



**UNIVERSITY OF
KWAZULU-NATAL**

**INYUVESI
YAKWAZULU-NATALI**

**ENVIRONMENTAL MICROCOSM: THE INFLUENCE OF RECYCLING
ON COMMUNITY ARCHITECTURE.** A learning centre for waste
management in the Bisasar Landfill, Durban.

SIPHESIHLE JONAS SPHEPHELO MDLULI

213508843

A Dissertation Submitted in partial fulfillment of the
Requirements for the degree of Master of Architecture to
The School of Built Environment and Development Studies

University of KwaZulu-Natal

Durban, South Africa

September, 2023

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DECLARATION

I hereby declare that this dissertation is of my own understanding and unaided work excluding where it has been acknowledged through proper means of referenced material undertaken in the study. The proposal will be submitted through the School of Architecture, Housing and Planning, University of KwaZulu-Natal, Howard College campus, in partial completion of the requirements towards the degree of Masters of Architecture. The proposal of the dissertation has not been submitted before for any degree or examination at any of the other universities that are acknowledged.

Signed 01 September 2023

A solid black rectangular box used to redact the signature of the author.

Siphesihle Jonas Sphephelo Mdluli

*“The problem is not architecture. The problem is the reorganization of things which
already exist.”*

Yona Friedman

ACKNOWLEDGEMENTS

To my supervisor, Mr. Juan Ignacio Solis- Arias, thank you for the guidance as well as the tremendous support throughout the process of compiling this document.

I would like to express my sincere gratitude for the support offered to me by the Department of Public Works. They have moved heaven and earth in ensuring the completion of my studies under the YP's Professional program (young professional) within the built environment. I will be forever grateful for the opportunity granted to me.

Thank you to Paton Taylor Architects for everything you have done for me. The time I have spent during my work experience under your guidance gave me the confidence, will and desire to express myself within the field of the built environment.

To my family, thank you for the immeasurable support and encouragement during the process of this research. The amount of time and effort invested in me throughout the years without a doubt is immeasurable. I will be forever grateful for all the sacrifices my parents have made for me especially the Nkosi family household where it all began. You have played an integral part in the success of my life and upbringing. To my mom, Lindiwe Jabulisiwe Mazibuko, I adore you for all the times you have put up with me as your only child and the trials and tribulations that you have undertaken during your stay on earth is inspirational. To my dad, Thuli Mdluli, I love you with all my heart. Your determination and work ethic have motivated me to become a better individual. To my best friend, Hlalo Skhosana, I will forever cherish the memories we shared together 'skhokho sami'. Last but

not least. To my late brother, Sebeni Mdluli who is born on the 8th of September 1980-2018. I appreciate the love and support you have shown me throughout my journey of life. To my unborn son, Siphesikhona, ‘ngiyakuthanda ngehliziyo yami yonke’. Your father made it.

Finally, I would like to thank our almighty God for granting me the opportunity to further pursue my studies in the field of Architecture throughout this journey embarked. We are all God’s children. This accomplishment would not have been a success without the gift granted by our Creator. God helps those who help themselves.

ABSTRACT

In the 20th century, the relationship between architecture, industry, waste management, urban space and urbanization is one troubled with conflicts which stem across African cities specifically focusing in on marginalized communities through its impact on diverse groups and sectors in society within urban areas of South African contexts. There is a linear separation of waste from the urban environment we inhabit, a divide whereby one needs to repair the physical and mental separation of waste and public activity through architecture. Many cities in the global Southern hemisphere suffer from vast inadequacies and deficiencies within the municipal waste management sector specifically focusing on the urban context of Springfield, Durban. In the city of Durban in South Africa, waste management is fragmented and insufficient due to large amounts of household waste remaining uncollected which is then transported alternatively to municipal landfill areas. Furthermore, these municipal landfill zones house existing eco-systems which utilize waste management as a survival mechanism for the urban poor. On an urban scale, municipal waste management within existing landfill sites is an ever-growing challenge in vast rapid urbanizing areas resulting from an urban displaced city. Moreover, new waste initiatives should build upon existing waste management practices already implemented within urban areas that house informal settlements by waste pickers, waste scavengers, waste entrepreneurs as well as community- based organizations such as Abahlali Basemjondolo also referred to as shack dwellers.

The dissertation considers the lives and formalities of a resilient community of informal waste reclaimers living within an active landfill site in Springfield known to man as the

Bisasar Landfill. Moreover, there is a need to focus on displaced and marginalised communities who face shared challenges which give rise to environmental spatial justice within the built environment. The research explores how architecture and waste management can be combined to facilitate community engagement through waste and to contextualize the highly contested spatial hierarchy of these existing landfills in a response to empower a community through economic opportunity in a country where a large percentage of people are unemployed within the urban informal sector.

This research findings will be the basis for the design of a learning centre for waste management in Springfield, Durban that adapts to the needs of informal waste reclaimers within the Bisasar landfill. Moreover, the intention of the dissertation is to acknowledge the importance of the informal waste reclaiming community. These waste reclaimers play a fundamental role within the waste management sector. The proposal exploits landscape architecture and built form as a fundamental component that can establish a foundation to rehabilitate the lifecycle of the Bisasar landfill. Nonetheless, an area within the built form of the design will build a foundation where recycled materials extracted from the landfill can be processed or transformed as building waste material for economic opportunity. In essence, the design component will respond to the needs of an ever-growing community of informal waste reclaimers in the form of a landfill station.

DEDICATION

This dissertation is dedicated to all the socio-economic classes who stem from marginalized communities due to environmental injustices within the current system of waste management practices housed in DSW (Durban Solid Waste) municipal landfill sites within urban contexts specifically, the hard-working local waste picker and collector recyclers both on an informal and formal platform that reside in resilient communities of Springfield within the urban areas of Durban. Thank you to the municipal DSW (Durban Solid Waste) for implementing existing strategic planning for waste management in the waste industry and for allowing researches to find gaps or solutions in defining a new architectural approach to solving social-economic and environmental issues of waste management in our society for inhabitants that reside from marginalised environments of South Africa. Finally, to Mfundo Nhlengethwa of DSW (Durban Solid Waste) whom is the site inspector of the Bisasar landfill and engineer by profession for the eThekweni Municipality, your knowledge, experience, and in-depth insight made this research study of the Bisasar Landfill possible.

