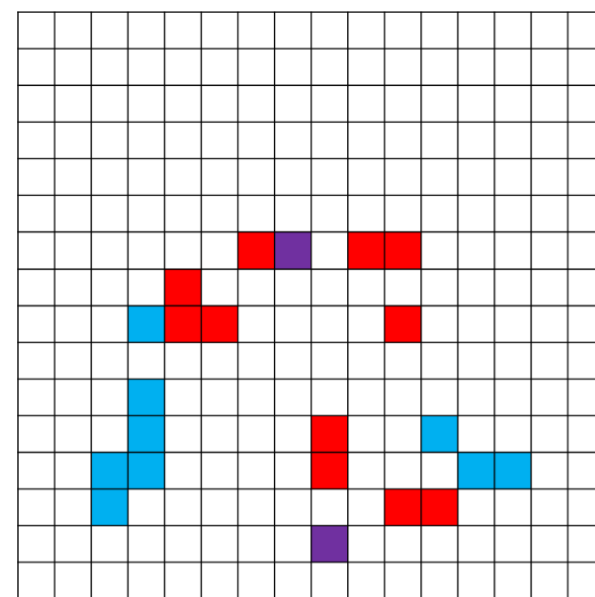


Figure 53: Most diverse chain retailer locations
(Red = products; Purple= combo; Blue = services)

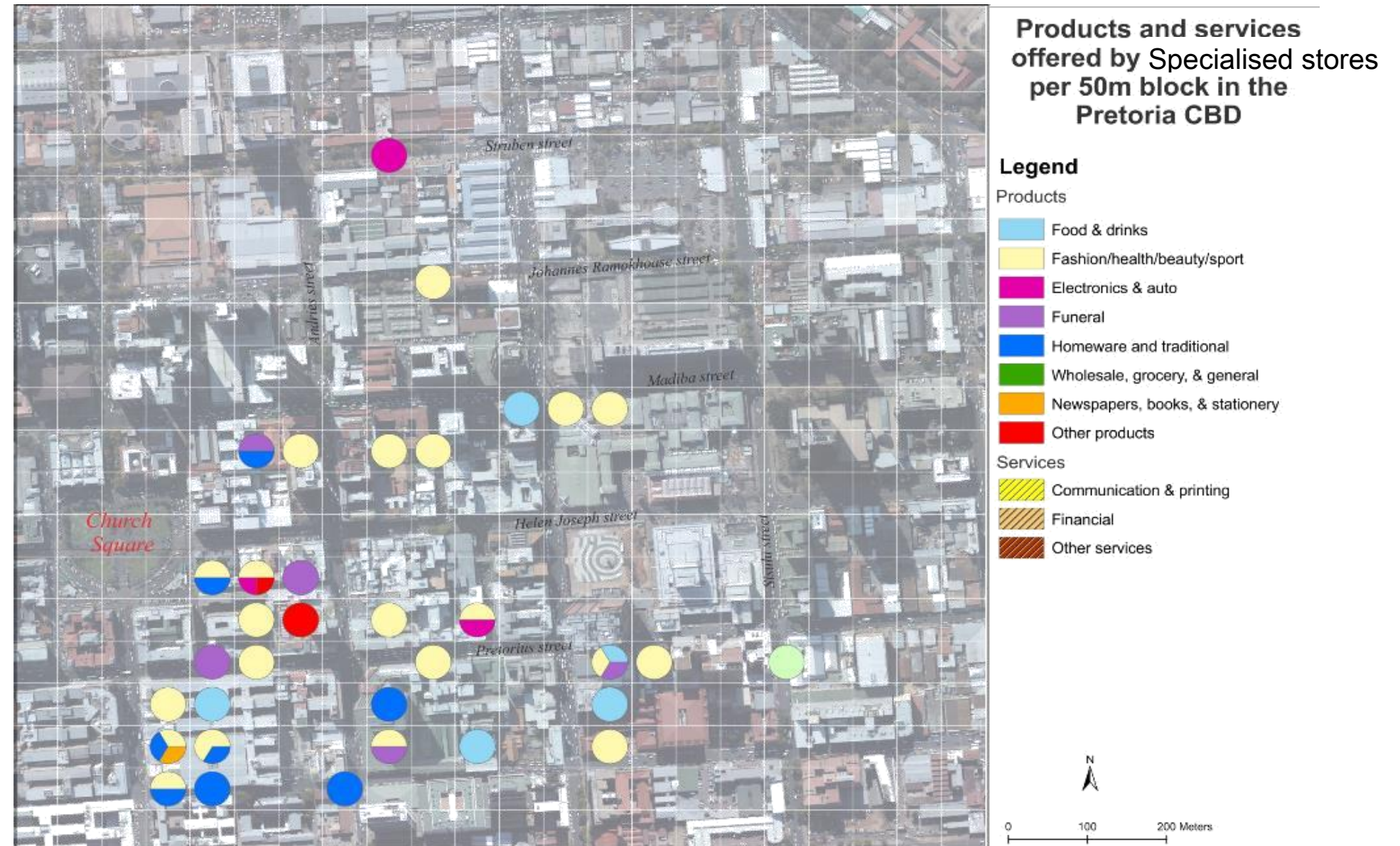


Figure 52: Specialised independent retailer product and services in 50m grids

Furthermore, in general, they occupy larger tracts of land, thus reducing the overall diversity possible in the 50m grids, as revealed in the diversity map. The locality with the greatest diversity is to the South East of the study area, which incorporates multiple arcades and shopping centres with street frontage.

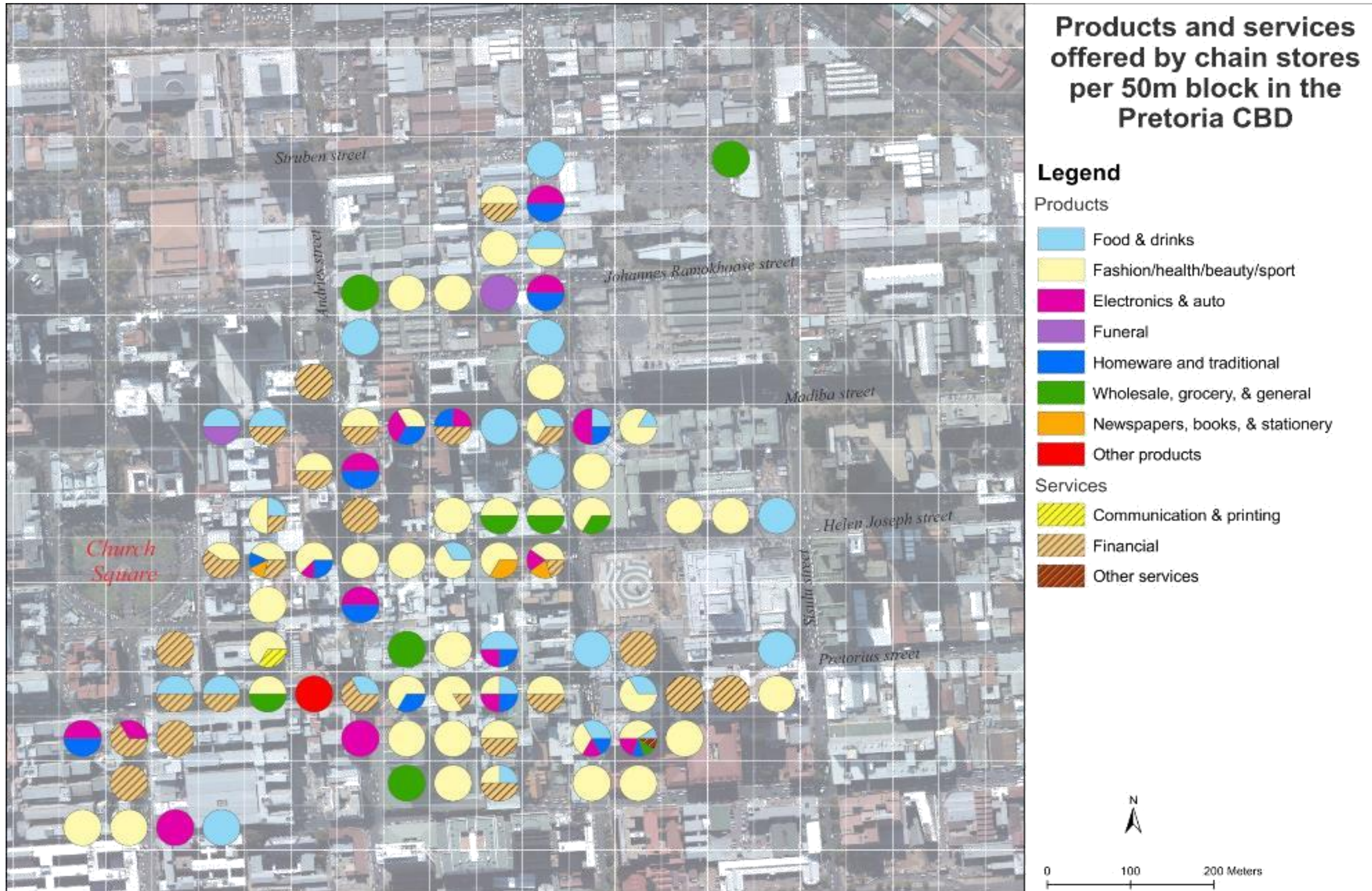


Figure 54: Products and services offered by chain stores per 50m block in the PTA CBD

Product and Services Diversity Across Retailer Types: The combined product and services diversity is depicted in Figure 55: Collective diversity concentration - entropy map, where certain trends are revealed. It can be elucidated that the locations exhibiting the greatest diversity for each group differs, although certain areas are similar. Within the areas that have cross-diversity among different types, significantly, similar products and services are tendered. This points to the agglomeration advantages of corresponding retailers locating in close proximity, thus attracting similar clientele.

As explicated in the contextual analysis, the built environment exerts a identifiable influence on the diversity of products and services. Firstly, relative to land use, the Southern and central sectors are the most diverse, reflected in the retailers' stock diversity. Moreover, the central and Southern sectors also exhibit the greatest permeability and access, resulting in more favourable conditions for product diversity (increase in total retail space). The Northern sector has both the least amount of land use diversity and low 'block resilience', from which low diversity in products and services ensues, with the exception of Lilian Ngoyi Street, which experiences an inordinate volume of through traffic (pedestrian and other).

5.2.5 Size and Physical Manifestation

The multifarious, discrete retailer groups are characterised by dramatically different configurations, in both size and physical manifestation (within and across types). These physical characteristics, as well as the approximate total size of all retailers per group, is calculated in Table 4. The variety of discrete retail groups range from large formal structures in shopping centres, to highly informal mobile traders with no structures. This is reflected in the relative mobility of each of the retailers, where the mobile and street traders have the capacity to freely move around, however their chosen localities may not be secure (due to questionable legal status). This can contribute crucial flexibility, permitting the trader to relocate to another more 'profitable' area, which can occur daily, or even during different periods of the same day, enabling the vendor to respond to changing market conditions.

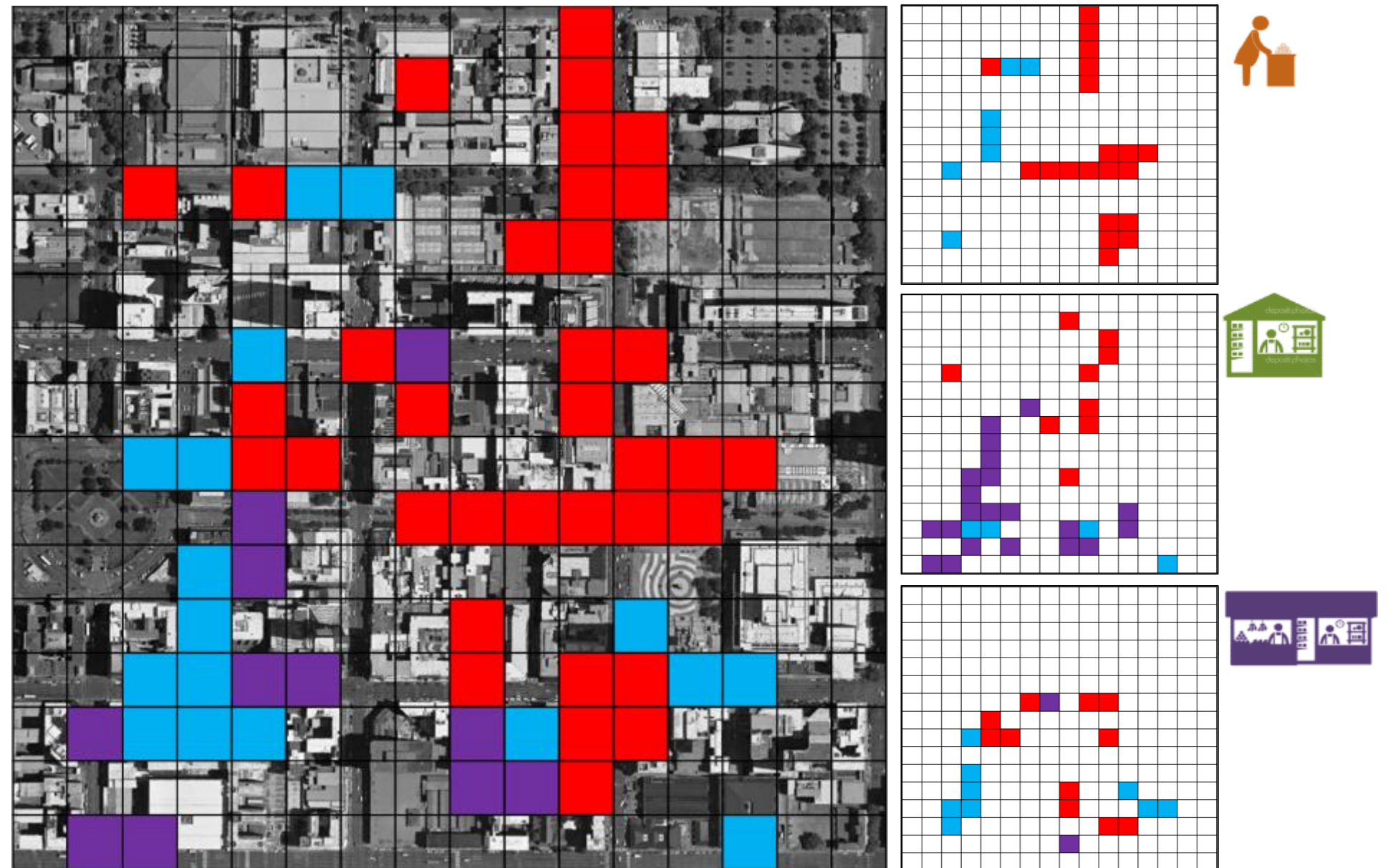


Figure 55: Collective diversity concentration - entropy map

New formal street trader stalls frequently lack this flexibility, however they compensate through alternate benefits, inclusive of weather protection or stock storage. This occurs in the circumstance of more formal retailers, however, they utilise stock diversity to attract patrons to their locations rather than responding to customer motility.

The total size calculation is highly speculative and is only conducted to demonstrate the relative consumption of retail space (and will be utilised in calculating employees per m² in the next section). Chain or national retailers may only constitute the third most represented group in the CBD, but are exceedingly ahead in the occupancy of retail space therein. Collective retailers are composed of individual retailers, typically one large anchor merchant, with smaller 'line stores'.



Figure 56: Total area: Individual retailer groups

| Types | Physical Description in CBD | Size Range | Total Area* |
|-------|---|---|---|
| | The emphasis is on mobility, where the trader walks with a portable display/stock in one or both hands, traversing through crowds on sidewalks or sells to cars waiting at traffic signals. On occasion, these vendors are stationed at busy intersections and relocate according to crowd density (or when metro police is present). | <1m ² | N/A |
| | Street traders have both informal and formal structures. The informal structures are more common ranging from a small "beer crate" and chair, gazebos with tables and chairs to caravans converted into mobile restaurants with accompanying gazebos, tables and chairs. Two types of formal stalls exist, viz. a row of undercover stalls with a working surface/selling point and chairs and a stand-alone stall, with a 360° working service/selling point. | <1m ² -10m ² | 347 X 5m ² * = 1735m ² |
| | Independent shops or retailers are in formally built structures, which range extensively in terms size and building quality. These shops are commonly part of mixed use buildings on the ground floor. Typically, they consist of a shopping area where stock is displayed or service is rendered, with a sales counter and or changing rooms, store rooms (either at the back or on top of shop) with very few providing public toilet facilities. Additionally, independent shops may accommodate multiple traders ("sub-letting") (Restaurants are included). The largest variant of individual shops are single department style retailers. | 20m ² -3000m ² | 368 X 100m ² * = 36800m ² |
| | Franchise and Chain retailers, tend to be larger than the individual retailers with multiple stores in one area and throughout the region/country. The largest of this group is the clothing mega shops with three floors and multiple departments as well as grocery stores (found on Stanza Bopapi). They are found on the high-streets and internally in shopping centres. | 80m ² -10000m ² | 171 X 500m ² * = 85500m ² |
| | Wholesalers are large retailers with large rows of stock, specifically orientated towards other smaller retailer sales. | 1000m ² -3000m ² | 3X 2000m ² * = 6000m ² |
| | Arcade systems are located underneath buildings connected via passage ways that link from street to street cutting through blocks or only leading below a building into a courtyard. Next to the passageways shops gets access ranging from small individual shops to large national retailers such as grocery stores. | 200m ² -5000m ² | 11 X 2000m ² * = 22000m ² |
| | The shopping centres in the CBD area are mostly internal malls (usually 2 floors) under mainly office blocks with the exception of Sammy Marks Square which is a free standing centre. Some centres link up with the Arcade system at various points on the ground floor. The centres have parking facilities underground or free standing parking facilities. The centres range from convenience to small regional centres. | 5000m ² -33514m ² | 74332m ² |

Table 4: Physical size and area for retailers in the PTA CBD

5.2.6 Employment

The employment components within each retailer group provide a valuable gauge of their overall contribution to the economy. The various individual retailers within each group exhibit idiosyncratic and dissimilar worker configurations. For instance, a fast food outlet differs vastly from a clothing store or grocery retailer. The employment figures displayed in Table 5 are deemed highly subjective, similarly to the retailer typology enumeration utilised in calculating.