TABLE OF CONTENTS

DECLARATION	i
ACKNOWLEDGEMENTS	ii
DEDICATION	iv
ABSTRACT	v
TABLE OF CONTENTS	vi
LIST OF TABLES	xi
LIST OF ILLUSTRATIONS	xi

PART ONE

BACKGROUND RESEARCH ON ISSUES

No. of Pages

CHAPTER 1 INTRODUCTION

1.0 INDEPENDENT VARIABLE AND DEPENDENT VARIABLE

1.0.1 Independent Variable.....2

1.0.2 Dependent Variable.....2

1.1 INTRODUCTION

1.1.1 Background.....2

1.1.2 Motivation/Justification of the study.....4

1.2 DEFINITION OF THE PROBLEM, AIMS AND OBJECTIVES

1.2.1 Definition of the Problem7

1.2.2 Aims9

1.2.3 Objectives9

1.3 SETTING OUT THE SCOPE

1.3.1 Delimitation of Research Problem.....10

1.3.2	Definition of Terms	10
1.3.3	Stating the Assumptions	13
1.3.4	Key Questions	
1.3.5	Sub Questions	14
1.3.6	Hypothesis	14
1.4	CONCEPTS AND THEORY	
1.4.1	Introduction	15
1.4.2	Concepts.....	15
1.4.2.1	Environmental Spatial Justice in Urban Contexts.....	15
1.4.2.2	Contextualising Urban Resilience and African Cities.....	16
1.4.3	Theory	18
1.4.3.1	Theory of Empowerment and community Learning.....	18
1.5	Research Methods and Case Studies	13
1.5.1	Introduction	20
1.5.2	Research Philosophy and Strategy	21
1.5.3	Secondary Data Collection	21
1.5.4	Primary data collection	26
1.5.5	Research Materials	26
1.5.6	Conclusion	29
 CHAPTER 2 LITERATURE REVIEW		
2.0	Chapter 2 Introduction	31
2.1	Environmental spatial justice in Urban Contexts	
2.1.1	Introduction.....	31

2.1.2	The rise of Environmental Justice in Waste management, Urban Form and Fabric.....	36
2.1.3	The History of Contextualizing Environmental Injustice.....	39
2.1.4	Hybridity in environmental spatial justice between architecture and nature.....	42
2.1.5	Conclusion.....	46
2.2	Contextualising Urban Resilience and African Cities	
2.2.1	Introduction.....	47
2.2.2	The history of Urban Resilience in African Cities.....	52
2.2.3	Identifying Characteristics of Resilient Urban Communities	56
2.2.4	The role of Urban Resilience in Adaptive-Social Ecological Systems and Sustainability.....	66
2.2.5	Integrating resilience, Adaptability and Transformation.....	71
2.2.6	Conclusion.....	77
2.3	Theory of Empowerment and Community Learning	
2.3.1	Introduction.....	78
2.3.2	Threshold concepts in transformational learning.....	81
2.3.3	Alternative knowledge systems.....	84
2.3.4	Community learning process in waste and architecture.....	86
2.3.5	Conclusion.....	89

CHAPTER 3 KEY PRECEDENT STUDIES

3.0	Chapter 3 Introduction.....	91
------------	------------------------------------	-----------

3.1 Architecture of Urban Resilience, hybridisation and urban informality: Torre David- Informal vertical Communities.

3.1.1	Introduction.....	92
3.1.2	Justification of Case Study.....	94
3.1.3	Location.....	95
3.1.4	Historical and Social Context of Case Study.....	97
3.1.5	Architectural elements of the design.....	99
3.1.6	Conclusion.....	106

3.2 Architecture of re-use and adaptation: North Transfer Station.

3.2.1	Introduction.....	108
3.2.2	Justification of Case Study.....	111
3.2.3	Location.....	111
3.2.4	Historical and Social Context of Case Study.....	113
3.2.5	Architectural elements of the design.....	115
3.2.6	Conclusion.....	120

CHAPTER 4 KEY CASE STUDIES

4.0	Chapter 4 Introduction.....	123
4.1	Architecture of the environment and community empowerment: Waste pick-up and disposal Facility.	
4.1.1	Introduction	125
4.1.2	Justification of Case Study	127
4.1.3	Location	127
4.1.4	Historical and Social Context of Case Study.....	129

4.1.5	Architectural elements of the design	130
4.1.6	Conclusion	136
4.2	Architecture of upgrading informal Settlements (communities): Lotus Park Neighbourhood Centre & Waste Management Station.	
4.2.1	Introduction.....	138
4.2.2	Justification of Case Study	139
4.2.3	Location	140
4.2.4	Historical and Social Context of Case Study	142
4.2.5	Architectural elements of the design	145
4.2.6	Conclusion	156
4.3	Architecture of the environment and sewer waste management: Durban harbour tunnel north and south entrance structures & Mahatma Gandhi road sewer pump station.	
4.3.1	Introduction.....	157
4.3.2	Justification of Case Study	159
4.3.3	Location	159
4.3.4	Historical and Social Context of Case Study	162
4.3.5	Architectural elements of the design	164
4.3.6	Conclusion	168
4.4	Architecture of the environment and waste management: Durban Bisasar Landfill-methane gas-to-electricity plant Bisasar Road.	
4.4.1	Introduction.....	170
4.4.2	Justification of Case Study.....	172
4.4.3	Location.....	173

4.4.4	Historical and Social Context of Case Study.....	175
4.4.5	Architectural elements of the design	175
4.4.6	Conclusion	179

CHAPTER 5 ANALYSIS AND DISCUSSION

5.1	Introduction	182
5.2	Interviewee's Demographics.....	184
5.3	Interpretation of Data.....	191
5.4	Conclusion.....	192

CHAPTER 6 CONCLUSION AND RECOMMENDATIONS

6.1	Introduction	194
6.2	Summary of Study.....	195
6.3	Suggested Design Findings and Guidelines.....	198
6.4	Conclusion	212

BIBLIOGRAPHY.....

7.1	List of References	212
7.2	Appendices.....	233

CHAPTER 1

INTRODUCTION

INDEPENDENT VARIABLE & DEPENDENT VARIABLE

1.0.1 Independent Variable: Landfill Sites- Urban space, Architecture and Learning

1.0.2 Dependent Variable: Bisasar waste management recycling facility in
Springfield, Durban.

INTRODUCTION

1.1.1 Background of the study

In South Africa and in all Africa, solid waste management is a growing challenge to many rapidly urbanizing areas. The growth rate of urban solid waste in urban areas is faster than the growth of urbanization in rapidly vast rising cities. Moreover, the current system of waste processing in South Africa currently exists as a linear process within the current system of Municipal Solid Waste Management. There is a need to recognize the difficulties that are experienced in managing waste and to critically understand the reasons, especially on an informal urban scale. In most African countries, uncontrolled urbanization resulting from the over flow of garbage waste displaced towards the periphery of urban environments has led to an increased exposure to the current environmental vulnerabilities of the urban poor in urban cities. The relationship between industry, waste environments (Landfills) and urban ecosystems play an integral part in the survival of sub-systems within the waste management sector. Specifically, South Africa suffers from a series of solid waste management problems within the built environment envelope. Furthermore, 90% of waste that is generated within the country is still disposed on landfill areas or illegal dumping sites within informal and urban contexts (Statistics South Africa, 2012). Street vending and waste picking are the dominant working force that is undertaken by the urban

poor, and besides the physical dangers of these activities that expose them to the high levels of air pollutants that coexist in the built environment (Statistics South Africa, 2012).

The increase in the volume of waste that is generated in South Africa on an urban scale is due to a number of critical factors that include the increasing population rate of inhabitants, rapid urbanization in urban cities, industrialization and economic growth more specifically urban areas within the community of Springfield, Durban (Statistics South Africa, 2012). In addition to this, most urban households (informal) resort to illegal dumping, burning and burying of solid waste on municipal landfill sites as a means of protest due to the lack of poor service delivery. This is directly responsible by the relevant solid waste disposal authorities that collect refuse from current households and public container skips on a regular basis using trucks as a form of transport aid as a collection resource for waste disposal. This system is seen to be ineffective due to the mounds of decomposing refuse that have been found in urban and informal urban areas. On an urban scale, this results in the destabilization of municipal landfill areas which cause damage to the environments eco-system. The current spatial planning in South Africa in terms of the built form has been subsequently influenced by the hierarchy of the Apartheid regime specifically focusing on areas which are demarcated such as municipal landfill sites (Statistics South Africa, 2012).

The research proposal seeks to discuss the various concepts that relate to solid waste management and how these independently impact urban health making reference to African countries in peri-urban cities focusing on South Africa. The concepts that will be mentioned are currently existing but are applied to a context where the urban setting succumb challenges of solid waste management, environmental spatial injustice, unequal impacts of environmental pollution on diverse groups in society due to inadequate waste

management practices leading to the rise of environmental justice within diverse communities. Furthermore, a discussion and interrogation of the interlinkages and pathways between waste management, architecture and urban space within the built environment will be developed to understand how they can coexist with one another in the urban fabric of marginalized areas, creating spaces which foster a sense of belonging through community engagement and waste as a learning process in peri-urban areas of South Africa focusing on the community of Bisasar, Springfield in Durban. Furthermore, the highly contested spatial hierarchy within the context of these landfills as an undesirable urban settlement in the built environment can be contextualized in a response to empower the community through skills development, social equality, work opportunity and most importantly economic sustainability of the urban poor who reside in such densified urban fabrics within the built form. Essentially the focus of this discussion would be to re-evaluate the spatial planning of landfill sites as an opportunity for public engagement and the integration of built form into the urban space that currently limits the marginalized communities. There needs to be a shift in uncontrolled urbanization where rapid urbanization processes that have been implemented may continue to shape the urban landscape throughout the built form in a responsive and cohesive architectural approach to urban resilience.

1.1.2 Motivation/ Justification of the study

On an urban scale, waste pickers constitute the bottom layer of waste recycling and urban informal sector within the waste economy. Despite their low economic and social status, waste pickers are seen as fundamental role players within the waste management organization. Most of these waste pickers attain incomes which are below the poverty line

set by the eThekweni municipality, whereas the majority of these collectors earn a tad higher than the poverty-line-income bracket (Statistics South Africa, 2012). The poverty circumstances of these waste pickers are not temporary, however prolonged as there is no connection between collectors and high-level waste traders within existing community mechanisms which work effectively in reducing risk and transactional costs faced by government within the waste management sector (Statistics South Africa, 2012). These pickers collect the waste from public spaces such as garbage dumps and existing street edges. On the other hand, the collectors of this manifestation purchase the waste from the waste producers, such as households, shops and to higher-level traders. Moreover, these waste pickers and collectors are contributing more value than their own income to existing waste producer's as well as the saving of the governments financial expenditure for disposing waste. Thus, the need of waste infrastructure management in the built environment needs to be executed in a responsive approach within the city and in peri-urban areas of South Africa within the community of Springfield, Durban.

A significant change within the municipal solid waste generation has now lead to the need for innovation to further resolve the difficulties and challenges that face solid waste within the municipality specifically focusing on existing landfills within urban contexts of South Africa. These problems arise from the absence of adequate policies, facilitator legislation, and environmentally stimulated public, which have a relatively massive impact on the environment and health (Statistics South Africa, 2012). Although South Africa has adopted a natural environmental strategy; waste disposal is still uncontrolled and large quantities of the waste remains uncollected by eThekweni municipal DSW (Durban solid waste) authorities. Thinking about architectural interventions that can ensure proper management

of solid waste, enforce regulations, and implement proper environmental awareness programs is the main purpose of the research. Solid waste generation and urbanization within the built environment are closely related and therefore it is of great importance in this research to reflect on the phenomenon urban resilience to further enhance an architectural solution to the built environment.

The research proposal seeks to discuss the various concepts that relate to solid waste management and how these independently impact urban health making reference to African countries in urban cities focusing on South Africa. The concepts that will be mentioned are currently existing but are applied to a context where the urban setting is succumbed to challenges of solid waste management, environmental spatial injustice, unequal impacts of environmental pollution on diverse groups in society due to inadequate waste management practices leading to the rise of environmental justice within diverse communities. Furthermore, a discussion and interrogation of the interlinkages and pathways between waste management, architecture and urban space within the built environment will be developed to understand how they can coexist with one another in the urban fabric of marginalized areas, creating spaces which foster a sense of belonging through community engagement and waste as a learning process in urban areas of South Africa focusing on the community of Bisasar, Springfield in Durban. Furthermore, the highly contested spatial hierarchy within the context of these landfills as an undesirable urban settlement in the built environment can be contextualized in a response to empower the community through skills development, social equality, work opportunity and most importantly economic sustainability of the urban poor who reside in such densified urban fabrics within the built form. Essentially the focus of this discussion would be to re-

evaluate the spatial planning of landfill sites as an opportunity for public engagement and the integration of built form into the urban space that currently limits the marginalized communities.

1.2 DEFINITION OF THE PROBLEM, AIM AND OBJECTIVES

1.2.1 Definition of the problem

In South Africa and across the continent, there is a lack of proper waste management in municipal landfill sites in disadvantaged communities. This issue has led to an increase in environmental justice in the urban fabric of growing cities, which results in unjust environmental pollution affecting various ethnic and racial groups (Statistics South Africa, 2012). The issue that this study focuses on is to explore the environmental justice issue in the context of rapid urbanization and waste architecture in African cities. Due to the lack of economic opportunities and social services in most of the continent, the growth of urban populations has not been accompanied by the development of a resilient urban environment. This has led to the increasing number of people who are unable to maintain a clean environment within the built form. In the face of new urban challenges waste management and health issues are creating a negative impact on the environment and is creating an urban sprawl that is deteriorating. Furthermore, the growing urban population means more solid waste, and higher impact on the environment and health. The increasing volume of solid waste has resulted in the need for more efficient waste management services. This is why the increasing demand for these

services is contributing to the development of solid waste management policies and procedures in African countries (Statistics South Africa, 2012).