Chain or national retailers offer the most prominent total employment in the CBD; however, if calculated utilising the number of workers per metre squared (m^2), they only generate a single employee per $25 m^2$. The principal causal element for this inverse relationship of high employment and comparably low worker density arises from the considerable magnitude and capacious nature of large retail stores, whereas, the largest portion of personnel is concentrated in independent merchants. The mobile vendor and street trader groups yield the highest concentration of employees per m^2 , rendered by their compact nature, although their total, overall employment is modest. The overall employment in chain stores and collective retailers is comparatively considered reasonably high; however, there is a potential for overreliance on a specific retailer or centre, effectuated by a clustering or converging compaction of retail workers

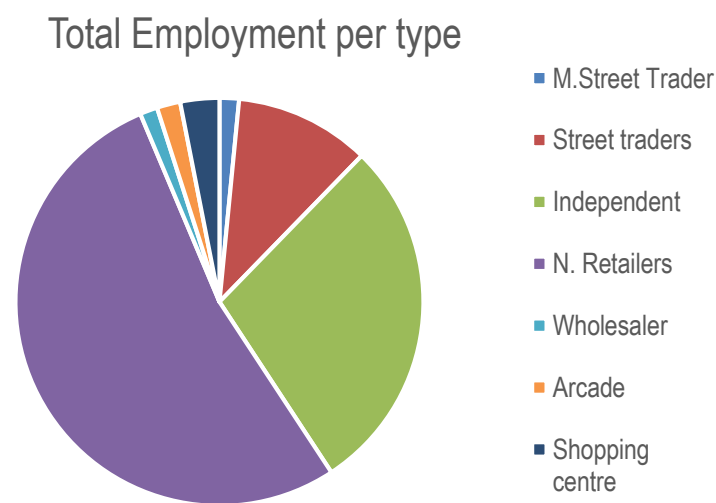


Figure 57: Total employment per type

| Types | Employment in CBD | Range | Total Employment* |
|-------|--|------------|---|
| | The mobile street trader can operate alone or can operate as part of a larger group of vendors transacting in multiple locations. In the case of the CBD a large achar "informal" network operates, with a few hundred traders vending, in Pretoria and Johannesburg. Due to their mobile nature and general "illegal" status, accurate numbers and information on trading networks is difficult to ascertain. | 1 | 30 X 1* = 30 1 emp. per 1 m^2 |
| | Street traders either operate as single owners, although some have one major employer (as part of a network of traders). In the CBD the majority of traders operate as single owners with some having one employee. | 1-3 | 347 X 2* = 694 1 emp. per 2.5 m^2 |
| | Independent stores have multiple workers, but are also operated by the owner. In the CBD, the typical configuration is the owner and two staff members. Certain independent stores operate comparably and similarly to large national retailers, with in excess of fifty workers. | 3-50 | 368 X 5* = 1840 1 emp. per 20 m^2 |
| | Franchise and Chain stores tend to be large, with great amounts of workers undertaking <i>inter alia</i> , sales, stock control and management. Additionally, these retailers have offsite personnel and management on site including distribution centres and Head offices. | 10-150 | 171 X 20* = 3420 1 emp. per 25 m^2 |
| | Wholesalers are large retailers, with a large proportion of staff in sales and stock management. | 20-50 | 3X 30* = 90 1 emp. per 67 m^2 |
| | Arcade systems consists of a collection of retailers including independent and national retailers. It should be noted that shopping centres and arcades are interlinked and, thus, difficult to separate. Only direct employment is considered as the retailers in the arcade are already counted above. | Direct: 10 | 12 X 10* = 120 (Indirect: 605*) |
| | Shopping centres is a collection of retailers including independent and national retailers. It should be noted that shopping centres and arcades are interlinked and thus difficult to separate. Only direct employment is considered as the retailers in the shopping is already counted above. | Direct: 20 | 10 X 20* = 200 (Indirect: 800*) |

Table 5: Employment of retailers in the PTA CBD

* Indicates the observed average employment per retailer (speculative). Achar or Achaar refers to South Asian pickles sold in South Africa.

concentrated therein. Essentially, when numerous individuals are employed by a single large organisation, there is the risk that, in the event of a shock, adversity or disturbance, an immense loss of jobs could occur. Additionally, if an anchor tenant undergoes analogous circumstances, relocates, alters or closes, similar aftermaths may result, in consort with the consequences of potential ripple effects and corollaries thereof, affecting adjacent, related or intersecting retailers, which may not exert strong, replaceable or correspondent drawing powers requisite in attracting customers (in terms of specific goods or locational desirability). It should be noted that employment conditions and benefits vary greatly, although important, was not assessed by this study.

Retailer Interviews

As expatiated in the methodology chapter, a proportional, convenience sample was selected from the retail entities in the case study area. The overall sample is depicted in the images to the left. A total of twenty-three interviews were conducted, comprising one with a shopping centre; four with chain retail stores; nine with street traders; and eight with independent or individual shops. Taking the general population into account, it is deemed that this sample is representative of the overall population of the location's retailers. The ensuing section utilises graphic representation to depict, delineate and elucidate the study findings. Within each graph, the retail type is designated by its associated colour, viz. black for shopping centres; purple for chain stores; green for independent retailers; and orange for street traders.

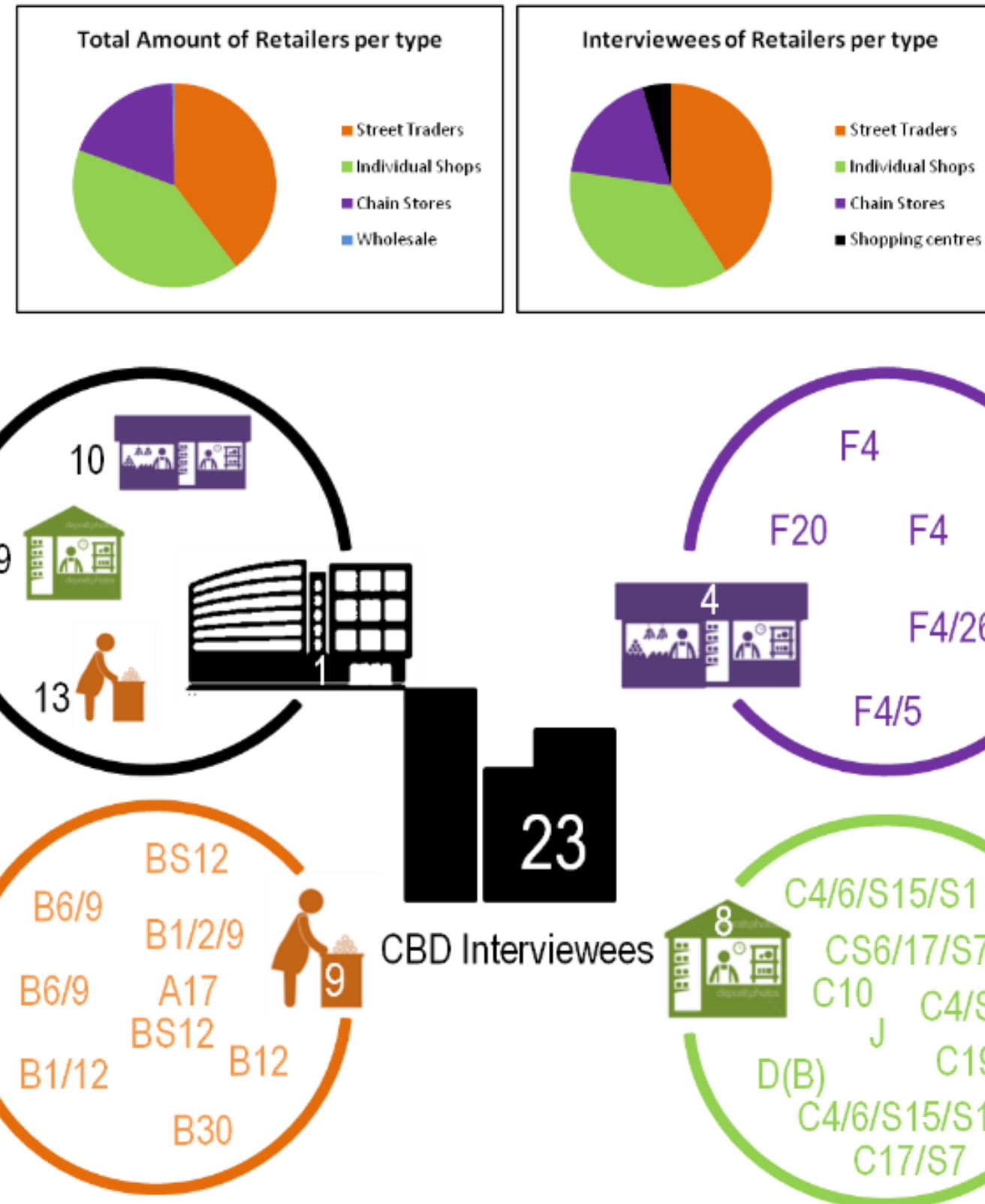


Figure 58: Retail interview sample

Retailer coding can be seen in Annexure A

5.2.7 Operational Duration of Business (or Retailer)

The operational duration of the retailers, with the longevity thereof denoting the viability, sustainability and experience of the businesses, constitutes a fundamental determinant for the overall resilience of the sector. Typically, this predicates that the lengthier the operational period of the enterprise, the greater the number and variety of perturbations with which the retailer would have experienced. The entity's relative resilience is reflected and indicated by its continued operation and its maintaining existence despite multiple challenges having occurred over an extended interval. Figure 59 delimitates that most retailers established operations within the preceding five years. Furthermore, it is interesting that the majority of independent retailers have functioned in the area for between two and five years and the remaining independent merchants, combined with certain street traders, having commenced operating within the twelve months prior to the study. The equal largest group of respondents (mostly employees) didn't know how long the business was trading for in the area and in some cases traders that have been trading for a long time couldn't recall how long they have operated in the area.

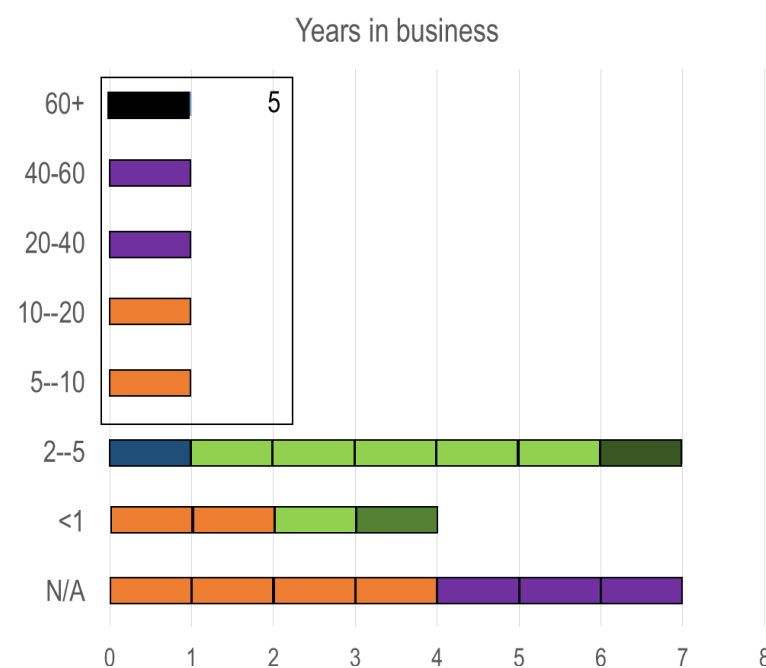


Figure 59: Years in business in the CBD of PTA

N/A refers to did not know/ could not remember

This may be attributable to recent appointments; lower-level employees not being apprised of internal affairs and details. The longevity of street traders is immensely influenced by forced removals; however certain vendors have an extended CBD trading history. The commercial enterprises with the oldest or longest legacies of conducting business in the CBD comprise national retailers and a shopping centre.

5.2.8 Ownership and Management Type

The type of retail ownership regulates how retailers manage their businesses. Overwhelmingly, single owner operated retailers prevailed; with the respondents predominantly constituted of street traders and independent retailers with the proprietor working in the business, managing and supervising activities. This format may engender business decisions based on direct, observable operational facets; however strategic and functional elements may be neglected or overlooked, due to misplaced focus, a lack of alternate perspectives and no collaborative input, as a sole individual undertakes the process. Conversely, this is mitigated, remedied or negated in enterprises with more than one leader, for instance cooperatives, with a group of owners or co-ownership, where there are two owners. Typically, National Retailers are responsible to stakeholders and are managed by a Board of Directors. These organisations frequently focus on long-term factors and strategic investments, potentially directly impacting the retailers' extended operations. The cumbersome corporations may be slow or sluggish in reacting to a situation or perturbation occurring at a lower level or 'on the ground'; however, their magnitude and extensive capital could facilitate greater recovery and adaptation qualities than smaller retailers. Management firms centrally control and supervise shopping centres and arcades, overseeing, handling and administering a multitude of factors, relating to, *inter alia*, tenant mix (renters); maintenance; and security. Both management firms and Boards of Directors (national retailers) consist of specialised divisions dealing with specific tasks, which are generally staffed by highly-educated/skilled individuals. For example, risk management divisions collaboratively construct specific plans and

tactics to be deployed in the event of perturbations; whereas smaller retailers are compelled to commonly rely on experience and more intuitive alternate strategies.

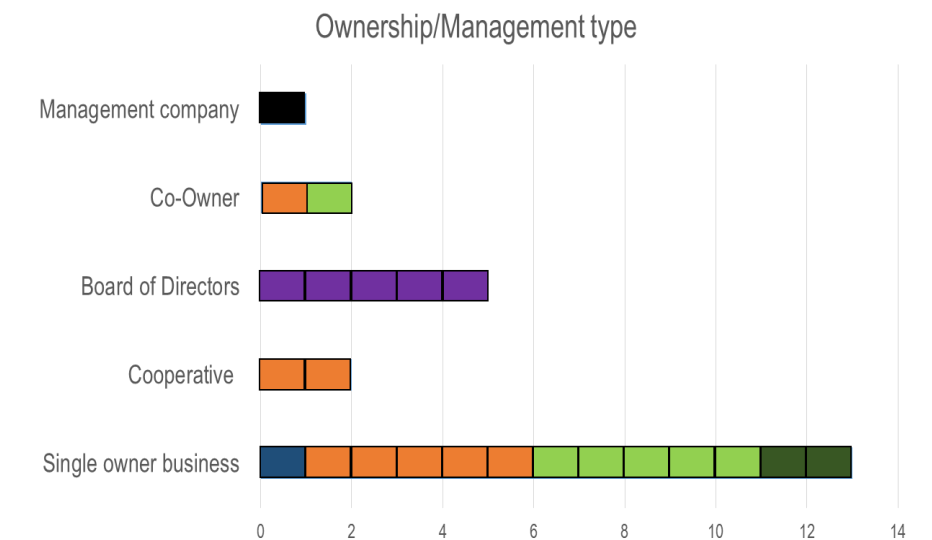


Figure 60: Ownership/Management type

5.2.9 Motivation for Operating Business

The respondent retailers stated various motivations for operating/owning their business, these motivations can impact on their overall business strategies. Not surprisingly the main reason for operating the business was between income generation and profit.

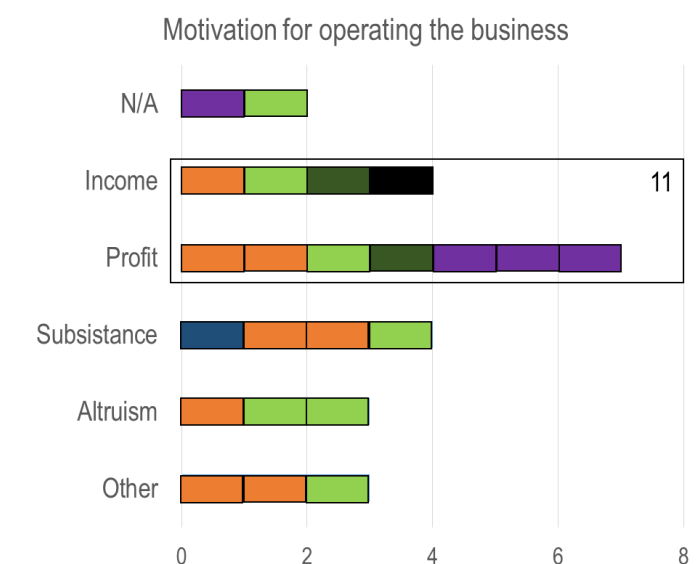


Figure 61: Motivation for operating business in the PTA CBD

Subsistence is different from profit and income generation as it mostly serves to sustain relatively meagre living standards. Some retailers pointed more “altruistic” motivations of their businesses such as a large national retailer’s ‘good business journey’ (supporting smaller enterprises and sustainability practices) or a street trader want to promote a certain lifestyle. Other reasons range from a former formal sector worker, wanting to generate his own income by becoming a street trader as well as a person simply choosing the industry because of her skills and talent.

5.2.10 Trading Locations

The area’s retailers may trade in a single location or have multiple outlets. This can indicate a reliance on a specific business site, along with their overall exposure to local risks, which is diminished in the circumstance of situating in additional localities. Certain street and mobile traders do not occupy a specific or permanent location and relocate at differing intervals, as explained earlier. However, the majority of street traders and independent stores exclusively operate from, and remain on, their current, distinct placement. Certain of these two merchant types operate from two locations, situated both within and outside the area. All the chain store and shopping centre respondents acknowledged that their operations constituted components of a network of shops. This is a deliberate strategic positioning, with several advantageous corollaries including establishing less reliance one specific location or shop for the retailer group (locational



Figure 63: Trading location in the PTA CBD

diversity), consequently risks and potential threats are dispersed and enables the company to establish a large market ‘awareness and presence.

5.2.11 Trading Networks

Trading networks have the potential to facilitate retailers with collective bargaining power; as well as, *inter alia*, rendering the ability to negotiate lower prices; stock sharing; and garner assistance in the management of the business and handling of legal matters. The majority of traders (street and independent) are not involved in trading networks, which may be formal or informal. Formal trading groups comprise retail groups (chain stores) and property management companies (shopping centres); whereas the latter informal variant includes multitudes of street traders, who function as employees thereof, selling goods in multiple locations.

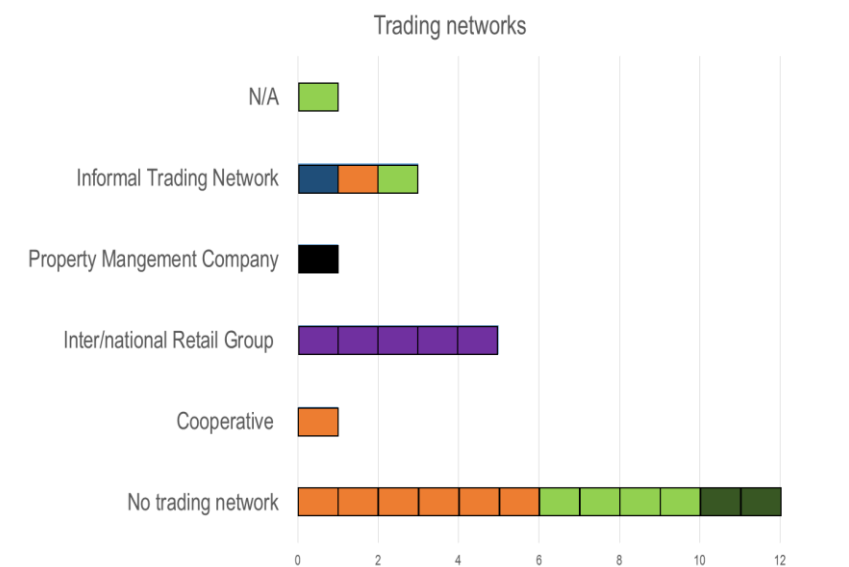


Figure 62: Trading networks in the PTA CBD

5.2.12 Operating Hours

A concern’s operating hours directly affects the retailer’s capacity to transact and earn income. Typically, a retailer undertakes various cost-benefit assessments in order to determine their optimal trading hours. There are several alterations in the composition of the potential customers traversing the area throughout the day, which renders the creation of a variety of trading opportunities for individual, disparate retailers, which occur at different times and intervals, for example office workers ‘going out for

lunch’. The respondents exhibit distinct operating hours, predominantly corresponding to the standard working hours of 8:00 a.m. to 5:00 p.m.. Certain retailers, to benefit from unique, specific or specialised circumstances, institute atypical trading hours, for instance corner shops (convenience stores) operating from 7:00 a.m. to 9:00 p.m. or later. The majority of street traders transact between 9:00 a.m. and 5:00 p.m., with some commenting, that their productive capacity is affected by the inordinately long distances they have to travel from their residences to the CBD.