Human activities and the producing of their products are seen as the main causes of the current global environmental and climatic changes that have direct effects on health and the wellbeing of its citizens. At a local municipal level, many human activities generate waste which are the major causes of environmental and health challenges. In most developing countries and South Africa, solid waste is not sorted at the sources, collection, transportation and disposal points. An increased public support-social services, production services and infrastructure can be justified not only for reducing poverty but also contributing positively to society if this issue of solid waste management is resolved. Collectors and waste pickers constitute a bottom layer of the urban informal sector and this organisation of the urban informal sector in developing countries needs to be addressed. Despite their low economic and social status, pickers and collectors are the fundamental role players that make important contributions to society. Urban informality in Africa cities is growing rapidly. The built form in the informal urban context is portrayed as being obsolete by its inhabitants due to it being a rigid and static in nature through an ever-changing context. People in the informal context/settlement are now taking control/ ownership in the adapting of the physical nature of the existing built form that now defines formal urban landscapes. The idea manifests within the immediate context, existing buildings surrounding the proposed site. These spaces are now defined by streets in conjunction with the urban setting (built form).

On an urban scale if this issue is not yet resolved through architectural response and intervention the disposal on municipal landfills and illegal dumping sites within the urban and peri-urban contexts will be detrimental to its inhabitants as well as the environment we inhabit.

1.2.2 Aims

- To discover the underlying social principles that define urban resilience. This involves looking into how people within the disposal waste sector that reside within the informal urban context (informal waste picker collectors) shape the existing physical and spatial environment to better uplift their needs.

1.2.3 Objectives

The main objective which guides this research is the conceptualisation of urban resilience in African cities and how its influence on waste architecture can contribute to a sustainable urban fabric (environment).

1. To explore how the concept of urban resilience can influence spatial integration of waste management in landfill sites for the community within urban areas of South Africa.
2. To explore ways in which architecture can be used as a public interface for promoting integrated community learning processes in waste management within peri-urban areas.

3. To define an architecture of resilience for waste management that can empower the community of the peri-urban area of Springfield in Durban.

1.3 SETTING OUT THE SCOPE

1.3.1 Delimitation of Research Problem

This study aims to address the difficulties that are experienced in managing waste and to critically understand the disconnect between uncontrolled urbanization and the growing challenge of waste management in African cities which has led to the widespread of urban poverty and the resistance of informal settlements within urban areas. Although the level of socio-economic development of waste management within informal settlements will be investigated, it will not be an in-depth focus, rather the focus would be on improving the waste management on municipal landfill sites for the urban poor who inhabit these spaces and the environment. Furthermore, to examine the disconnection that occurs from the poor service delivery of government to help alleviate this problem of neglecting certain areas in the management of this waste disposal in Springfield. As a result, this disconnection leads to illegal dumping zones within the residential areas of Springfield due to poor service delivery.

1.3.2 Definition of Terms

The following are some of the key terms that will be implemented throughout the conducted research. Furthermore, by defining these key words and terms it will give the

reader a better understanding of the terminology and this will prevent any misunderstanding within the scope of works that is provided.

Key Terms:

Urbanization: Rapid growth in the increase in a population in cities, towns and rural areas within the built form.

Urban Informality: Social and economic processes that shape and build the urban fabric within the informal urban context to create a city that caters for people and its people take ownership of this built form and spaces within its context.

Landfills: Its referred to as an illegal or legal garbage dumping site where waste is generally stored on the ground.

Community learning: To promote learning, social development, develop the capacity of individuals, communities and groups of all ages in improving their quality of life using a range of formal or informal methods of learning.

Waste: A material or substance that is eliminated or discarded which is no longer useful at any given point or time.

Sustainability: The ability to maintain a depletion of a natural resource in order to maintain an ecological balance.

Recycling: The physical reprocessing of old materials which can be later transformed into new products.

Waste Management: The managing, collecting, treating, and disposing of waste material which is then discarded or recycled.

Urban areas: It refers to a region surrounding a city, where the built – up area, is a human settlement with a high population density of human structures within the built environment such as commercial buildings, roads, houses, bridges, and railways.

Informal Settlements: An area where it is seen as a marginalized environment on an informal scale.

Formal: Represents a city that isn't ordered- this is in terms of its cultural, economic, political, social organization and how on an urban scale a city or spaces are unplanned.

City Resilience: It refers to the ability of cities to function successfully. It aims to help the poor and vulnerable individuals thrive in these places.

Urban Resilience: A resilient city is capable of responding to and preparing for a major threat with minimal damage to its public safety and health, economy, and security.

Environmental Microcosm: Ecosystems that predict the behavior of natural ecosystem which includes a community, place or a situation which encapsulates the characteristics of something much larger.

1.3.3 Stating the assumptions

- The current waste disposal management within the urban informal cities does not reflect the transforming and kinetic characteristics of the built environment. This on an urban scale needs to be reevaluated and the built form design needs to adapt into the environment.
- Underlying principles in the built form define the gap between the formal and informal urban context. This can be addressed or defined using versatile and flexible solutions that suite both the contexts.
- Urban resilience can be explored as a catalyst towards a responsive architectural typology.
- The rapid sprawl of urbanization in cities can influence an architectural typology of the reduction of waste on municipal landfill sites.

1.3.4 Key Questions

How can waste management, architecture and urban space define or create a new architectural approach of urban resilience for the community of the district of Springfield in Durban?

1.3.5 Sub Questions

1. How can the concept of urban resilience influence spatial integration of waste management in municipal landfill sites in the community within urban areas?
2. How can architecture act as a public interface through integrated learning processes (waste management) within urban areas?
3. How can architecture of resilience for waste management empower the community of the urban area of Springfield in Durban?

1.3.6 Hypothesis

- The contemporary city of Durban results from the conflicts between uncontrolled urbanization and the growing challenge of waste management in African cities which has led to the widespread of urban poverty and the resistance of informal settlements in urban areas through urban resilience which has led to the need for environmental justice within the communities of Springfield, Durban.

1.4 CONCEPTS AND THEORY

1.4.1 Introduction

The concepts and theories that underpin this research proposal are divided into 3 categories each. Moreover, these concepts and theory for the research proposal create debate for an

interesting approach to the research problem and the drivers that will be in place for the research proposal that has been chosen. These concepts and theory will be explored and applied to comprehend the role in which urban resilience contribute to architectural design. The following are some of the concepts and theories that will be driving the topic at hand that has been chosen for the research and they are as follows: *(Theory of Empowerment and Community learning, Urban Resilience and Environmental Justice)*.

1.4.2 Concepts

1.4.2.1 Environmental Spatial Justice in Urban Contexts

Author Pellow D. (2014) argues that the phenomenon of environmental spatial justice emerged within the urban fabric as one of which unequal impacts of environmental pollution on different social classes, racial and ethnic groups is identified within the built form and urban space of cities. The impact of environmental justice as a phenomenon is emphasized through indigenous persons, ethnic minorities, inhabitants of colour, and low-income communities that are confronted with the high burden of environmental exposure from elements such as air, water, and soil pollution from industrialization, militarization as well as consumer produces Pellow D. (2014). It is through environmental inequality, or environmental injustice that the construct of environmental racism emerges on an urban scale through the phenomenon of environmental spatial justice (Pellow D. 2014). The concept provides an understanding between the relationship of inhabitants and the environment where the focus is shifted towards the relationship between marginalized groups and environmental issues that face the built environment specifically highlighting emphasis on existing locations of hazardous landfill waste sites in the communities of

African cities where countries such as South Africa plays host to a disproportional high number of these landfill waste sites. The concept of environmental spatial justice will be used in the research as the secondary driver for the research and architectural response through empowering an existing community in the district of Springfield in Durban, specifically focusing on the problem of environmental spatial justice which houses existing locations of hazardous landfill waste sites within communities of African cities where countries such as South Africa plays host to a disproportional high number of these landfill waste sites. Moreover, waste facilities are often at times disproportionately located in areas which house more deprived residents as a result of the disproportionate exposure of communities of colour and the poor to pollution due to waste on an urban scale.

1.4.2.2 Contextualising Urban Resilience and African Cities

‘Resilience is based on the shifting relationships between scales, and between autonomy on the one hand and connectivity on the other.’ (Allan, P. & Bryant, M. 2011). The phenomenon of urban resilience is described as the ability of communities, cities, institutions, businesses, and systems within a city to survive, adapt, and grow. According to Wilbanks (2007) urban resilience is defined as “The capability to prepare for, respond to, and recover from a significant multi-hazardous threat with minimum damage to the public safety and health, the economy, and security of its inhabitants”. The phenomenon of urban resilience is predominantly related to the social, spatial and environmental component of this framework. Architecture within the urban resilience framework further argues that as cities continue to grow and deal with uncertainties and challenges like environmental, climate change, urban resilience has become an ever so increasingly

favoured concept which is expanded upon (Carmin, J., Nadkarni, N., & Rhie, C., 2012); (leichenko, 2011). The concept encompasses multiple facets of placemaking as a paradigm, creating cities that embrace technology through the need to generate robust cities. Moreover, it is through urban resilience within the built environment of cities to survive and adapt within their regions. Resilient architecture within the built environment is flexible, able to change and adapt in the response of changing circumstances of inhabitant's in urban cities. The concept of urban resilience will be used in the research as the primary driver for the research and architectural response through empowering an existing community in the district of Springfield in Durban, specifically focusing on the problem of environmental spatial justice which responds to a resilient community whom are affected by these contested spatial systems currently existing within the built form. To further understand the conceptual framework of urban resilience within the built envelop of cities, the paradigm will be examined to understand the potential and drawbacks of efforts to make urban areas in African cities more robust and adaptable to further identify spaces for transformation within the built form.

1.4.2.3 Theory of Empowerment and Community Learning

Author Marc Zimmermann (2000) exemplifies the theory of empowerment as an underlying approach which brings social change within densified communities and provides a lens through which principles and a framework for organizing of knowledge insight. Furthermore, he briefly describes the theory as one that examines the construct of empowerment through individual, organizational and community.

This theory suggests ways to measure the construct that takes place in different contexts and circumstances. Rappaport (1984) defines empowerment as a mechanism process which inhabitants, organizations, and communities gain a sense of mastery over their lives. Moreover, the phenomenon of empowerment can refer to a collective action that may improve the quality of life within the community and the connection among the public and their organizations (social change). The theory identifies social problems that exist in many cities and this is due to unequal distribution of access to resources Rappaport (1984). Moreover, the theory of empowerment expands on the notion of knowledge insight within densified communities as an educational learning process seen as fundamental to community development within the urban fabric. Author Stephen Brookfield (1983) defines the conceptualization of the phenomenon of learning in the community and community learning as the process of learning in natural settings within the urban fabric which is set against the formalities of education unfolding in a school environment (instructional setting). Moreover, the capacity of individuals and groups of all ages through participation in the development of their own learning and understanding plays an integral part of improving their quality of life. Author Brookfield S.D (1983) argues, it is through the process of community learning (inhabitants engaging with one another to bring about change which enhances local life) where inhabitants can make a tangible contribution within their own communities on an urban scale as seen in figure 1.4.2.3.1.

Other examples of community-empowerment processes and outcomes can be found for toxic-waste issues Levine (1982). The concept theory of empowerment is both a value-added phenomenon for making working within the community and is a theoretical framework for which one can understand the processes of effects to exert influence over

decision making processes that effects one's life and the quality of community life (Perkins and Zimmerman, 1995; Rappaport, 1981; Zimmerman and Warschausky, 1998). A difference between the values that underlie the empowerment approach to social change and empowerment theory is necessary within the built environment. The theory is subjected to goals, aims and strategies for implementing change and bringing social and economic change to the people due to the failure of service delivery for the people that reside in peri-urban areas. The theory of empowerment phenomenon provides a lens through which principles and a framework for organizing of knowledge insight. This theory suggests ways to measure the construct that takes place in different contexts and situations. It is through participation with others that goals may be achieved, efforts to gain access to resources and a simple understanding of the social-political environment are basic components of the construct of empowerment. On a community level analysis this phenomenon can refer to a collective action that may improve the quality of life within the community and the connection among the community and their organizations. Empowerment suggests a distinct approach in the developing of interventions and creating social change. This includes the perspectives and views that identify social problems that exist in many cities and this is due to unequal distribution of access to resources Rappaport (1984). An empowerment approach is needed within the built environment where it can house intervention design, implementation, and on a built form perspective evaluate the professional's role with the target population.



Figure 1.4.2.3.1 illustrating diagram sketch for the concept theory of empowerment. (Source: Elia Fulmen, 2010).

1.5 RESEARCH METHODS AND CASE STUDY

1.5.1 Introduction

This study will use qualitative methodology to achieve its aim. The research findings will become stronger, more reliable and practical by using qualitative approach to the research proposal.

1.5.2 Research Philosophy and Strategy

Quantitative method will generate data from the population of the surrounding of landfill sites in Springfield residences with proper sampling techniques (detail below). The voluntary participants will be exposed to a set of questions with sets of answers that are

controlled specifically focusing on informal waste pickers, a landfill operations manager, and three architects within the built environment.