Figure 65: Operating hours for respondents in PTA CBD

5.2.13 Location of Residence

Prevalently, respondents and their employees reside outside the study area. Street traders live predominantly in townships⁵ (Soshanguve; Mamelodi; Eersterus; and Attridgeville), typically involving long journeys on public transport, which can result in up to 6 hours of travel a day. As stated, this has a potential negative impact on their active and productive periods, essential to owner-operated businesses. Furthermore, affordability issues pertaining to housing within the vicinity are significant, as certain independent and chain store managers and owners reside in the area. Employees living in townships and suburbs (workers mix) are evident within large retailers.



Figure 67: Location of residence for retailers/workers

5.2.14 Storage of Goods

Storage of goods constitutes a significant issue for any retail operation. Having a stored stock enables retailers to replenish the goods that have been sold, in conjunction with the saving advantages associated with buying in bulk, ultimately rendering enhanced profit margins. Furthermore, should supply be disrupted, the retailer has a stockpile, which facilitates sustaining

⁵ a suburb or city of predominantly Black occupation, formerly officially designated for black occupation by apartheid legislation/government.

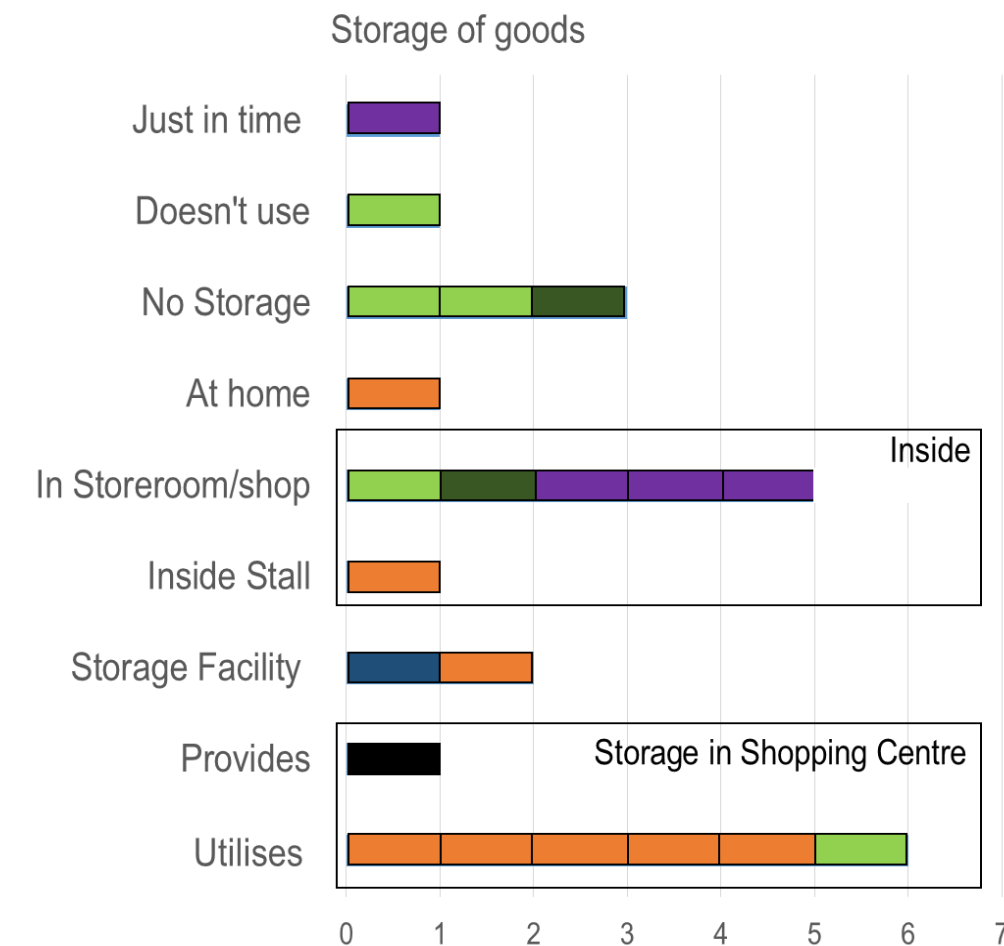


Figure 66: Storage of goods in the PTA CBD

trade until the product is available again. Storage, in addition, allows traders to speculate on goods, buying large volumes at certain periods, when the item(s) is priced advantageously. It is noteworthy that it can be disadvantageous to invest too much capital in stock, as the capital outlay may endanger the retailer, along with the monetary expenditure not earning interest, especially if there is a drop in demand, with resultant lack of sales or price reduction.

A majority of street traders store their stock in nearby storage facilities, however their goods supply is limited, as they have to transport the stock to and from these locations, which include paid for, or rented, depositories in

shopping centres, as well as a City of Tshwane run storage utility in the study area. A symbiosis is clearly displayed between the street traders and shopping centres in this regard. It is obviously more expedient and efficient to have the storage facilities sited within the stores, which benefits those traders who can accomplish this. One of the national retailers relies on 'just-in-time' supply dynamics, which is efficient, but has potential risks and can create vulnerabilities if a supply chain disruption occurs (Giunipreo & Eltantawy, 2003 & World Economic Forum, 2013).

5.2.15 Reasons for Choosing Trading Location

This section is correlated to the overall contextualisation of the area, however, it critically explores and expounds the locational decisions undertaken by retailers in the area. A principal and crucial observation concerns the diverse retailers being presented with differing levels of choice in terms of their specific needs. This is exemplified by large retailers typically possessing greater capital to invest in a new location, however are restricted due to size and other considerations, limiting choices to large spaces in shopping centres and high street retail locations. Conversely, street and mobile traders can generally be accommodated next to sidewalks; however, their legal status constrains their locational options, especially considering Metro Police enforcement. Independent retailers articulated that their siting selection, *vis-à-vis* their current location, was based on available open retail space in the area.

The dominant motivation, elicited from respondents, for their choice of the Tshwane CBD for retail trading purposes constituted the actual or potential consumers in the area. As elaborated in the contextualisation of the area, the CBD functions as a key transportation interchange; government service centre; retail and businesses centre (unplanned); as well as a cultural hub and education core. These critical 'roles' of the CBD engenders the locale attractive and desirable, to residents, tourists, workers; students and other users, which, in succession, creates advantageous opportunities for retailers. Similarly, the respondents focused on the desirability of residing in the area, in conjunction with the other uses and activities therein, inclusive of the educational institutions, resulting in the influx of a multitude of students. This creates a market for student related retail opportunities, encompassing internet cafés and text-book shops. Furthermore, customer convenience was emphasised, which connects to the overall accessibility of the area (central location). Additional area-specific facets, motivating retailers, incorporated the tourist attractions in the area, for instance Church Square with statues and historical buildings, actuating a market for street traders taking and developing photographs of tourists. One trader in Church Square was provided with a fixed stall by the State, as part of a Government

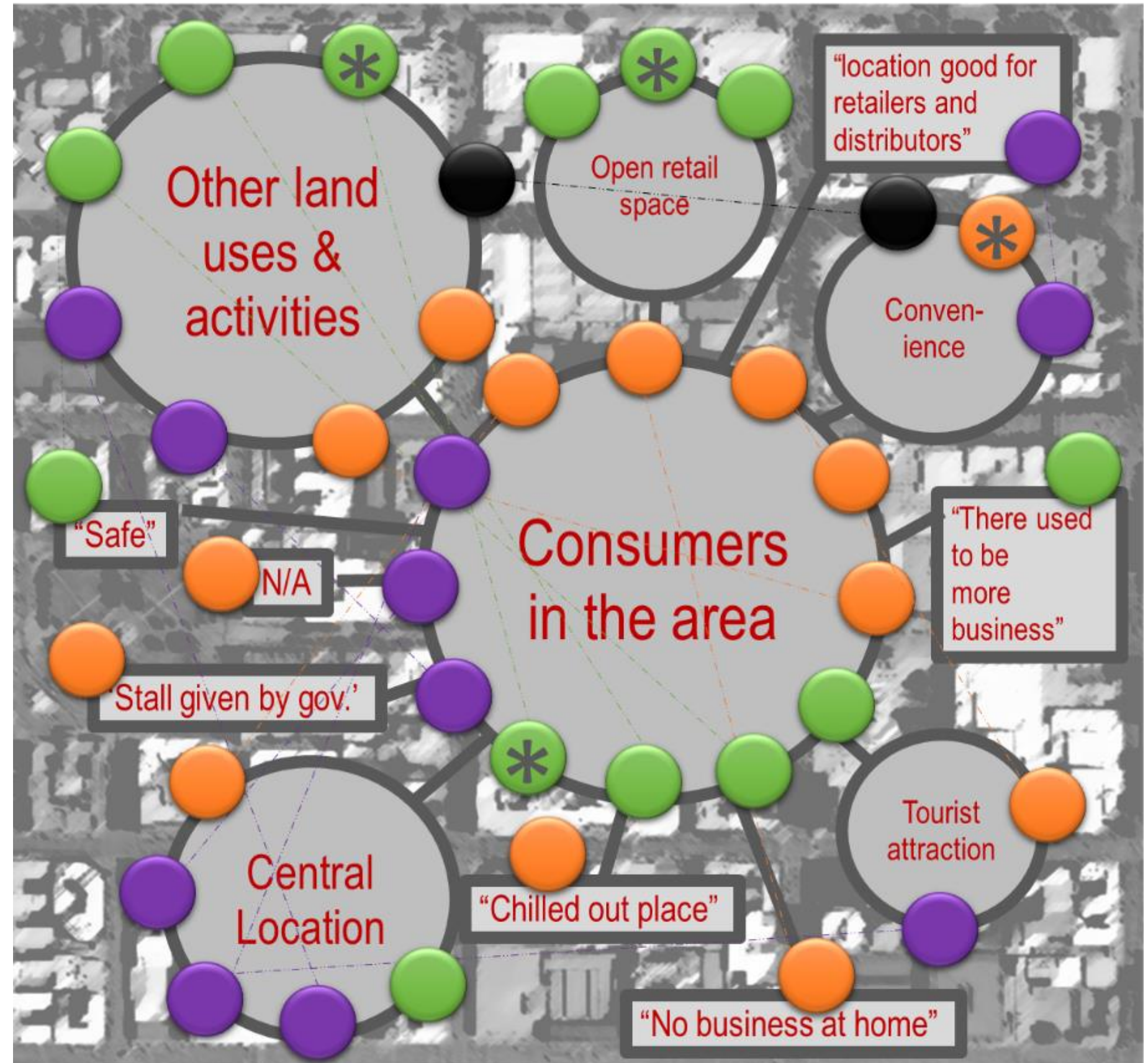


Figure 68: Reasons for trading in the area (trading location) in the CBD of PTA

* Specialised independent retailers.

Programme, providing her a 'lucrative' trading space, thus directly influencing her trading location choice.

5.2.16 Changes in the Area

Changes within the study area can directly impact on retailers, predominantly concerning their business prospects. Change is constant, although may not always be blatant, apparent or perceived. A mix of independent and street traders asserted that they had not observed any alterations or changes occurring while they have been operating, although certain traders have been established for less than a year. A mixture of retailers contended that they perceived the principal modification in the area constituted an increase in competition (in a negative sense).

National retailers averred that the consumer base had altered in their operational durations, indicating major shifts in socio-economic conditions within the area/city (including less disposable income). This is analogous to the overall economic conditions currently existing in the Country (macro-economic conditions). A street trader remarked that there are seasonal changes that occur in the locale, which unequivocally affects the type of

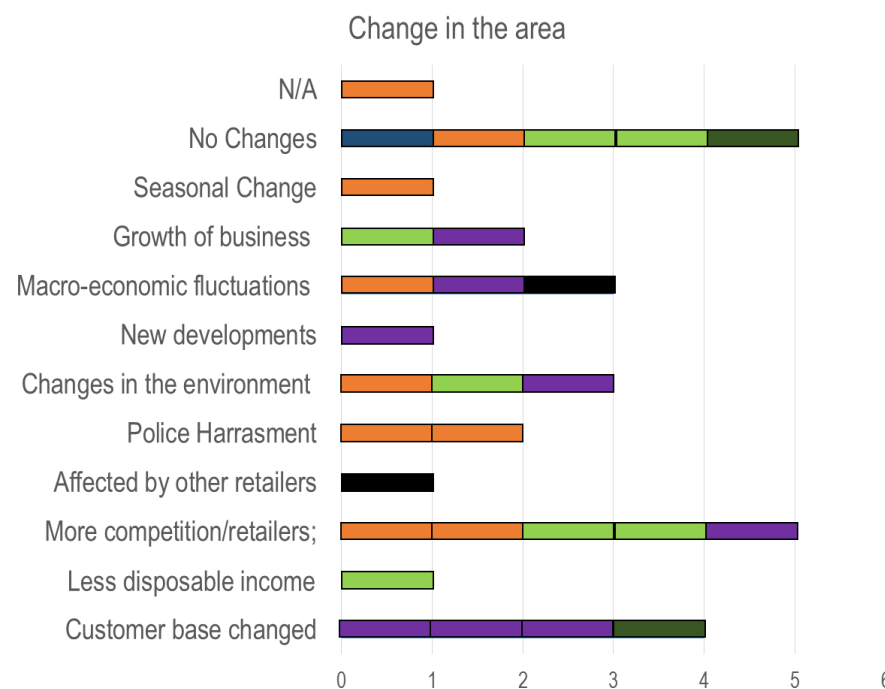


Figure 70: Change perceived by retailers in the CBD of PTA

stock proffered by retailers (Summer, Christmas, Valentine's Day). An increase in police harassment was identified by street traders, directly impacting their transactions, with for instance, the vendor's income decreasing, due to his forced removal from a more lucrative site. The new development of the City of Tshwane's HQ, as well as the extensive BRT network implemented in the CBD, were distinguished as critical factors relating to change by a large retailer, indicative of a consequent potential alteration in consumer profiles and access. An independent and a national retailer avowed that the most dominant change they had experienced was the growth of their own businesses.

5.2.17 Relation to Other Retailers

As clarified above, competition among the retailers is an issue highlighted by several respondents, this, however, disregards the specific relationships and links that may exist among them. As expected, the majority of participants stressed the negative effects of competition with retailers in the immediate vicinity (including independent and national retailers). One retailer mentioned the larger city context, asserting that shopping centres in townships are taking business from them, with consumers shopping locally, rather than travelling to the CBD for retail purposes. Certain national retailers utilise other retailers in the area, and across the Country, to

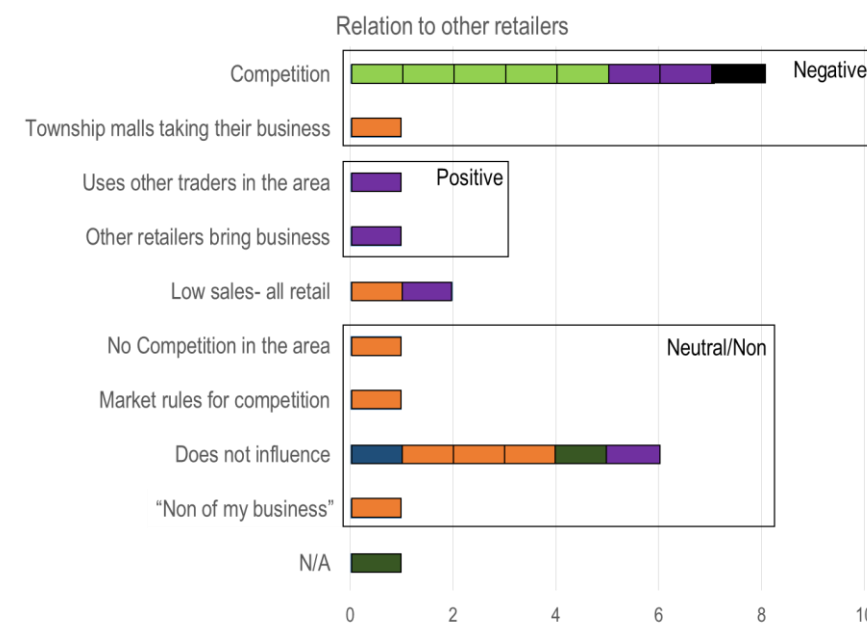


Figure 69: Relation to other retailers perceived by retailers in the CBD of PTA

distribute their goods, resulting in a decentralised distribution network. Additionally, respondents acknowledged that other retailers attract consumers and business to the area, including passers-by or foot traffic motivated to visit a specific location.

5.2.18 Customer Targeting

Customers are a crucial part of any retailers' business, but the type and composition or customer profile differs. This difference stems from the overall market that the retailer attempts to capture based on the overall needs and desires of potential customers. Smaller retailers typically don't have specific targeting of consumers, mostly relying on passers-by. On the other hand, large retailers actively attract certain groups of consumers through advertising campaigns and alike. Consumers and their relative incomes directly affect retailers, thus changes in the fortunes of different consumer groups impact retailers differently. If a retailer targets very specific consumers due to a specific niche product, if these consumers suffer an economic shock the retailer might suffer. Large grocery stores that target a wide range of consumers are often shielded from aforementioned problem.