1.5.3 Primary data Collection

This primary data is gained through personal interaction with local case studies in the per-urban informal context of Springfield, Durban and interviewees that are directly affected by this selected case studies. The case studies contribute a large portion of the primary data that is gathered and analyzed in the research proposed. This will also include physical interviews with people who have been exposed to these informal dumping sites, the informal waste picker collectors as well as the municipal waste disposal authorities and each individual will highlight their challenges that they are facing and this in response will be dependent on the questionnaire survey to be provided. Furthermore, this will provide and support the information gathered from the people that will be interviewed, this is seen as crucial in building driving elements or arguments that will enhance and justify the research proposal.

Sampling strategy

Purposive sampling techniques

The actual inhabitants of the area of Springfield on an urban scale will be selected to form part of a purposive sample because most of these waste picker collectors exist currently in

peri-urban areas however the target will be inhabitants of the area of Springfield to further narrow down the focus to one a specific area.

Survey Questionnaires:

A significant sample of informal waste picker collectors including male and female who live in the sampled off residential areas of Springfield including shack dwellers will be handed out the questionnaires to be completed. The sample size will be determined through site visits in the area and in the form of recorded data that is captured in the number of inhabitants that are affected by the problem of solid waste in the area of Springfield, Durban.

This qualitative part of the study will be conducted by a time- lapse of how these inhabitants of the area interact with these waste management issues around the area and how they are affected by the notion against commentary social capitalism due to environmental spatial injustice and poor service delivery of government in the collection of this waste from the households of urban areas. Therefore, the field observation will also help to further examine the disconnection that occurs from the poor service delivery of government to help alleviate this problem of neglecting certain areas in the management of this waste disposal in Springfield. As a result, this disconnection leads to illegal dumping zones within the residential areas of Springfield due to poor service delivery.

Interview with experts:

In this qualitative part of the study, a focused group target audience in the form of an interview will be conducted as a method of producing data that can be used to help aid the research study. The interviews will be conducted within areas of community-based organization meetings which will be on an informal scale and all ethical procedures will then be followed. The following interview experts will be interviewed during the process of the collection of the data and they are as follows: Interview expert 1- Rodney Choromanski Architects and Asiye Etafuleni (eThekweni Municipality) who deal with waste architecture, interview expert 2- Antonio Blanco (expert architect in waste architecture and management), interview expert 3- Mfundo Nhlengethwa (landfill site inspections operator and engineer), interview expert 4- Informal waste pickers within the municipal landfill (Inhabitants who form part of the informal economy specifically in waste management), interview expert 5- Kathryn Ewing, Stephanie Potgieter or VPUU (Violence Prevention through Urban Upgrading), (Architects for the Lotus park community Centre). All primary data will be collected using physical contact with the relevant people pertaining to the study. Therefore, other methods for primary data collection will be done via digital platforms where necessary that are made available to the user.

A total of 5 groups will be interviewed. The groups are divided into 5 and they are as follows:

Group 1- 1 person

Group 2- 1 person

Group 3- 1 person

Group 4- 5 persons

Group 5- 1 person

The total number of people interviewed is a total of 9 persons.

Desktop Case study description: Four case studies

Three case studies are taken from the research proposal dependent variable which looks at a successful waste center (architecture of the environment and community empowerment) in Durban and Cape Town. The purpose of this selection case study is to have a first-hand understanding of the relationship between waste management, nature and how it is affecting the livelihood of the people that are affected by it both on an informal and formal scale specifically in peri-urban areas.

Case study 1- local case study will look at a successful waste recycling facility (architecture of the environment) typology that caters for the informal waste picker and collector community of Durban, KwaZulu-Natal through community interactive engagement spaces regarding waste management and the processes of managing or recycling waste (waste recycling facility) by Rodney Choromanski Architects. The study is located near the Durban ICC at the intersection of Shepstone Street and Palmer Street on Monty Naicker Road.

Case study 2 – local case study will look at a successful community Centre in informal settlements (re-use) typology that looks at an existing waste dumping site which has been converted to a community learning Centre within the peri-urban area of Gugulethu, on the periphery of Western Cape fostering spaces for community engagement (Lotus Park

Neighborhood community Centre) by Sustainable Urban Neighborhood (SUN) development.

Case study 3 - local case study will look at a successful waste disposal facility (architecture of the environment) typology on the periphery of the Point Precinct which looks at a waste sewer station situated in the heart of the industrial harbour context within the CBD (Central Business District) suburbs of Durban, KwaZulu-Natal fostering spaces for public engagement through waste and architecture (Durban harbor tunnel north and south entrance structures & Mahatma Gandhi Road sewer pump station) by Rodney Choromanski Architects.

Case study 4 - local case study will look at a successful waste to electricity facility (architecture of the environment) typology in the heart of the Springfield industrial Precinct which looks at a methane gas to electricity facility located on the periphery of the Bisasar landfill within the central region of the Durban CBD (Central Business District) in the peri-urban area of Durban, KwaZulu-Natal fostering a response to the extraction of hazardous methane gases exploited into the environment through waste, architecture and nature (Bisasar landfill methane gas to electricity facility) by the eThekweni Municipality.

All relevant material related to the case studies is sourced from published journals, books and articles sourced from the internet.

1.5.4 Research Methods and Materials

The research materials of the data collection will be in the form of precedent studies and case studies that are found that relate to the problem stated in the dissertation topic. The sampling of this case study selected reveals certain characteristics about the research topic and helps aid the discussion of the research and the justification to achieve a purpose or argument for the topic chosen. This case study is chosen to have a first-hand understanding of the lack of cohesion between the user and the built environment. The line between informal and formal must co-exist so as to bridge the gap that needs to be filled in order to achieve balance. This will help the user to gain a better understanding of the research problem and what impact it has on social, physical, and environmental level. Due to the covid-19 pandemic outbreak, all primary data will be collected without any physical contact with the people and this is primarily due to the restriction that have been implemented during this pandemic. Therefore, other methods for primary data collection will be done via digital and virtual platforms that are made available to the user.

1.5.5 Secondary Data Collection

This data will include data that has been refined and observed by other people who specialize in the field that is related to the issues that directly inform the research topic and this data will include the mentioned literature review and precedent studies to further support the argument for the research proposal.

Literature review:

The analysis of the theory will help aid the secondary data collection of the information in the source of a literature review. Moreover, these concepts and theories will be explored

and applied to comprehend the role in which urban resilience contribute to architectural design. The following are some of the concepts and theories that will be driving the topic at hand that has been chosen for the research and they are as follows: Urban Resilience and African Cities (*City Resilience Framework Theory and Urban Agenda, Environmental justice, Hybridization, Waste and architecture for the community*). This includes sources from the libraries which can be accessed online. This literature review will be aimed at better understanding the external influences that justify your data collection as evidence or backing of the research data that is proposed. How architecture can respond within the context and the literature review will be what is driving the design based on the information that is collected thereafter. Due to the covid-19 pandemic outbreak, all secondary data will be collected without any physical contact with the people and this is primarily due to the restriction that have been implemented during this pandemic. Therefore, other methods for secondary data collection will be done via digital platforms that are made available to the user (internet).