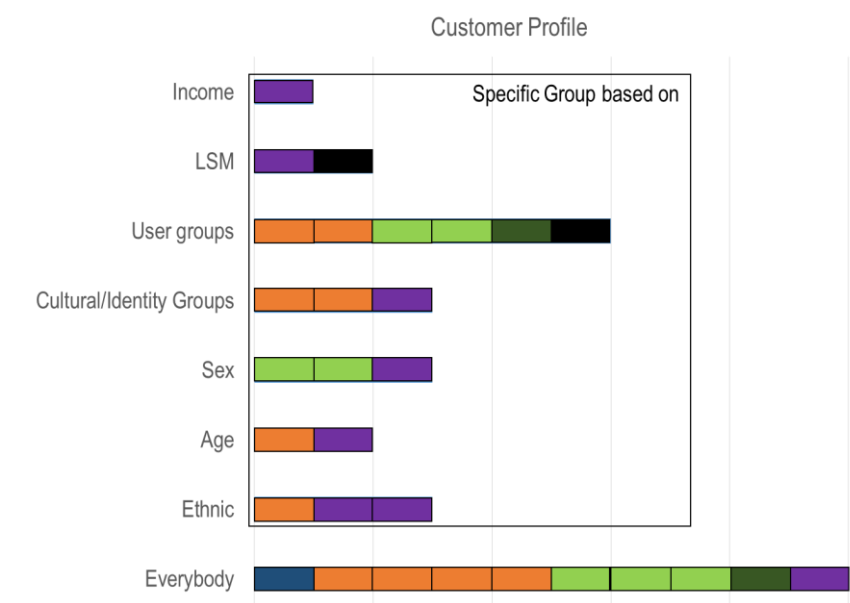


Figure 71: Consumer profile of retailers

5.2.19 Supply Chain

The supply chain of any retailer is essential, to ensure continuous provision of goods and services to clients. Retailers source their goods from various producers and intermediaries, inclusive of other retailers and wholesalers. The larger retailers source directly from factories in South Africa and various international markets, with some relying on their own production capacity. Typically, smaller independent and street traders obtain supplies from alternate retailers and wholesalers, although these may source from elsewhere. One street trader sources her fruit directly from farms in Nelspruit, which renders her a distinct advantage (more variety out of season and possibly lower costs) over other fruit vendors in the area, who primarily purchase from the Tshwane Fresh Fruit Market (see <http://www.tshwane.gov.za>).

The overall vulnerability of a supply chain may be explicitly exposed through consideration of the origin of production or supply. If a product is produced locally (with locally sourced components), it is particularly vulnerable to local disasters and perturbations; whereas an internationally expanded supply chain will have different potential risks and disturbances. Moreover, extended supply chains have other environmental and human costs or externalities, which are not explored by this study, but remain significant to resiliency and sustainability issues.

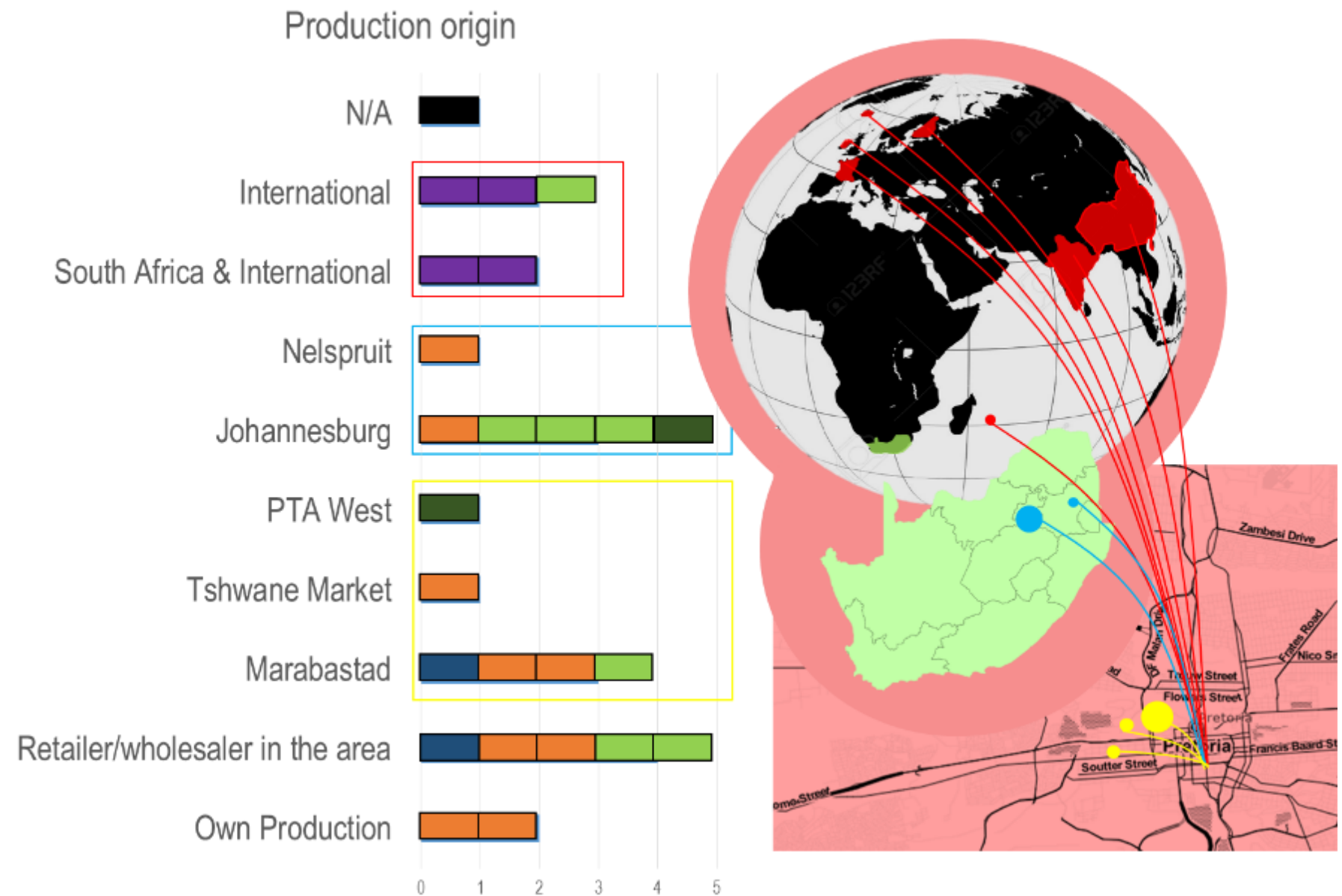


Figure 72: Supply chain of retailers

5.3 Describing the Collective Functional Retail Group

The preceding findings enable the elicitation of certain observations relative to the manner by which the retail function manifests associated diversity in the case study area. Similarities exist among the variety of retailers, supporting and substantiating the construct that retailers form a collective functional unit, based on similar functional traits. The characteristics or behaviours exhibited by the retailers, as discussed above, initiates the development of a representation of the overall retail functional group. Each retailer type has its own characteristics, as well as differentiation, specialisation and distinction across the types, forming multiple intersecting cross-scale layers of diversity.

5.3.1 Adaptive Capacity of the Individual Retailer, Retailer Types and the Retail Functional Group

This chapter endeavoured to explore and explicate the functional and response diversity of the retail sector in the case study area. Both types of diversity are fundamentally connected through the capacity to respond to perturbations. This capability is referred to as adaptive capacity. Carpenter and Brock (2008, p. 40) describe adaptive capacity as *“the ability of a living system, such as a social–ecological system, to adjust responses to changing internal demands and external drivers”*. The capability to respond or react to changes in the environment is based on a variety of factors, including specific characteristics, in this instance, those of retailers. The layers of diversity, as expounded in the preceding discourse divisions, constitutes the foundation of this ability to respond. This may be exemplified by a very large ship, through its size being inordinately difficult and time-intensive to turn, although it is more robust; comparably a small boat is far more nimble, but is more at risk to certain hazards related to size. Within the retail sector, the assorted characteristics impact how each retailer, within their specific group, has a varying capacity to respond to change. A large retailer may have vast capital reserves and operate globally; however, it is more physically bound to large retail premises.

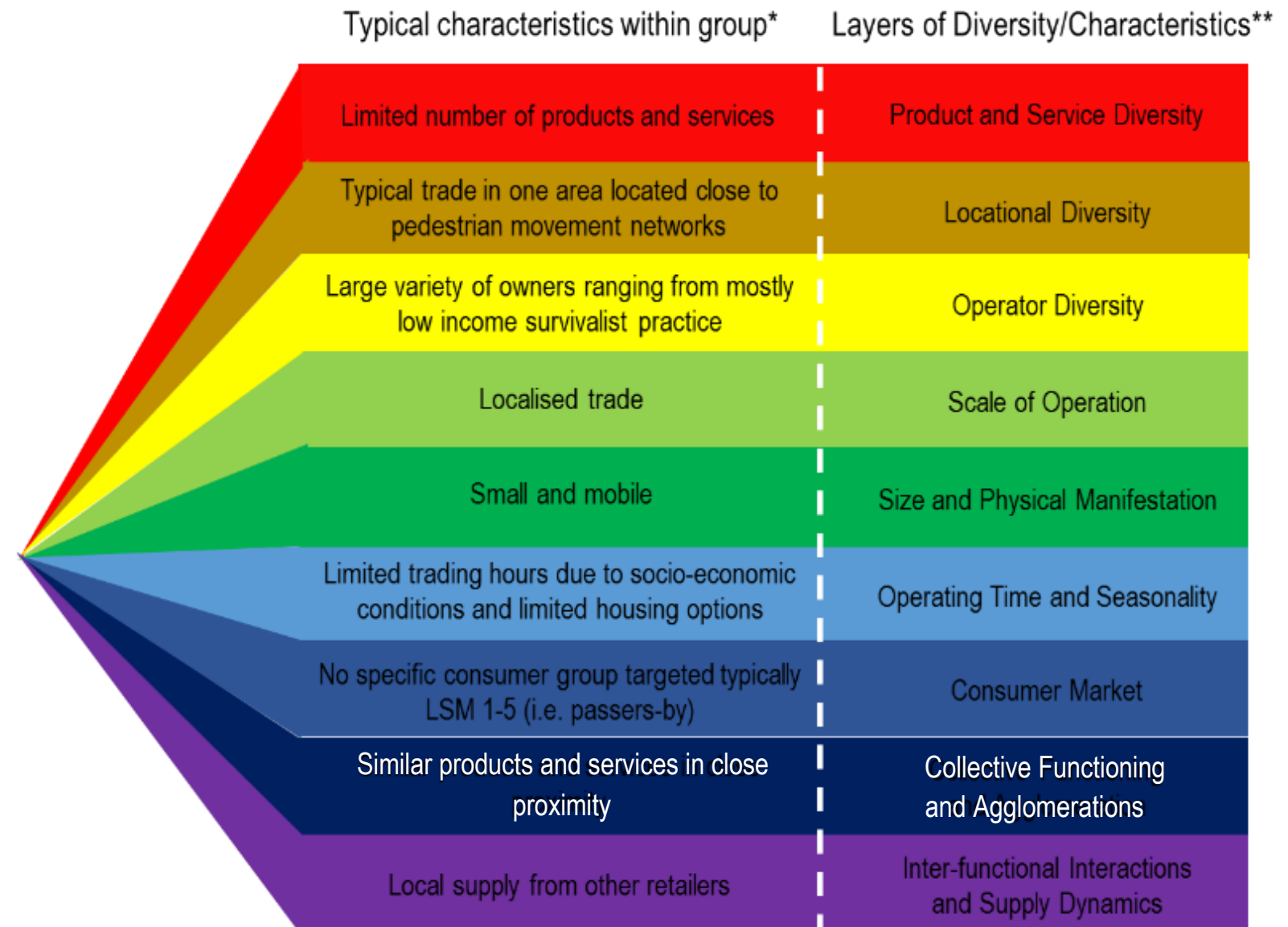


Figure 73: Adaptive Capacity of street traders composed of the layer of diversity/characteristics

*This only represents the typical group characteristics, although diversity exists within the functional sub-group or type.

**This does not represent all the layers that were analysed.

Smaller retailers, for instance street traders, are inherently mobile, enabling spontaneous relocation, exclusive of any legal and/or other constraint(s). The assortment of characteristics or layers of diversity are not necessarily confined by the retailer sub-groups or types, they remain in constant flux, resulting in diversity and similarity across types. The street trader who sources her goods directly from farms clearly demonstrates this, and this is reflected other larger retailer groups' behaviour. However, in the circumstance of this fruit vendor, her tactics render a key competitive

advantage over other similar traders. Overall the layers of diversity (or varying characterises) contribute a deeper comprehension of the functional group, extending beyond merely identifying different types of retailers. Through understanding the characteristics of retailers, we elicit a comprehension of the adaptive capacity of the retail group as a whole.

5.3.2 Hierarchy and Panarchy of Retailers Types

Scale hierarchies exist within the functional group, constituting a key characteristic of a CAS and SES (Cilliers, 1998). Each retailer type represents a sub-assembly within the subsystem comprising the retail sector in the urban context. As previously elaborated, within the framework, adapted from the ecological context, each species operates at a different spatial and temporal scale, due to characteristics within the panarchy of the functional group (Elmqvist, et al., 2003). From the findings reviewed in the previous section, a hierarchal structure is elicited in the retail functional group.

Principal, core trends emerge among the retailers, which indicate that an underlying hierarchy exists within the sector. The clearest exemplar of the hierarchy that develops, constitutes the product and services diversification of retailers. At one end of this scale, shopping centres have the greatest volume and selection of products, based on the multiple retailers located therein. Similarly, large chain stores frequently tender thousands of products and services. Conversely, street traders commonly offer a few items and simple services. The overall product diversification is conceptually conveyed by a few large retailers tendering vast ranges and volumes of products, at one end, extending to a great number of smaller retailers proffering small quantities and choices of products and services. Stirling (2007) and Salat (2011) refer to the smaller entities within a functional group as the “long tail of diversity”. This ‘tail’ contributes crucial redundancy to the functional group, as a concretion of products in a few retailers can render the entire system vulnerable.

In addition, this is valid for physical manifestation, whereby the large retailers occupy the most extensive spaces, while the more modest street traders and others occupy smaller spaces. A large retail floor area effectuates extended space for greater product and services diversification, ultimately engendering increased revenue potential.

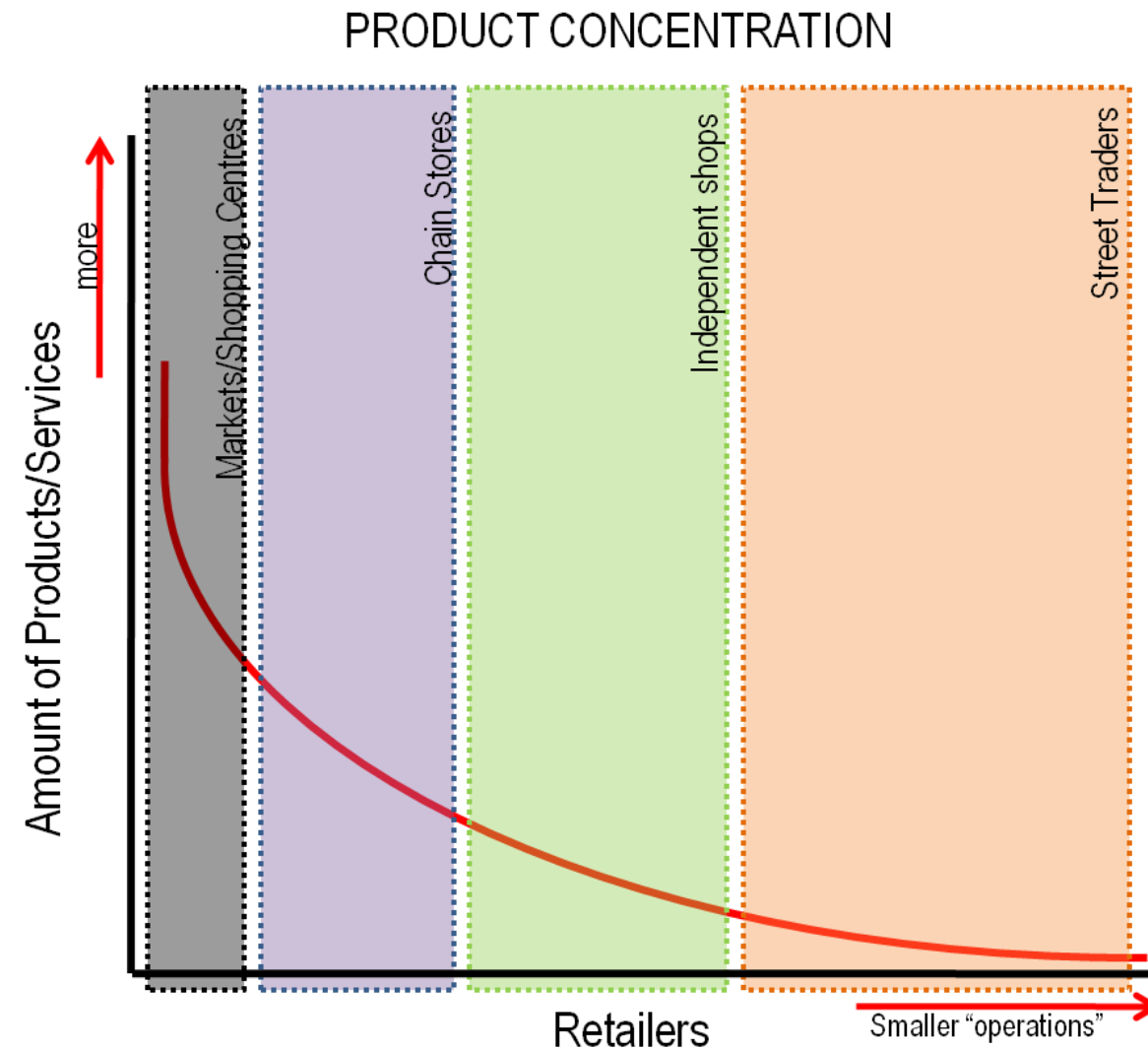


Figure 74: Product hierarchy of products and services

Large retailers appoint more employees per store, although cumulatively, smaller retailers, for instance street traders, represent a sizeable proportion of employment. Larger operations require more extensive workforces with, importantly, job specialisation and skill competencies. The street trader or independent retailer are required to accomplish multiple jobs, functions and activities, inclusive of financial management; buying of stock; and sales.

Large retailers, for example chain stores, can occupy multiple sites, locally and internationally. Smaller retailers only operate locally, with limited locations. This denotes that the retailers operate within different spatial and temporal scales. Larger retailers have the capacity to strategize and plan well in advance, through thorough feasibility studies as to whether a location

is suitable for investment, whereas more moderate retailers, for instance street and independent traders exert a much more intuitive assessment of business feasibility and locational choices. Predominately, smaller retailers source their goods locally, while larger retailers rely on domestic, international and their own manufacturing and/or re-packaging initiatives as sources for their products. This reiterates the different scales by which the retailers operate, in consort with the control they exert over supply.

The findings connote that large retailers require a greater volume of consumers and higher consumer spending in order to sustain continuous operation, while smaller retailers require less of both. This correlates to the catchment area, which is required to be far more extensive for larger

retailers, for instance shopping centres, with consumers originating, in certain circumstances, from the scale of the entire city. Smaller retailers operate locally, drawing patrons, residents and passers-by, from the immediate and adjacent vicinity, requiring comparably modest consumer quantities.