Precedent Studies: Three precedent studies

The following precedent studies will analyse existing illegal dumping sites or landfill that are currently existing in specific areas of the study in order to understand how architecture can enhance the development of communities in peri-urban areas and what impact this has on a community as a whole and they are as follows:

Precedent study 1 - international precedent study will look at a successful community residential typology that looks at an existing vacant building which was invaded by an

informal community from South America, Venezuela, Caracas (Torre David Vertical tower) will be looked at architecture of hybridization, urban informality, community empowerment by Enrique Gomez and Associates. The precedent study relates back to the theoretical framework undertaken from the concepts and theories that underpin the research specifically related to urban resilience in Latin American cities.

Precedent study 2- international precedent study will look at a successful waste recycling facility(re-use) typology that caters for the community through interactive and learning spaces regarding waste management and the processes of managing or recycling waste (North Transfer Station) by Mahlum Architects.

All relevant material related to the precedent studies is sourced from published journals, books and articles sourced from the internet. Therefore, other methods for secondary data collection will be done via digital platforms that are made available to the user (internet).

Research Data analysis strategies:

The qualitative data will be analysed drawing from the conceptual and theoretical frameworks that will be provided in chapter one of the research. Content and thematic analysis will be conducted on the data that will be produced from the interviews and observations from the findings. An analytical framework that is based on the theoretical framework will be carried out in the documents that will be selected as a primary data source. Therefore, other methods for secondary data collection will be done via digital platforms that are made available to the user (internet).

1.5.6 Conclusion

Most of the developing countries such as South Africa and the world today are not able to provide proper waste infrastructure facilities for the collection and disposal of solid waste in South Africa (Statistics South Africa, 2012). The solid waste is being dumped openly along roadsides and landfills regardless of the solid waste management systems that are in place currently. Remote areas of the city are mostly ignored and the collection efficiency is inadequate. These dump sites are responsible for blockages of drains, the breeding infestations. This is due to the lack of insufficient funds, poor service delivery from the government and proper equipment. As a result, this is leading to illegal dumping and open burning on an informal urban scale. The chapter has set a guideline by means of the research background and methodology for this dissertation. The techniques and concepts used by the author's mentioned has set out the conceptual and theoretical framework towards the approach of the research and design parameters for the topic chosen. Furthermore, the way in which the methods of collecting this data for the research proposal will help establish a meaningful approach to the dissertation, providing justification from the inhabitants who reside in the peri-urban areas within the district of Springfield on how the research methods and materials will be conducted during the processes of further investigation.

CHAPTER 2

LITERATURE REVIEW: CONCEPTS AND THEORY

2.0 INTRODUCTION

The concepts of Environmental Spatial Justice in urban contexts and Contextualising urban resilience and African contexts as well as theory of empowerment and community learning will be used in the research as the main driver for the research and architectural response through an existing community in the district of Springfield in Durban, specifically focusing on the problem of environmental spatial justice between the natural environment and the built environment which houses existing locations of hazardous landfill waste sites within communities of African cities where countries such as South Africa plays host to a disproportional high number of these municipal landfill waste dumps. Moreover, waste facilities are often at times disproportionately located within areas which house additional residents as a result of the disproportionate exposure of communities of colour and the poor to pollution due to waste on an urban scale.

2.1 ENVIRONMENTAL SPATIAL JUSTICE IN URBAN CONTEXTS

2.1.1 INTRODUCTION

To further understand why environmental justice is crucial within the urban fabric of resilient communities, inhabitants are consistently reminded that it is through the movement of fighting environmental racism which manifests when inhabitants fear that their well-being and health are being unreasonably placed at risk for the reasons due to the colour of their skin or for the sound of their accent. Moreover, within densified urban communities of urban areas environmental justice became a symbol of the rise of a new social movement referred to as Abahlali Basemjondolo (shack dwellers) which were people of colour, residing from poor communities and arise from marginalized environments

whom are facing ecological dangers far greater than that of a middle class white environmentalist as seen in Figure 2.1.1.1.

Author Pellow P. (2014) argues that the phenomenon of environmental spatial justice emerged within the urban fabric of peri-urban areas as one of which unequal impacts of environmental pollution on different social classes, racial and ethnic groups was identified within the built form and urban space of cities. Moreover, the impact of environmental spatial justice as a phenomenon is emphasized through indigenous persons, ethnic minorities, inhabitants of colour, and low-income communities that are confronted with the high burden of environmental exposure from elements such as air, water, and soil pollution from industrialization, militarization as well as consumer products in the form of waste Pellow D. (2014). Therefore, it is through environmental inequality, that the construct of environmental racism emerges on an urban scale through the phenomenon of environmental justice where it has captured the attention of crucial playmakers within the built form of peri-urban contexts Pellow D. (2014). Moreover, environmental spatial justice as a phenomenon focuses on the existing locations of hazardous landfill waste sites in the communities of African cities where countries such as South Africa plays host to a disproportional high number of these landfill waste sites as illustrated in figure 2.1.1.2.



Figure 2.1.1.1 and Figure 2.1.1.2 illustrating the Abahlali Basemjondolo (shack dwellers) and informal waste pickers who reside in such densified urban fabrics. by Author, 2022.

Furthermore, Pellow D. (2014) asserts that racial justice on a community platform plays an important part of critically identifying key factors which contribute to environmental spatial justice on a racial perspective whereby race is seen as a factor which predicts where these landfill waste sites are located within the urban context of poor communities. Moreover, Robert Bullard describes environmental racism as “*a racial discrimination in the environmental policy making, the enforcement of regulations and laws, the deliberate targeting of poor communities of colour*” for these “ugly” spaces of waste facilities in peri-urban areas. On the other hand, by turning the issue on its head one can define a remedy for environmental racism through the phenomenon of environmental justice as a principle for all inhabitants and communities in the entitlement to equal protection of environmental health laws and regulations. Therefore, environmental justice on an urban scale can be seen as an environment whereby inhabitants live, work, play, children go to school and its seen as the physical world that inhabitants occupy in an urban space. As a result, Pellow D. (2014) argues that it is through the physical environment that “*environmental justice*” can’t be separated from the cultural environment. Therefore, it is through the integration of

environmental justice in densified urban communities to define an approach which benefits the urban communities of cities in peri-urban areas. He further argues that environmental justice as a construct in the built environment is to solve environmental issues which stem from underlying social inequalities that drive different exposures to pollution however, the voices of people of colour and the working-class citizens are significantly important in defining or influencing resilient communities through environmental justice within the built form. As such, race within the phenomenon of environmental justice plays a crucial role in identifying the location of these hazardous landfill waste facilities in urban contexts of cities. Finally, Pellow D. (2014) argues that the phenomenon of environmental justice can be seen as a framework which provides an understanding between the relationship of inhabitants, the natural environment and built environment where the focus is shifted towards the relationship between marginalized groups and environmental issues that face the built environment as seen in figure 2.1.1.3 and figure 2.1.1.4.