5.3.3 Structural Diversity Model of the Retail Functional Group

The overall structural composition of the retail functional group categorises the assorted variants of retailers within a hierarchy. As evidenced in the research determinations, a majority of retailers in the case study area comprises smaller retailers, e.g. street traders, with a few large shopping centres servicing the locale. The structural diversity model demarcates the level at which each type of retailer operates, ranging the local to the global scale. Diversity is established, both within a particular type, as well as across scales or types. This conveys that each retailer in a particular retailer type has distinct, unique and defining characteristics, while concomitantly populate a 'functional' niche. This can be evinced in the independent retailers, manifesting in a variety of ways. Moreover, diversity stretches across scales within the case study area. As explicated previously, large retailers, although located in the case study, operate at a comparatively greater functional scale than the smaller enterprises. This culminates into cross-scale interactions among retailers, which may be termed the panarchy of the retail functional group.

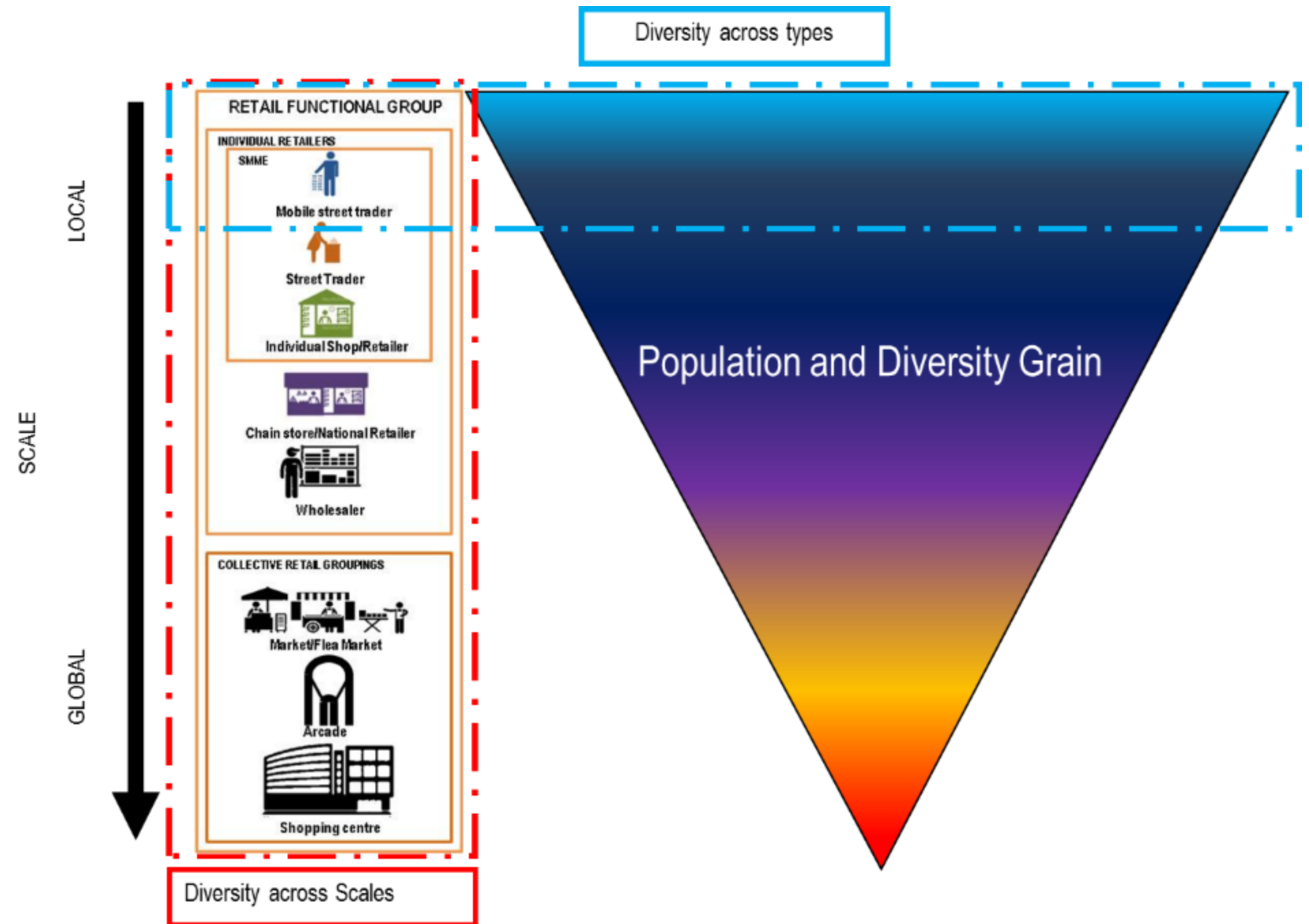


Figure 75: Structural diversity model of the retail sector

5.3.4 Panarchy of the Retail Functional Group

The panarchy model for response diversity elucidates the function of retail activities; and plots the typology of responses, according to scale; in consort with the response time. Each of the identified retailers operates at their individual scale or level, although they influence and affect one another. The panarchy model clearly illustrates the structure of the diversity pertaining to a specific function aligned to scale and reliant on specific variables; inclusive of, *inter alia*, gamut of operation; capital required for response; goods and services tendered; survivalist vs. entrepreneurial enterprises; capital accessible by retailer; vulnerability; adaptability; and openness to global and/or local economic fluctuations. The panarchy model does not attribute superiority, pre-eminence or precedence status to any specific retailer; instead it advocates that the different manifestations of retail activities (typologies) are constituents of the same functional grouping, which may potentially interact in symbiosis and mutualism. For example, informal traders catering for the incidental, convenience shoppers or for those who can only afford to buy small quantities at a time, may procure their stock and goods from bulk retailers situated inside the formal shopping centres. Additionally, these shopping centres service a clientele or customer range, who may possibly purchase goods with more consideration and planning and/or are able to buy greater volumes or bulk items. Furthermore, a trader who renders a service, for instance a barber or photographer, may acquire his supplies from the shopping centre.

The characteristics of each merchant are subsumed within a retailer group, and the assorted groups coalesced, thereby composing the retail sector and rendering key differentiation. These variations and differences of type, scale and other unique attributes engender retail group functional redundancy, as various alternate retailers have the potential to replenish a 'retail functional niche' by substituting, replacing or supplanting a defunct, relocated or inadequate retailer or business. This is facilitated through each retailer's unique characteristics enabling them to respond to environmental changes or perturbations. The following section expounds the functional groups' intrinsic response diversity.

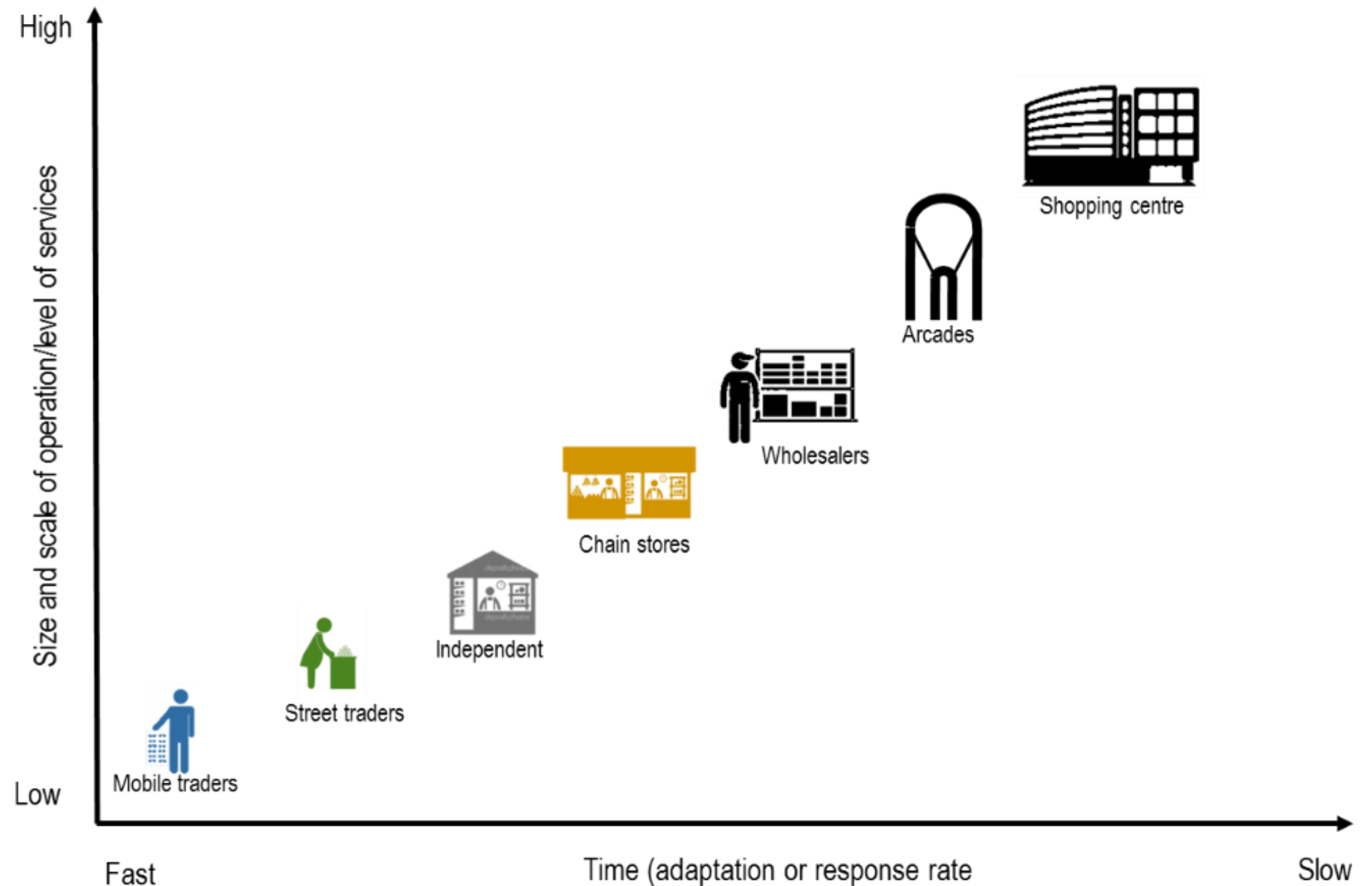


Figure 76: Panarchy model of the retail sector

5.4 Exploring Response Diversity

Response diversity consists of the variety of modes by which a specific entity responds to environmental change or perturbation. The previous section elaborated the composition and functioning of the retail functional group. The specific characteristics of the retailers and retailer types facilitates the discernment of the degree to which a retailer is potentially susceptible or vulnerable to specific threats. This section considers the retail functional groups' response diversity to threats.

5.4.1 Business Vulnerability

A business's perception of their general, overall vulnerability has significant ramifications; this can indicate the spectrum of circumstances and conditions with which they contend or, alternatively, has the potential to reveal particular inherent characteristics rendering it vulnerable. A range of vulnerability can be elicited from the findings generated by the interviews conducted with retail respondents. The retailers who deemed themselves extremely or very secure, predominantly comprised large chain retailers. The respondents asserted that their sense of security and confidence was engendered by being 'backed' by a large 'good' company. Essentially, they



Figure 77: Business vulnerability of retailers

are reassured, feeling less overall vulnerability, by being incorporated and supported by a greater establishment. An amalgam of retailer types considered themselves secure, ranging from the large shopping centre, which is empowered by a larger property management company, through to the street traders who have obtained license from the municipality. The most insecure and apprehensive retailer types, exhibiting and expressing several trepidations and fears, comprised the independent retailers and street traders. Independent retailers contend with specific pressures, which relate to the continued operation of the business, including overhead costs, which were anxiously highlighted as a major issue. The primary causal agents for street trader insecurity and apprehensions pertained to uncertainty and fluctuations in income, along with prosecution or harassment by authorities. The ensuing section explicates the manner by which specific retailer groups contend with distinct, defined threats.

5.4.2 Threats Facing Discrete Groupings

As drawn from the differences among the assorted retail entities within the functional group, each retail entity group contends with certain specific as well as common challenges. The next section clarifies the perceived threats faced by each sub-group in the study area; these are decidedly not exclusively the entire endangerments occasioning risk to these entities or sub-groupings; they merely constitute certain factors they perceive as hazardous to their business. For example, despite certain respondents citing macro-economic conditions as a persistent issue, this potentially jeopardises all retail activity to a varying degree. Each retail activity is imperilled by different, disparate and distinguishable hazards, construed from their individual and unique risk exposure. However, retail entities are human driven; this denotes that each entity, even if exhibiting identical characteristics to another, may react in a unique or dissimilar manner. This is engendered by the human element therein, through their uniqueness, every person has different life experiences, knowledge and skills, which render individual cognitive processes, effectuating divergent responses to change. This emphasises that it is imperative to consider retail entities as

inseparable and indivisible from both humans and nature. This study does not intend to dehumanise the retail sector, conversely it accentuates the important human facet therein, adamantly asserting that this unequivocally triggers response diversity.

Response diversity may be exemplified, in the ecological context, by utilising the entities of an elephant and a mouse. Both constitute herbivores (functional group), and are mammals; however, they clearly exhibit blatantly distinct and different characteristics, in conjunction with operating on disparate spatial and temporal scales. Furthermore, they react dissimilarly in the event of a perturbation, for instance when a bush fire spreads through their grassland area. An elephant operates on a larger scale, i.e. requiring an extensive expanse of land due to specific energy resource needs and habitat provision thereof; whereas a mouse functions on a diminutive spatial scale. This denotes that an elephant may be able to escape from the spreading inferno by travelling out of the area. Subsequent to the blaze, the mouse may have lost a certain food source and would have to alter its diet to include another grain type. Furthermore, one species' response can affect the reactions of other species, which may occur synergistically or in a diametric, antithetical or different manner. Similarly, it may be construed, that a shopping centre and a street trader will exhibit different responses to change and perturbation.

5.4.3 Threats Facing Retailers: Identified Themes

In the interview process, the retail entity respondents were presented with an enquiry pertaining to what they perceived as threats to their business. This is deemed significant, as it was theorised that if the retail entities operate at different scales, they would be exposed to different risks or, at minimum, would respond differently to change or perturbation. It is noteworthy, that certain responses to this query (see Annexure B Section 3) were garnered immediately; however, particular participants required more time in answering the question/s, or augmented and elaborated further into the interaction, while answering another question. This section is

closely colligated to whether retailers believe their businesses are secure, with good prospects.

The principal themes were discerned through a coding process of identifying themes acknowledged by the retail entities. Additionally, the immanent threats with which the industry as an entirety contend are significant, for instance macro-economic conditions, however this inquiry centres on perceived threats, due to the necessity for ascertaining the resultant response diversity. The logical procedure entailed permitting the retailers to freely contemplate and identify the threats they considered as hazardous to their businesses, rather than prescribe a prepared list and require the respondents to select items and issues.

Figure 78 plots the primary threats (the circle size indicates the number of retailers perceiving the issue as a threat) distinguished by the respondent retailers, which constitute the following:

- Competition (cited by six retailers)

This refers to the competition from other retailers, within and around the case study area.

- Crime (cited by four retailers)

This concerns both stock theft, as well as customers being targeted by thieves.

- No Perceived Threats (cited by three retailers)

In this element respondents asserted they were unaware of any specific threats, although blatant and latent threats may exist.

- Metro Police Actions (cited by two retailers)

This incorporates the harassment and prosecution of street traders for 'illegal trading practices', including the confiscation of stock.

- Macro-Economic and Political Concerns (cited by three retailers)

Macro-economic fluctuations relate to the general economic climate within the Country, which affects retailers. Macro-political fluctuations, conversely, refers to the overall political climate of the Country (political stability).

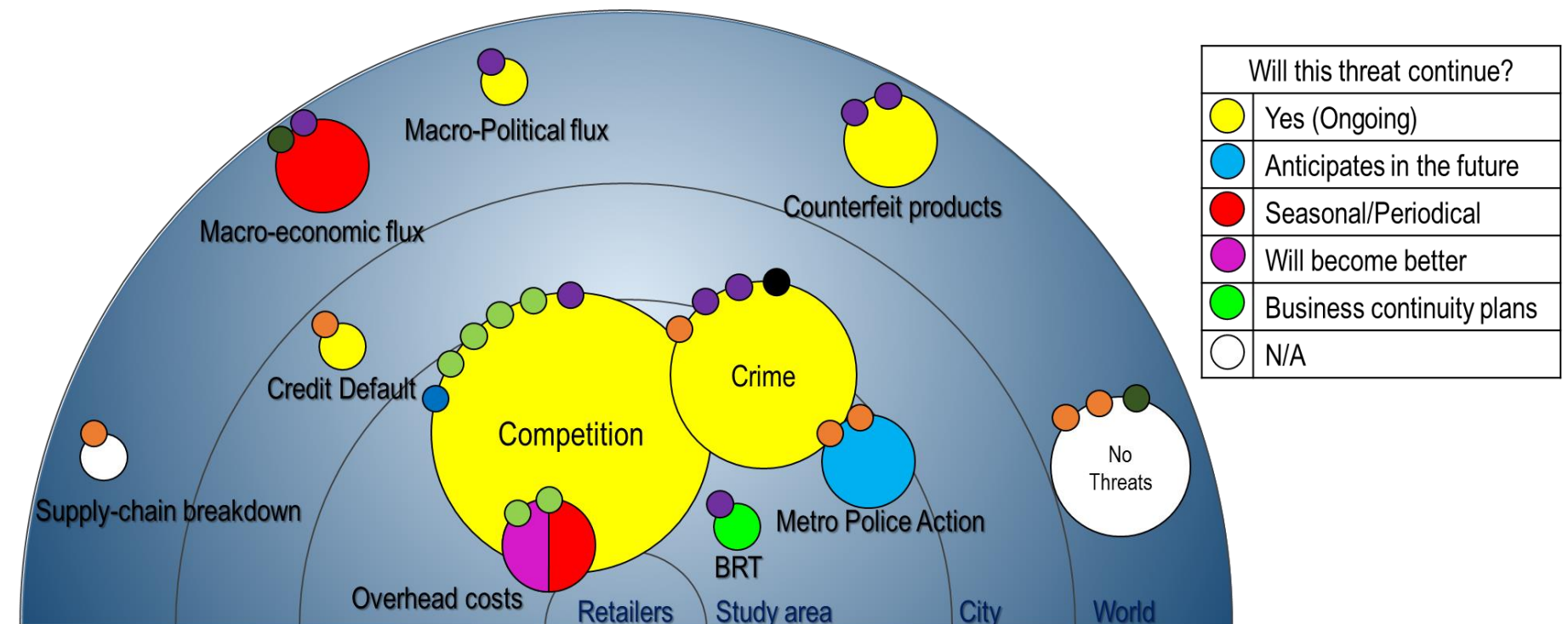


Figure 78: Threats/perturbations that affect retailers in the case study area

- Counterfeit Products (cited by two retailers)

This encompasses the illicit trade of products purposefully designed to mimic well-known 'Brand' name retail products and services.

- Overhead Costs (cited by two retailers)

This pertains to the overall business expenses incurred by retailers in immediate and sustained business operations. This, *inter alia*, includes the payment of utilities stock issues; staff; and rent.

- Credit Default (cited by one retailer)

This constitutes the failure to make an expected payment on a debt.

- Supply-Chain Breakdown (cited by one retailer)

This is a disruption of the supply-chain caused by an event that results in non-delivery or unavailability of stock to a retailer.

- Transportation and Office Re-Development (cited by one retailer)

In the case study area, the new BRT system is to move the current taxi services to an alternate location, resulting in a loss of custom from taxi-passengers and commuters.

5.3.3.1 Continuation of Threats

The figure above also portrays whether the perceived threat is expected to continue. This specifically reveals whether the risk is considered as occurring once, or will remain or occur again. Competition between retailers was cited as an on-going threat by participants, which is indicative of an over-supply of retailers within the area. This constitutes a continuing and persistent hazard to the income potential of retailers. Furthermore, crime was perceived as an on-going threat to the locale's retailers; although actual incidences of criminal activity are single occurrences, there is a cumulative negative effect. This impacts the volumes of passers-by and people frequenting the area, which diminishes with increased safety and security concerns, in consort with traders being targeted, losing stock or cash, thus reducing profits. Counterfeit products were distinguished by respondents as an ever-expanding problem, specifically with cheap counterfeits, which are imitation, forged or fake products, being sold in the same area as the originals or actual brand items. The macro-political situation in the Country, was highlighted by an individual retailer. This is subject to constant and unforeseen fluctuations, composing an enduring peril to their multi-national business.

The street traders who emphasized Metro Police prosecution as the principal factor endangering their activities, revealed concerns of continued police harassment and prosecution, although they were unsure of when it will occur. This institutes multiple challenges, especially in preparing for these eventualities.

Macro-economic fluctuation was identified as seasonal by an independent concern and a chain store. This refers to both the macro-economic conditions currently enfolding the Country, in conjunction with seasonal consumer-spend variations. In both instances, the unpredictable nature of the overall economy may negatively affect retailers. This is in concord with the issues of overhead costs, as cited by two independent retailers, who concluded that frequently they are unsure of their exact operating expenditures, with these constantly altering due to larger-level fluctuations, inclusive of increases in electricity or rent. One of these respondents anticipated that these overhead costs would improve from the current status.

5.4.3.2 Scale of Threat

Within Figure 78, the identified threats have been positioned according to the scale they originate from, ranging from local threats to global threats. Threats such as macro-economic and political fluctuations are engendered by national and international level events, affecting the local context. Similarly, counterfeit products predominantly created in foreign countries are of global scale; typically flooding worldwide markets through illicit trade. Supply-chains are expansive, stretching across the globe and are fundamental to the continuous and continuing provision of goods to retailers. A retailer emphasised that the supply of her goods from a farm in Mpumalanga was once disrupted, with a major impact on her business. This can also be extended to other retailers who may potentially face the same threat from supply-chain disruptions.

Several threats, in addition, operate on a city-wide level, including competition, crime and overhead costs. Competition is not limited to the localised study area, as retailers from other areas can directly affect trade

within the local context. A street trader responded that the development of shopping centres on the periphery of the city, has removed the necessity for certain consumers to travel to the CBD. This directly impacts the local retail market.

5.4.3.3 Impacts of Threats on Retailers

Competition: This threat affects all retailers to a certain extent. The retailers that prioritised competition as their primary threat, asserted that a recent intensification of competition has impacted their 'bottom-line'. There is, however, a positive connotation to this, an increase in retailers (competition) could signify an increment in consumers in the area. Within the free market economy competition is fundamental and imperative in developing new specialised products and services, i.e. new niches for retail products.

Macro-Economic and Political Conditions and Fluctuations: This may not necessarily directly impact retailers but can create a climate where consumer spending is depressed or compromised, in consort with business expansion rendered difficult due to economic uncertainties.

Metro Police Actions: This threat was solely the concern of informal traders (mobile and street traders) and is principally engendered by the nature of their operations, as the majority are in contravention of City of Tshwane by-laws. The Metro Police are mandated with statutory legislation enforcement; as there is a legalising trading procedure available to vendors wishing to transact in Tshwane, whereby the vendor is licensed (Bureau of Market Research, 2004). This is managed by the Department of Local Economic Development, with rent paid by the informal trader, who is designated a legal trading location for a set period (monthly or yearly on a contract basis). This legitimising trading process is, however. constrained and limited in effectuating no illegal trading in the city, as there are multiple barriers to legal registration affecting traders, which encompass:

- Not enough money for registration and/or rent (although informal systems often exist);

- Only trading for a limited time span;
- Insufficient trading areas;
- Trading areas frequently situated in areas not amenable to capturing and exploiting foot traffic (lacks flexibility);
- Lack of knowledge pertaining to the legal process;
- Have to be a South African Citizen or have legal status to work within the Country (need a work permit/visa if not South African);
- Lack of assistance *vis-à-vis* financial/business management;
- Less than 10% of traders are represented by organisations; and
- Payment for the rental space or stall, frequently excludes auxiliary services, for example security, cleaning and ablution facilities.

Taking into account the preceding registration constraints, it is inevitable that informal traders would be regularly challenged by Metro Police officials. The Metro Police officials are prescribed with fining illegal traders and to confiscate their goods. This can habitually result in chaotic situations, which turn violent, especially when large scale raids occur. Officially, when goods have been confiscated the trader can redeem them from a central storage facility, after paying a fine. However, in reality this seldom occurs. A street vendor selling 'achar' in the inner-city of Pretoria asserted that if her products were impounded, she would not be able to retrieve them, alleging that the Metro Police commonly steal products. Confiscated perishable goods lose all their utility, as they are compromised and expire in the interval between seizing and collection. Furthermore, interviewees asserted that Metro Police request bribes from vendors, which would allow them to avoid the confiscation of goods or associated fines. One mobile trader considers the bribes he pays to Metro Police officials his rent to operate in the area.

Mr E. Elias (Head of the South African National Traders' Retail Alliance) comments that the Metro Police prosecution affects the product diversity that traders stock, due to the fear of confiscation, and includes a reduction in the overall quality of goods kept. This has a direct impact on the capacity of the traders to accumulate stock, in consort with their competitive and comparative advantages in the market place. Mr Elias continues, that from the evolutionary approach (retail ladder concept), where one commences

as a trader and progresses to owning a shop or set of trading locations, if the lowest tier of the retail group is discouraged the bottom most individuals cannot move, which directly impacts the poor.

No Perceived Threats: These retailers did not perceive any tangible threats, however this does not signify that they may not have to contend with alternate, blatant and latent, perturbations and change. The haecceity or characteristics of these traders may be indicative of a particular vulnerability to alterations or unforeseen threats.

Overhead Costs and Credit Defaults: The daily overhead expenditures requisite in operating a business can constitute a threat to the survival of the business. This includes credit defaults on loans to operate the business, in addition to having potential vulnerabilities to macro-economic and political fluctuations.

Supply-Chain Breakdown: A supply-chain breakdown can directly impact on a business's ability to maintain operations. This is particularly relevant to retailers who rely on single suppliers of a product, denoting a supply-chain malfunction may directly affect product stocks. One street trader mentioned that she sources her products (fruit and veg) directly from the farm, should there be a hiatus in the supply, potentially rendered by several factors, her stock costs would be substantially higher, thereby diminishing her profitability.

Counterfeit Products: These products specifically affect large corporations tendering specific desirable and well-known brands. One multi-national clothing retailer indicated that the counterfeit or imitation products of their brand are sold by certain street traders nearby to their business premises. Another national retailer asserted that, although the quality of the counterfeit goods is low, consumers in the area tend to buy these forged products because they are cheap and afford status, as frequently they cannot readily be identified as fake.

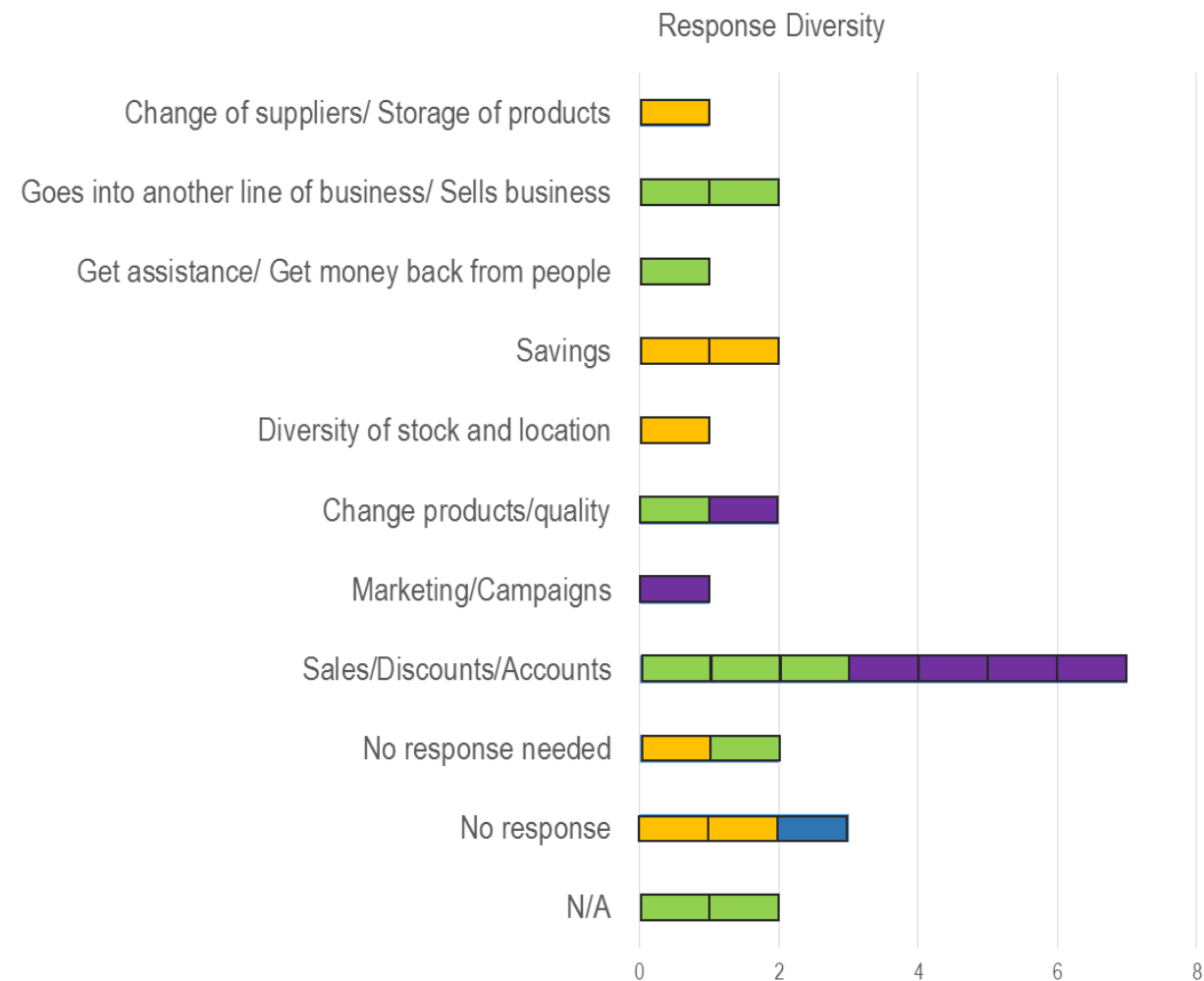


Figure 79: Response diversity to all threats

The succeeding section will review the retailers' responses to the threats, with which they, along with the entire functional group, contend.

5.4.4 Response Diversity to Threats

This section reviews the assorted responses to threats, in consort with the differences between retailer types. Response diversity, in the retail sector, refers to the range of actions or reactions, occasioned in countering environmental changes, among the individual retailers of the retail functional group. The resilience to environmental change or perturbation is enhanced if the individual retailers' responses differ, resulting in continuing function (Elmqvist, et al., 2003).

The overall collation and descending frequency of the responses to all threats evinced that the most prevalent reaction constitutes sales or discounts (seven respondents); followed by no response second (three respondents); then sell business, utilising savings and a change of product or quality (two respondents); and finally, change of suppliers/storage, loans, diversity of stock and marketing campaigns (one respondent per each).

- Competition

The primary responses to competition by the various retailers vary substantially. Large chain stores embark on sales campaigns in order to entice increased business. One chain store respondent revealed that they react to the other large retailers and initiate sales and specials in response to those of competing entities. An independent retailer mentioned that they

would source new ‘powerful’ products to attract customers away from competitors. Another independent retailer remarked that he would first decrease prices, but may have to sell the business and open up a different enterprise. A mobile street trader had no response simply adding the he *“takes it one day at a time”*.

- Crime

The retailers that heightened crime as their primary threat exhibited disparate responses thereto. The national clothing retailer elucidated on creating partnerships with shopping centre security, in consort with increasing store security in order to mitigate the intensification of crime in the area. A street trader stated that she would move locations and sell different products, if necessary.

- No Perceived Threats

Although these retailers perceived no threats, they still revealed certain responses to unforeseen threats. Two traders advocated the utilisation of savings, while an independent shop owner contended that he does not anticipate any bad times, and *“he knows what he is doing”*.

- Metro Police Actions

This threat specifically affects street traders and, as previously explained, they respond to this on-going risk by reducing stock diversity to limit the losses from confiscation by the authorities. The street traders asserted that they can relocate, with one mobile trader explaining that he runs away when he spots any Metro Police officials, and sells his goods in a different area. This colligates with the mobile nature of these vendors.

- Macro-Economic and Political Concerns

The retailers (chain stores) affected by macro-economic and political fluctuations revealed that when sales decrease they aggressively market

their products; have sales; give discounts or vouchers to clients; and encourage people to open accounts, thereby contributing a more stable income stream for retailers.

- Counterfeit Products

One international clothing brand responds by altering their stocks and improving the standards of their products. Multiple factors are taken into account, including an influx of students; how the environment affects people (climate/season) and for example, if the National Theatre is not operating they lose business. Another chain retailer stated that they rely on reducing prices through sales campaigns. An international fragrance retailer explained that they constantly have to develop new fragrances that are more difficult to copy, in conjunction with a strict confidentiality policy to protect ingredients and processes.

- Overhead Costs and Credit Default

Overhead costs specifically affected independent stores, with one utilising sales to increase revenue and another trader collecting debts from people owing him money. A street trader who utilised a loan to buy stock stated that she does not have a specific response; she *“just sits and waits it out”*.

- Supply-Chain Breakdown

The street trader that sources her stock directly from the farm said that if the farmer could not provide produce, she would be compelled to utilise the Tshwane Fresh Produce Market, affecting her profitability. She added that her stock variety would also decrease should this occur.

- Transportation and Office Re-Development

The relocation of the taxi services and removal of offices workers has had an impact on a large national retailer. The retailer, as a response, instituted

and promoted weekly sales, vouchers and discounts, specifically targeted towards existing customers in order to retain their business.

5.4.5 Saving and Insurance of Traders

A key contributor to the long term adaptive capacity of retailers is their ability to utilise various savings and repositories in order to endure through difficult times. One retailer indicated that they would sell their personal goods in order to survive until business picks up again. Insurance for goods, staff and buildings was primarily acknowledged by the large chain retailers and shopping centres, and is exploited to secure their investment. Insurance is important in the event of theft, fire and injuries to either staff or clients. The retailers without insurance run the risk of losing stock and thus profits, in an unforeseen event. Smaller retailers, for instance street traders and independent retailers, have bank savings which can aid in business survival. Additionally, certain street traders are part of collective saving schemes, e.g. a ‘stokvel’⁶ which also adds revenue towards the continuation of the business. Five retailers revealed that they have no savings or insurance, rendering them vulnerable should their revenue stream be affected.

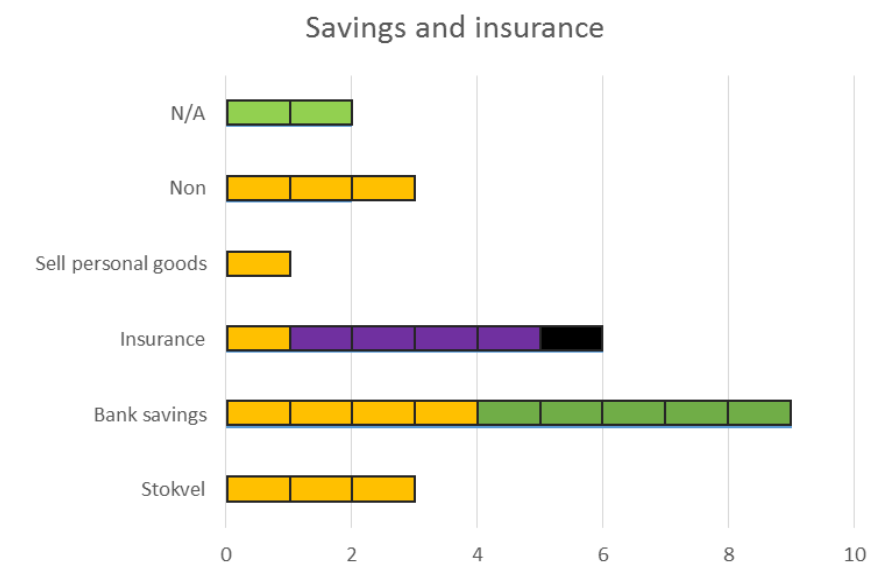


Figure 80: Savings and insurance of retailers

⁶ a savings or investment society to which members regularly contribute an agreed amount and from which they receive a lump sum payment.

5.5 Conclusion

This chapter presented the findings of the research project. The first division explained the context within which the retail functional group operates. The context exposes various cross functional linkages between the retail sector and other sectors within the study area. The initial component of the functional and response diversity framework involved the description of the retail functional group. This section revealed that each retailer has unique characteristics that form sub-assembles of retailer types. Multiple retailer types emerge, operating at different scales, although all are present in the same case study area.

The unique characteristics of each retailer type and their scale of operation creates a panarchy of retailer types within the retail functional group. Each of the identified retailers operates at their scale or level, although they influence one another. The panarchy model illustrates how diversity to a specific function is structured, aligned to scale and dependant on variables, inclusive of scale of operation; capital needed for response; goods and services provided; survivalist vs. entrepreneurial enterprises; capital available to retailer; vulnerability adaptability' and openness to global/local transformations.

The overall position in the panarchy, together with innate characteristics, determines the adaptive capacity-related response diversity of retailers. The response diversity of retailers varies depending on both the retailer type, as well as the threat. Because retailers exert different responses to threats, this facilitates the opportunity for certain enterprises to survive. In the event of one retailer having to terminate operations, alternate retailers may be able to substitute, filling their retail 'niche', effectuated by similar functional characteristics. Additionally, due to the overall size of the retailer operations, the majority of capital is concentrated within the larger retailers, with the smaller concerns controlling and possessing far less. This can directly influence the survival of businesses, allowing a large retailer to survive for a duration even though generating minimal or no profitability; however, smaller retailers do not have the same capacity. This aligns with

the concept of the panarchy, in terms of the time component. Within the panarchy concept larger systems or entities function on a longer time period, i.e. it takes longer for larger systems to revolve through their adaptive cycle. Additionally, this can be revealed in the retail functional group, where large entities typically have longer-term objectives, focussing on long-term growth, whereas smaller entities, e.g. street traders, focus on day-to-day survival. This can clearly affect the overall adaptive capacity of retailers, where large retailers may react slowly to changing conditions, but have stored capital. Smaller retailers can rapidly react to changing circumstances but cannot sustain unprofitability for long intervals.

A fundamental finding constitutes that diversity creates more diversity; more retailers tend to locate where diverse land uses exist and, where more diverse retailers settle, the greater the diversity of products and services. These cross-functional linkages are crucial to creating a progressively diverse and resilient retail sector.

Chapter 6

Conclusion



The chapter concludes, reviews and explicates how the project has answered and achieved the overall research questions and objective. From the outcomes, a variety of lessons of the application of resilience on the urban context is drawn and explained. Finally, the research limitations and future research is discussed

6.1 Introduction

This dissertation commences with the premise that the contemporary complexities of a, progressively complex, unpredictable and completed local and global milieu, with never-ending changes and transformations, resilience is crucial. Specifically, with regard to this research endeavour, resilience signifies and facilitates city development and management with the potential capabilities necessary in adapting and adjusting to these alterations and fluctuations. Resilience theory was originated and derived from an ecological context, focusing on the dynamic interactions that comprise a complex adaptive system. The resilience of connected social and ecological systems, of which cities are comprised, is deemed imperative for the sustained survival of human-dominated systems. The primary challenge in the application of resilience concepts constitutes the inherent difficulties in, and virtual impossibility of its direct measurement, enumeration and appraisal, as resilience is an emergent behaviour of complex adaptive systems. However, it is feasible, practical and possible to operationalise resilience, through identifying and evaluating the constituent facets of resilience, for instance, diversity. The principal intention motivating this research project comprised clarifying and evaluating how an ecological resilience concept, viz. functional and response diversity, would manifest in an urban socio-ecological system. To enable the transfer, extrapolation and application of ecological functional and response diversity to the urban context entailed the selection of a fundamental, critical urban function, retail activity. The function of retail activity (distribution of goods and services) is essential and significant, in both social and economic contexts and includes its associated incorporation of ecosystem services. The retail function was investigated and explored in the City of Tshwane CBD, through the interpretation and transfer of the ecological construct of functional and response diversity.

The initial step constituted extrapolating functional and response diversity to the function of retail, generating a comprehensive exposition of the dynamics, interactions and hierarchy within the functional group. The

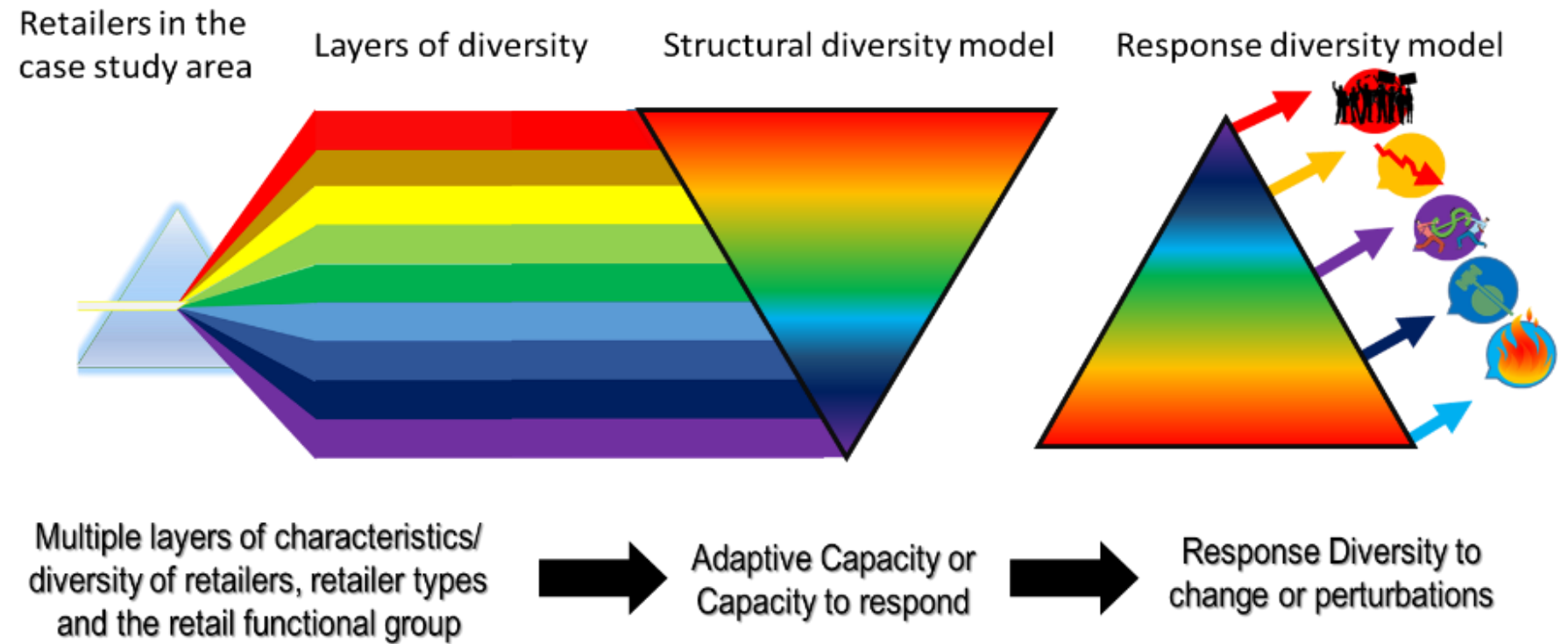


Figure 81: Research process from retailers in the field to functional and response diversity

understanding of the composition of the functional group was a critical imperative, effectuated by revealing and reviewing the discrete entities possessing the functional trait of retail (diversity of the entities with similar functional traits, across the gamut of scales and types). This was achieved through field observations (retail count etc.) undertaken in the case study area, supplemented by interviews with the retailer respondents, based on the entities' immanent haecceity. This system comprises a variety of defining characteristics, inclusive of, *inter alia*, scale of operation; physical size and design; operational structure; ownership; goods and services offered; primary purpose of operation; magnitude of consumer market; and start-up capital required to establish the business. These attributes determine the hierarchy of retail entities, consequentially governing all entities' capability to adjust and adapt (adaptive capacity) to changes. The interrelationships among entities and the population distribution (physical and structural) of each of these are vital in distinguishing, expanding and understanding the functional group.

Subsequent to the discernment of the discrete members and types of functional groups, each subgroup's responses and reactions to change and/or perturbation were elicited. It is deemed essential to take into account that, due to the entities' assorted domains, each operating at varying and various scales, they contend with different threats and/or have greater or lesser susceptibility to particular changes, engendered by their intrinsic characteristics. Humans are individuals, with unique experiences, skills and cognitive capacities, which renders a diverse and vast gamut of potential reactions to endangerments. As people control each retail unit, this induces and evinces the variety of responses (response disparity or diversity) to change in the functional group, thereby substantiating the contention that, as a diversity of entities and responses exists, the overall function is less vulnerable or susceptible to changes, whether perceived or not. Therefore, the resilience of the function is engendered by the functional or structural distribution of retailers, in consort with their adaptive capacity and diversity of responses to social-ecological changes. This creates functions with the capabilities to adjust and adapt to continuously changing circumstances,

ultimately producing cities that spontaneously and directly adjust, acclimatise and assimilate, resulting in sustainable, successful progress in fluctuating, transforming and altering conditions.

The principal intent of this chapter is to summarise and succinctly provide a synoptic review of the principal facets and findings of the research project. The chapter elucidates the manner by which the research question and objectives have been resolved, in consort with expositing the implications of the findings on the theory, advocating conceptual techniques and constructs for the future application of resilience within the urban context.

6.2 Reflecting on Research Objectives and Question

6.2.1 (1) Construct a Framework for Investigating Functional Response Diversity within the Urban Functional Context (2) Explore the Functional and Response Diversity of the Selected Function within the Identified Study Area.

In order to probe the role of diversity in actuating or ascertaining resilience, required the formulation of a framework to translate and extrapolate ecological resiliency concepts to the urban context. The foundation of the framework utilised the concept of functional and response diversity, adapted and interpreted for retail sector application. The framework was affirmed and verified as viable, executable and successful. It, initially, elicited and elucidated the functional retail group, encompassing the entire ambit of its diversity, which incorporates the delineated assortment of retailer types, in consort with their haecceity, revealing a variety of innate characteristics. The framework revealed that the retailers function on multiple, distinct scales, therefore they contend with different threats, along with a variation of response capabilities thereto. The framework allowed for the appraisal and analysis of the response diversity contributed by each retailer and type. In the interview process, retailers were questioned as to their perceptions of what actual or potential threats they face, in consort with their undertaken, possible or predicted responses and reactions thereto. Both functional and

response diversity, as applied through the framework, facilitated the elicitation and particularising of the role of diversity in creating a more resilient retail sector.

6.2.2. What is the Role of Diversity in Creating a Resilient Retail Sector?

The primary research question concerned establishing the overall contribution of diversity in creating a resilient retail sector. The findings evidence that, firstly, a functional group exists, composed of a vast conglomeration of diversity, on various scales and levels, which, within and among the group of retailers, renders a resilient functional group (through functional redundancy). It is contended that all retailers, to varying degrees, contribute to functional redundancy and resilience. Functional redundancy occupies the assorted layers of diversity exhibited by the group, characterising each functional member, as well as their individual and collective responses to change.

Conversely, response diversity is a function of the functional diversity of the retail functional group. The various retailers articulated and effected different responses to threats or perturbations, denoting the overall, entire function is enabled with an enhanced capability to persist due to these varying, distinct and disparate reactions. Additionally, the manner by which threats or perturbations affect retailers varies, as they function on different scales and possess a wide gamut of response capacities or capabilities.

A fundamental revelation of this dissertation constitutes the multi-layered nature of diversity, within the retail sector, as well as the urban context in its entirety. For this dissertation, diversity was extended from a superficial review, with its elucidation expanded through the application of functional and response diversity, which exposed the complex nature of diversity.

The structural diversity of the retail sector showed a wide variety of retailers. The retail sector demonstrated a duality of diversity, viz. across type, designated by the different retailer variants, and within type, denoting the

differentiation within a retail classification, for instance street traders (as described by Salat, 2011 and Page, 2011). Each retailer type is associated with unique characteristics, which collectively categorise the retailer variant, inclusive of, *inter alia*, physical manifestation; trading location; and scale of operation. Similarly, within the different retailer types/groups, each individual retailer possesses their own specific history, capital and other assets. Moreover, Leslie and McCabe (2013) refer to the differentiation in decision making rendered by each associated individual, which substantially conduces immense diversity, augmenting the study of human complex systems, rather than ecological systems.

The study revealed a significant result, wherein it was substantiated that diversity creates more diversity. This succession is contended by Page (2001) and Jacobs (1961), who cite exemplars, viz. places with more diverse land usages engender increased diversity activity and interactions; or teams with greater staff diversity are facilitated with the ability to formulate and render an increased variety of diverse options for decision making.

From the findings it can be extracted that diversity among retailers, within and across types, is concentrated and forms nodes of diversity. The ensuing section expands on locations which create an environment for trader diversity. Despite retailers competing with one another, in key locations it is apparent that they exert an attraction for one another or, minimally, that the specific site is desirable to them, drawing retailers for particular trading advantages. In certain locales, a lack of retailer diversity appears to negatively affect the existing retailers trading there. For example, in the central 'pedestrian mall' of Stanza Bopape Street, a street traders deficit in one section demonstrates a comparable, accompanying reduction of pedestrian movement. The other retailers located in this stretch report diminished business activities and profits. A direct correlation between the absence of the street traders and reduction of retailers' commercial activities, cannot emphatically be construed, however it is deemed that this factor potentially comprises a causal agent.

Alternate locations with intense trader diversity, in addition, exhibit and conduce a variety of land uses, modes of transport and activities. The diversity of other functions within the case study area draws a large amount of people to the locale, consequently creating a market in which retailers can profitably operate. The retailers, in succession, due to the diversity of traders, products and services rendered in the area, trigger an increased attraction for passers-by and potential customers. The findings connote that diversity is significant and fundamental in reducing vulnerability and providing redundancy for resilience.

6.4 Implications of the Findings

6.4.1 Implication on the Theory and Practice

The principal implication and greatest import of this research on the theory and practice of resilience thinking, comprises demonstrating that the operationalisation of resilience is possible. The construct of applying resiliency concepts to the urban environment is supported by several authors, including Resilience Alliance (2010); Simmie & Martin (2010); and Du Plessis (2008), however the actual operationalisation of resilience remains obfuscated and unestablished. Leslie & McCabe (2013), with their application of response diversity on human-dominated systems, instigated one of the initial attempts to operationalise resilience. This study aligned with their concepts, attempting to accumulate empirical data towards corroborating and actuating the application of resilience within the urban context. Resilience has been previously empirically researched in ecological fields but not in the urban context (Berkes, et al., 1998). The potential for extrapolating and translating the concepts of ecological resilience to the urban context was by rendered by the similarities between ecological and urban systems, which both constitute CAS and SES (Batty, 2008). This 'apodeictic noesis' and logic intimated and created the possibility of transferring and interpreting the concept of functional and response diversity to the urban context. This study, therefore,

operationalises resilience, and in consort, verifies, substantiates and confirms that the translation and extrapolation of concepts is achievable. Similarly, the endeavour to evaluate the viability and practicality of utilising determinants to research and appraise resilience, engendered the ratification and verification of the construct's exploitation in the urban environment. This denotes that the multiple components or determinants of resilience are sufficient and effective proxy indicators or substitutes therefor, and can actuate the measurement of resilience.

Within the context of the retail sector, the study has contributed an integrated overview of the retail sector, rather than evaluating individual retailers (Bureau of Market Research, 2004). Furthermore, it was distinguished, that although in competition with one another, retailers can exist in symbiosis and mutualism. The researcher advocates that future studies in the sector should consider the sector as an entirety, instead of separate or competing parts.

6.4.2 The Role of Planning, Management and Design in Creating a Diverse Retail Sector

The levels of diversity, whether comprised of trader type or product variety, deviates and fluctuates immensely throughout the study locale. Planning constitutes a fundamental factor in the management of space and usages in the entire city. Within the case study area, urban design and planning decisions may have repercussions and implications towards the success or failure of a retailer. A prime exemplar is engendered by the block-level design, which evinces a clear impact on trader location and diversity, as evidenced in the case study area. The consequences and connotations of the local-level design of buildings and blocks may be clearly elicited in localities where, *inter alia*, high permeability; mixed uses; and more buildings per block, facilitates an enabling environment, in which the diversity of the retail sector (and other functions) can thrive.

It can be clearly drawn that the management of retail activities by the authorities disproportionately and negatively impinges on the street traders

within the case study expanse. Continued prosecution of these entities directly encroaches on their resilience and the resilience of the retail sector, as they function as the 'long tail of diversity' (Stirling, 2007, Salat, 2011). Street vendors have the potential to ameliorate and augment the success of public space in city, if they are included in the design and management of public space, and not marginalised, excluded or relocated to places where trading is not viable or sustainable. Traders require transactional areas that are well-located, permeable and on pedestrian routes, thus will continue to occupy these localities illegally. Additionally, traders require storage facilities, enabling and facilitating greater flexibility in terms of stock variety, in consort with bulk purchasing. Intelligent, adaptive management, design and planning should take cognisance of these facets, stimulating effective and enabling public spaces accommodating these requisites. This may denote widening sidewalks, without total pedestrianisation of streets (also a traffic calming measure); providing ablution facilities at central points; increased and regular street cleaning crews; and the ameliorated, correct maintenance of pavement surfaces and public amenities.

Besides the design imperatives distinguished in this study, the exploration of diversity itself requires expansion within the planning fraternity. Diversity has been elicited as significant but its elucidation and complex nature are frequently underestimated. This study traversed from superficial conceptualisations of diversity to revealing the intricately complex nature of diversity and cities in general. Planners, for example Rob Roggema, are pioneering a new planning theory, which accommodates and considers complexity and diversity, termed 'swarm planning' (Roggema, 2012). This construct extends beyond the previous mechanistic and modernist conceptions of planning towards a new planning theory and practice, which takes into account the unpredictability of the future and incorporates the categorisation of cities as CAS. Additionally, management practices from ecosystem conservation, have the potential to be extrapolated to strategise and formulate responses to social-ecological change in cities (Schoon, 2008). These theories, in consort with empirical findings (including those presented in this study) have the potential to progress planning practices

and processes towards improved, effective and feasible city management and control, especially *vis-à-vis* uncertainties, complexity and change.

6.5 Future Studies

The principal contribution of the study constitutes the empirical application of the resiliency concept within the urban context. The translation of ecological constructs to the urban context was deemed crucial to eliciting how resilience manifests therein. The framework formulated to operationalise resilience is anticipated to contribute the initiation point or commencement for further empirically based research. Empirical research is considered fundamental and critical for rendering a solid foundation, which will facilitate the utilisation of the full potential and possibilities effectuated by resilience and its connotations.

This research endeavour was explorative in nature, occasioning opportunities and prospects for future research into the operationalisation of resilience within the urban context. The prospective application of the framework, delineated below, in addition, incorporates an explanation of the general limitations of the study (the overall limited scope of the study, as presented in the introductory chapter).

6.5.1 Apply Framework to Other Case Study Areas

The environment in which a system exists interacts with, and influences, the system. In the circumstance of the retail sector, this is clearly shown from the findings generated in the case study area. The overall success and vitality of the retail sector are impacted and influenced by a multitude of factors, which include, *inter alia*, urban morphology; land use; planning regulations; urban design; and historical development. The framework, as applied to the retail sector, in conjunction with the consideration of these preceding elements, has the potential for implementation, and should be exploited in alternate, additional contexts. It is advocated that future studies investigate other contexts within the City of Tshwane, to reveal city-wide interactions among the retailers. Regarding the City of Tshwane, it is

proposed that case studies may be drawn from a variety of representative retail nodes therein, for instance a decentralised node (e.g. Menlyn) and an emerging node (e.g. Soshanguve). Employing the framework to evaluate alternate local cities could potentially effectuate unique comparisons with the case study utilised in this investigation.

There is a dual utility in applying the framework to other contexts. Firstly, it further tests the applicability of the framework to other contexts, engendering a progressive, advanced validity and corroboration of the overall approach's functionality and practicality. Secondly, it enables the evaluation and explication of the manner by which the retail sector manifests in different contexts, in consort with the impact of local conditions on diversity and, accordingly, the resilience of the sector. It is deemed noteworthy, that due to the sampling and mapping techniques utilised in the application of the framework, its implementation in evaluating and exposing the retail sector is rendered achievable and, most significantly, is encouraged, empowered and facilitated.

6.5.2 Repeat Analysis over Select Time Periods to Uncover Changes in Diversity/Resilience

The study of resilience, in conjunction with investigating SES and CAS, constitutes the research of change. The capability to respond and react to changing circumstances is central and fundamental to the resilience of both CAS and SES. Due to the limitations of this study only a 'snap-shot' of empirical data was amassed utilising the framework. It is, however, deemed imperative to augment this by conducting a series of multiple assessments over an extended interval, which will facilitate the assessment of the true resiliency of the sector. This has the potential to render exceedingly interesting and detailed insights into the continuous perturbations and transformations within the system, as well as how planning interventions affect the retail diversity and/or resilience within the area.

6.5.3 Apply Framework to Other Functional Groups in the Urban Context

The retail sector is one of multiple urban functions that exist in the city. It is proposed that the functional and response diversity framework be applied to alternate urban functions. This will require certain adaptations of the framework, specifically in terms of sampling and mapping, as other functions may pose specific, unique challenges. The following list comprises suggestions and recommendations when considering a prospective function, on which to implement the framework:

- The function needs to be critical to the continued existence of the larger social-ecological system;
- It is requisite that the functional group be composed of a diverse number of entities;
- There should be a discernible hierarchy/panarchy within the functional group; and
- The function can be observed/measured/analysed with relative ease by a researcher.

Du Plessis (2008) identifies the following different functional categories that can be identified in a city such as (but not limited to) business and commerce (distribution of goods and services), residential (shelter), industrial (production), infrastructure (networks), social facilities (amenities) and green users (recreation and ecosystem services) amongst others.

Each of the potential studies presented in this section offer exciting opportunities and prospects, by which to extend and progress the foundation established in this study. This study ultimately presents a modest attempt towards the operationalisation of resilience in the urban context and only through more application of resilience theory in cities can both the planning and resilience field be capacitated to create cities that are able to adapt and thrive in changing circumstances.

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Annexure

Content:

Annexure A: Retail Coding System

Annexure B: Interview Schedule for retail entities

Annexure C: Consent Form

Annexure D: Retail Classification Examples

Annexure A

Retail Coding System

Retail Coding System

| | |
|---|--------------------------------|
| A | Mobile street traders |
| B | Street Traders |
| C | Individual Shop |
| D | Speciality Shop |
| E | Wholesale/Cash and Carry |
| F | Chain Store (National) |
| G | Multi National (International) |
| H | Shopping centre |
| I | Big box retailer |
| J | Corner shop/Convenience store |
| K | Informal Shopping centre |
| L | Tuck shop |
| M | Arcade |
| N | Supermarket |

Retail Activity Group

Type of Product

| | | | |
|----|-------------------------|-----------------|------------------------------------|
| 1 | Fruit and Veg | 16 | Footware |
| 2 | Sweets and Cigarettes | 17 | Electronics |
| 3 | Furniture | 18 | Film's/CD |
| 4 | Clothes | 19 | Medical Prod./Glasses |
| 5 | Grocery store | 20 | Cosmetics |
| 6 | Fashion accessories | 21 | Locks, Glue, ID books, Rat, Zambak |
| 7 | Hardware | 22 | Tombstones |
| 8 | Wholesale goods | 23 | Adult |
| 9 | Traditional Goods | 24 | Number Plate |
| 10 | Household items | 25 | Books and Stationary |
| 11 | Alcohol and Drinks | 26 | Sport |
| 12 | Food | 27 | Guns |
| 13 | Gold exchange | 28 | General |
| 14 | Computer | 29 | Florist/Flowers |
| 15 | Automotive | 30 | Tupperware |
| 31 | Building Material | | |
| 32 | Eggs | | |
| 33 | Butchery | | |
| 34 | Newspaper | | |
| 35 | Live Produce (Chickens) | | |
| | | 2 nd | Second hand |

Services offered (Value add)

| | |
|-----|---------------------------------------|
| S1 | Telephone |
| S2 | Airtime |
| S3 | Lotto |
| S4 | Money Market (computicket/buses etc.) |
| S5 | Fixing Shoes |
| S6 | Barbershop/Salon |
| S7 | Repair + Internet |
| S8 | Laundromat |
| S9 | Credit (Financial Services) |
| S10 | ATM |
| S11 | Funeral |
| S12 | Printing |
| S13 | Developers/Prop |
| S14 | Photo (ID/Tourist) + Printing |
| S15 | Tayloring |
| S16 | Betting (Tab) |
| S17 | Entertainment |
| S18 | Recycling |
| S19 | Herbalist |
| S20 | Key |
| S21 | Car wash |
| S22 | Automotive Services |
| S23 | Practice testing grounds (Automotive) |



Eg. B12/S1 – Street vendor selling food and provides the service of a portable telephone (see picture below, taken by author of the said retail activity).

Annexure B

Interview Schedule for retail entities

RETAIL RESPONSE INTERVIEW SCHEDULE

Retail Code: _____

Block/Area: _____

Person interviewed: _____

Race/Sex: _____

1. BUSINESS ENTITY AND OPERATION

1.1 Type of Retail Activity/Entity?

1.2 What products do you sell?

1.3 Are you the owner of the business? Y/N

1.4 How many employees does the business have (temp. & permanent)? _____

1.5 What is the main purpose for operating this business?

1.6 Where do you usually operate?

1.7 What are your normal operating hours? _____

1.8 Since when have you been operating here/been a retailer? _____

2. NEIGHBOURHOOD RELATION TO BUSINESS

2.1 Is your business part of a union, NGO, franchise, trade network or labour representatives?

2.2 Why a business in this area/neighbourhood?

2.3 How has the area changed throughout your time you have been operating and has it influenced your business?

2.4 What is your opinion of the other retail activities in the area in terms of influencing your business? (Similar type to business interviewed, Formal activities, Informal activities)

2.5 Do you pay money/trade to operate your business in this location?

2.6 Is your businesses registered to pay VAT and or TAX? Y/N

2.7 Do you live in the area? (if not in which area do you live) Y/N _____

And not where you live?

3. USERS AND SUPPLY CHAIN

3.1 Where do you buy your stock? (Supply chain)

3.2 To whom do you typically sell your stock? (type of people)

3.3 Where do you store your goods (Traders) _____

4. RISK, VULNERABILITY AND ADAPTIVE RESPONSES

4.1 In your opinion how secure/vulnerable is your business?

4.2 What do you consider a threat to your business?

4.3 In tough times what do you do to get by, respond to disturbance?

4.4 What insurance and or backup measures do you have?

4.5 When did these threats occur, or do you anticipate any future threat?

END

Annexure C

Consent Form

INFORMED CONSENT FORM

1. Title of research project: Exploring neighbourhood response diversity in the City of Tshwane
2. I hereby voluntarily grant my permission for participation in the project as explained to me by
.....
3. I am aware that the interview will be recorded by the researcher for quality purposes.
4. The nature, objective, possible safety and health implications have been explained to me and I understand them.
5. I understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purposes of publication.
6. Upon completion of this consent form you will be given a signed copy for your own records
7. If you have any further questions or require a copy of this consent form please contact me directly via email at albert.ferreira@up.ac.za or via cell phone 082 550 7483

Signed: _____ Date: _____

Witness: _____ Date: _____

Researcher: _____ Date: _____

Annexure D

Retail Classification Examples

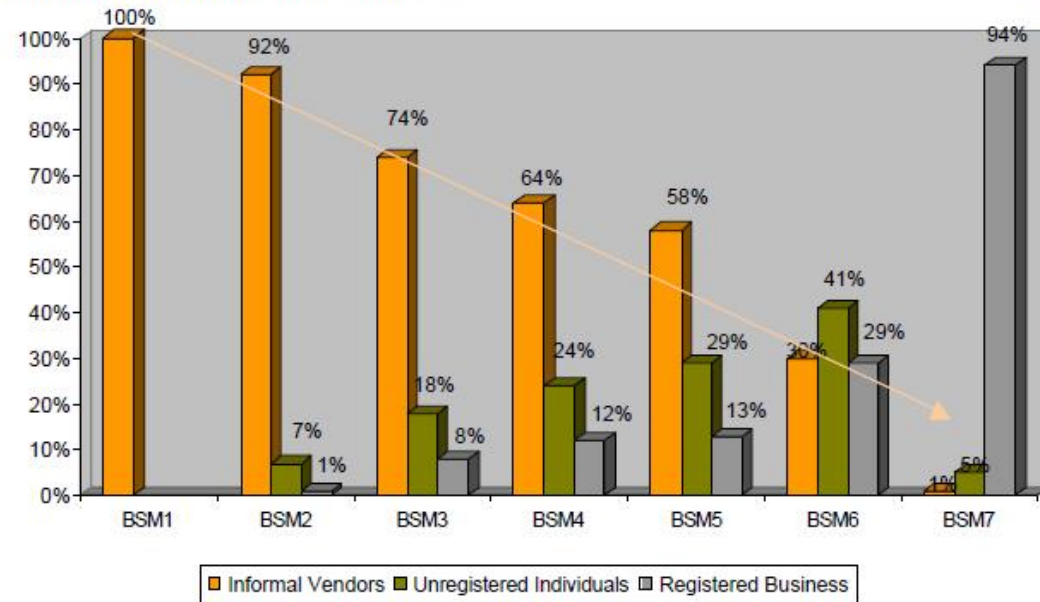
The BSM and illustration of the Landscape of Small Business

The BSM has identified 7 different segments plotting the growth of small business sophistication and sustainability.



| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---------|--------|---------|---------|---------|---------|--------|
| 12% | 9% | 26% | 23% | 10% | 10% | 9% |
| 123 522 | 97 370 | 278 291 | 247 075 | 110 512 | 100 171 | 96 876 |

BSM and the formality of the business



Business enterprises in the lower BSM tiers are primarily informal vendors. 100% vendors and hawkers are found in BSM1. The upper BSM tiers have representation of formally registered businesses. In BSM 7, 94% of businesses are registered.

Annexure D1: The illustration is used to show the differentiation of small business in Gauteng based using the Business Sophistication Measure on various parameters. BSM1 refers to the least sophisticated with BSM7 the highest sophistication level according to the measurement

SUMMARY TABLE: CLASSIFICATION AND HIERARCHY OF RETAIL FACILITIES IN SOUTH AFRICA

| Type of Centre | Size of centre (m ²)(GLA) | Trade area | Access Requirements | No. of households | Population | Socio-economic groups | Ave Radius (km) | Median Travel time (minutes) | Main tenants |
|--|---------------------------------------|--|--|--|------------------------------------|------------------------|-----------------|------------------------------|--|
| Small free standing and convenience centre | 500 – 5 000 5-25 stores | Serves part of a suburb | Suburban street | LSM 1-5; (<10 000) LSM 6-9; (<4 500) LSM 10-10+; (<2 000) | <40 000 <15 000 <7 000 | All LSM groups | 1 – 1.5 | <3 | • Café/Superette • few convenience stores |
| Neighbourhood centre | ±5 000-±12 000 25-50 stores | Centrally located for a group of suburbs | Major collector roads | LSM 1-5; (20 300-47 000) LSM 6-9; (9 000-20 100) LSM 10-10+; (3 700-8 600) | ±135 000 ±51 000 ±18 500 | All LSM 4-10 | 2 | 4-9 | • supermarket • convenience • some small specialised stores |
| Community centre | ±12 000-±25 000 50-100 stores | Strategically located to serve a suburban community | Major arterial road | LSM 1-5; (44 000-103 000) LSM 6-9; (20 000-46 000) LSM 10-10+; (8 000-19 000) | ±295 000 ±115 500 ±41 000 | All LSM 4-10 | 3 | 6-14 | • large supermarket • convenience • small national clothing • restaurants & takeaways • services |
| Small regional/ Large community centre | ±25 000-±50 000 75-150 stores | Specific sub region of city (can be large self contained community, i.e. Chatsworth) | Major suburban arterial road linking to a provincial highway | LSM 1-5; (90 000-209 000) LSM 6-9; (40 000-90 000) LSM 10-10+; (17 000-38 000) | ±600 000 ±280 000 ±83 000 | All LSM 4-10 | 5 | 10-16 | • large supermarket • 1 or 2 large clothing anchors • Strong national tenant comparison goods component • boutiques • restaurants • entertainment • services |
| Regional centre | ±50 000-±100 000 150-250 stores | Large region of city/rural towns | Major arterial road usually a Provincial main road linking to a National road | LSM 1-5; (180 000-420 000) LSM 6-9; (80 000-185 000) LSM 10-10+; (33 000-76 000) | ±1 200 000 ±464 000 ±165 000 | All LSM 4-10 | 8 | 14-20 | • large supermarket (even 2) or hyper • 3 or more large clothing • small clothing stores and boutiques • entertainment, restaurants • services • convenience |
| Super regional centre | >100 000 >250 stores | Large region in city and surrounding areas/Tourists | Major arterial road usually a Provincial main road, linking to a National road | LSM 6-9; (106 000-250 000) LSM 10-10+; (44 000-101 000) | ±623 000 ±217 500 | Above average LSM 5-10 | 10+ | 24-30 | • as at regional but more emphasis on entertainment and variety |

Annexure D2: Retail classification and hierarchy of retail facilities in South Africa (Prinsloo, 2010)

| Type of Centre | Size of centre (m ²) | Trade area | Access Requirements | No. of households | Population | Socio-economic groups | Ave Radius (km) | Median Travel time (min) | Main tenants |
|-----------------------------------|--|--|--|--|-------------------|----------------------------------|-----------------|--------------------------|--|
| SPECIALIST CLASSIFICATIONS | | | | | | | | | |
| Big Box Retailers | Vary from 2 000 to 15 000 | Depend on type of store or centre - mostly on regional level | Major urban arterial main road | LSM 6-9, (+25 000) LSM 10-10+, (+14 000) | 50 000-100 000 | Mainly above average LSM 7-10 | 5-10 | 10-30 | <ul style="list-style-type: none"> specialist traders |
| Entertainment /Casino | Vary from 2 000 to 30 000 | Depend on type of store or centre - mostly on regional level | Major urban arterial main road | 5 700 – 85 700 | 20 000 – 300 000 | Average and higher LSM 5-10 | 5-10 | 10-30 | <ul style="list-style-type: none"> specialist traders/entertainment and/or theme centre emphasis on food, restaurants & fast food outlets |
| Lifestyle Centre | 15 000 – 50 000 (can be smaller or larger) | Upscale catchment areas | Major urban arterial main road | LSM 6-9 (40 000-60 000) LSM 10-10+ (20 000-30 000) | ±200 000 ±105 000 | Mainly LSM 9-10 | 3-8 | 6 - 20 | <ul style="list-style-type: none"> upscale supermarket book stores dining entertainment speciality retail (house/home/garden) fresh produce stores |
| Value Centre | 10 000 – 50 000 | Next to regional centre or on main road/highway | Major urban arterial main road | LSM 6-9 (40 000-60 000) LSM 10-10+ (20 000-30 000) | ±200 000 ±105 000 | Middle to above average LSM 6-10 | 3-6 | 10-15 | <ul style="list-style-type: none"> emphasis on big box retailers specialist retailers home improvement small to large groceries |
| Hyper Centre | 15 000 – 35 000 | Strong correlation with a regional centre | Major urban arterial main road. | LSM 10-10+ (21 400 - 50 000) LSM 6-9 (60 000– 100 000) | 75 000 – 175 000 | Middle to above average LSM 5-10 | 6-8 | 10-15 | <ul style="list-style-type: none"> one hyper store (70% of area) convenience line stores services |
| Motor Showrooms | 500 -5 000 | | Along major arterial routes | | | Higher LSM suburbs | | | |
| Filling Stations | 30 - 260 | Local & through traffic | Main arterial routes, highways and feeder roads | Depend on the size of the filling station | | All LSM 4-10 | | | <ul style="list-style-type: none"> convenience store ATM fast food car wash |
| Airport Retail | Depending on size of airport | Size of airport will determine size of retail | Accessibility for arrivals & departures & visitors | | | Mainly higher LSM | | | <ul style="list-style-type: none"> mainly food curio's & souvenirs clothing exchange services |

| Type of Centre | Size of centre (m ²) | Trade area | Access Requirements | No. of households | Population | Socio-economic groups | Ave Radius (km) | Median Travel time (min) | Main tenants |
|--|---|---|--|--|---|-----------------------|--------------------------------------|------------------------------|--|
| UNPLANNED/INCREMENTAL CLASSIFICATIONS | | | | | | | | | |
| CBD/ Town Centre | Vary from 10 000 to 300 000 Number of stores depend on size of town | Normally very wide -outlying township areas | Major roads running through the CBD/ Town Centre – focus on taxi/train/bus transport | Normally very high, starting at ±10 000 households | 30 000+ | Dominant LSM 4-6 | Not fixed- Up to 50 km | Mainly by taxi | Wide variety of tenants including: <ul style="list-style-type: none"> national tenants supermarkets homeware stores furniture stores cell phone shops banking facilities |
| Taxi Rank Retail /Commuter Centre | 1 000 to 15 000 Depending on station | Same as above | Highly accessible area adjacent to taxi ranks/station | Same as above | 20 000 – 300 000 People per day | Mainly LSM 1-6 | Not fixed- Up to 50 km | 20 minutes plus | <ul style="list-style-type: none"> national tenants supermarkets homeware stores fast food outlets cell phone shops ATM facilities |
| Flea Markets/ Informal Trade | Vary from a few stands to hundreds of stands | Focusing on passing pedestrian volumes | High volumes of pedestrian traffic is important | Not applicable | Pedestrian volumes need to be very high | Mainly LSM 1-6 | Part of larger town/rural trade area | Passing by | <ul style="list-style-type: none"> food clothing and shoes fruit and vegetables electronic equipment cell phones music and DVDs |
| Spaza Shops | 10 – 50 | Provide the surrounding residents – walking distance 400-800m | | 200 - 400+ | 2 000 + | Mainly LSM 1-6 | Up to 500m | Up to 5 minutes walking time | <ul style="list-style-type: none"> convenience grocery goods cigarettes |
| Rural Retail Development | 5 000 – 30 000 | Whole community up to 50km | Close to main community and taxi facility | 20 000 - 210 000 | 80 000 – 560 000 | Mainly LSM 1-5 | Very wide up to 80 km | Up to 45 minutes | <ul style="list-style-type: none"> depend on the size – need to focus on the needs of the surrounding community |

In the context of an increasingly unpredictable and interconnected world with the forces of change a constant for city development and management, resilience promises the ability to be able to adapt to this change.

The application of resilience theory and concepts are however limited. The purpose of this research project is to explore how an ecological **resilience** concept, that of functional response diversity will manifest in the urban socio-ecological system. The case study area in the City of Tshwane is used to investigate the role of diversity in the retail sector. Functional diversity refers to the structural diversity that is created by similar entities that poses the same functional traits (i.e. perform the same function). Response **diversity** refers to the multitude of responses a specific entity towards perturbations. Characteristics of each unique entity and groups of entities determine their relative exposure to risk, vulnerability and capacity to respond to change or perturbations. The primary findings of the study suggests that diversity is key in determining and creating resilience **in the retail sector**.

It should be noted that diversity is multi-layered and contextual, and it is the layers of diversity which originates from both the structural diversity and response diversity of the functional group that create resilience.