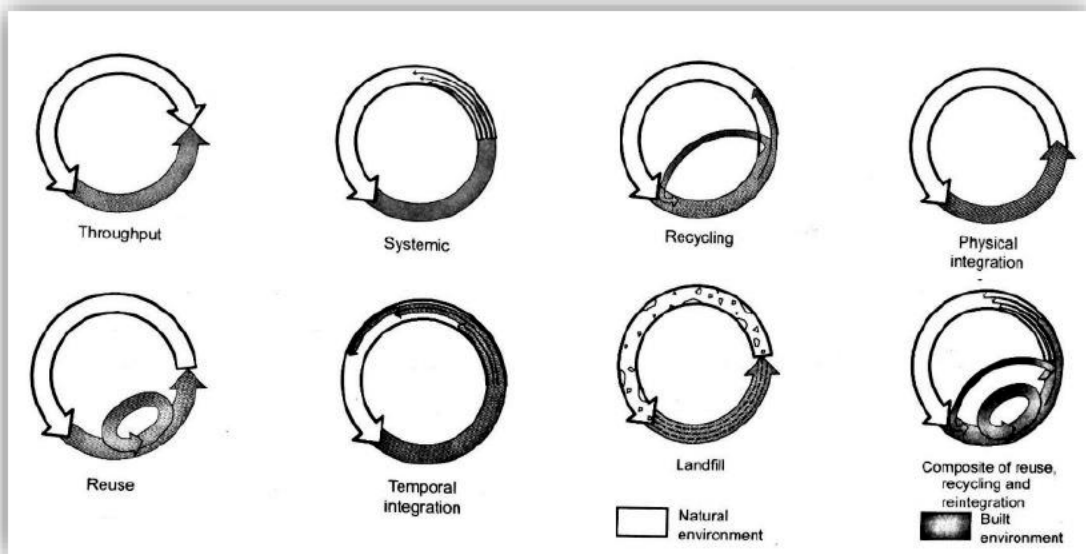


Figure 2.1.1.3 and Figure 2.1.1.4 illustrating environmental spatial injustice within the urban area of Springfield which identifies the location of a hazardous landfill and identifying a relationship between marginalized groups, environmental issues and integration between the built environment and the natural environment Yeang et al (2008).

2.1.2 THE RISE OF ENVIRONMENTAL SPATIAL INJUSTICE IN URBAN FORM AND FABRIC.

The rise of environmental spatial injustice in urban form stems from social and economic differences which is seen or reflected in space (spatial configuration) of urban contexts within the built environment. This results in imbalances of income, access to education, health, sanitation, and infrastructure which generates ruptures more or less visible. Moreover, socio-spatial inequalities within the urban fabric of densified communities may often go unnoticed where author Johnny Miller (2018) states, “*Differences in how people inhabit a space is somewhat hard to observe from the ground*”. This results in unequal scene of inequality within the spatial configuration of vast communities and the sharing of spaces between informal, formal and most importantly shack dwellings. To further identify or relate these typical kinds of spaces within the built environment specifically focusing on African contexts, one must consider the socio and spatial development of how these spaces are formed (environmental spatial injustice). Moreover, each of these particular spaces has dissimilar forms and urban morphologies which are specific to their respective contexts Johnny Miller (2018). Many developing countries specifically South Africa, a country which is socially and spatially noticeable due to the apartheid spatial planning resulting in shared spaces of territorial hybridization in urban space. Moreover, this has led to spatial and urban residential segregation representing significant magnitudes in the historical development of segregated settlement patterns in South Africa (Statistics South Africa, 2012). The urban footprints of these spaces are interconnected to colonialism and apartheid. The historical analysis of the rise of environmental spatial injustice in spatial development commenced in the period between 1652 to 1990 resulting from colonial roots

of spatial control and residential segregation in South Africa's earliest townships in the years 1652 to 1910. Moreover, the rise of urbanization in urban form and settlement within these spaces led to the consolidation of spatial control and the restructuring of space in densified urban areas as seen in figure 2.1.2.1 and figure 2.1.2.2.



Figure 2.1.2.1 illustrating social inequality through environmental spatial justice, urban form and fabric as seen from the sky in the context of the Papwa Sewgolum golf course in Durban, South Africa (top left, top right), Nairobi, Quenia in Kenya (bottom left, bottom right) and Mumbai in India by photographer Johnny Miller (2018).



Figure 2.1.2.2 illustrating social inequality through environmental spatial justice, urban form and fabric as seen from the sky in the context of Cidade in Mexico (top left, top right) and Tembisa in South Africa (bottom left, bottom right) by Johnny Miller (2018).

2.1.3 THE HISTORY OF CONTEXTUALIZING ENVIRONMENTAL SPATIAL INJUSTICE

On an urban scale, the phenomenon of environmental spatial justice has been acknowledged as a concept which identifies spaces within the built form that are associated to cause environmental harm across places, spaces and identifying locations of toxic waste specifically focusing on landfill sites as well as disadvantaged contexts. Moreover, Robert D Bullard (1997) argues that environmental spatial justice emerged as a phenomenon which can be perceived as a response to regional political circumstances of those whom are socially, politically, and economically discriminated whom stem from disadvantaged communities specifically within in urban settings. Moreover, the concept of environmental justice is a lens associated within the built environment which criticizes the concentration of pollution and natural hazards disproportionately situated in disadvantaged communities or minority neighbourhoods of urban settings as a form of racial discrimination. The concept of environmental spatial justice arose in the 1970s in North American cities. The lens of spatial justice within the urban fabric links social justice to space within the built environment Edward w. Soja (2009). He identifies the concept as one which involves fair and reasonable distribution of an urban space or setting (built environment) of socially valued resources and opportunities. According to Soja (2009), on an urban scale the idea of space has changed significantly from emphasizing flat cartographic concepts of space where it can be seen as a vessel or stage of human activity or the physical dimensions of a fixed form, to an active force which shapes human life. He further argues, urban spatial dimensions as technological innovation, economic development, social change, social separation, environmental degradation, and the production of spatial justice and spatial

injustice demonstrates critical spatial thinking on an urban scale. Spatial justice stems from the complimentary idea to ‘‘rights of the city’’, connecting space with justice. Edward Soja (2009) expands on the idea of analyses and contextualizing spatial justice through steps for analysing spatial inequality in urban spaces as illustrated in figure 2.1.3.1.

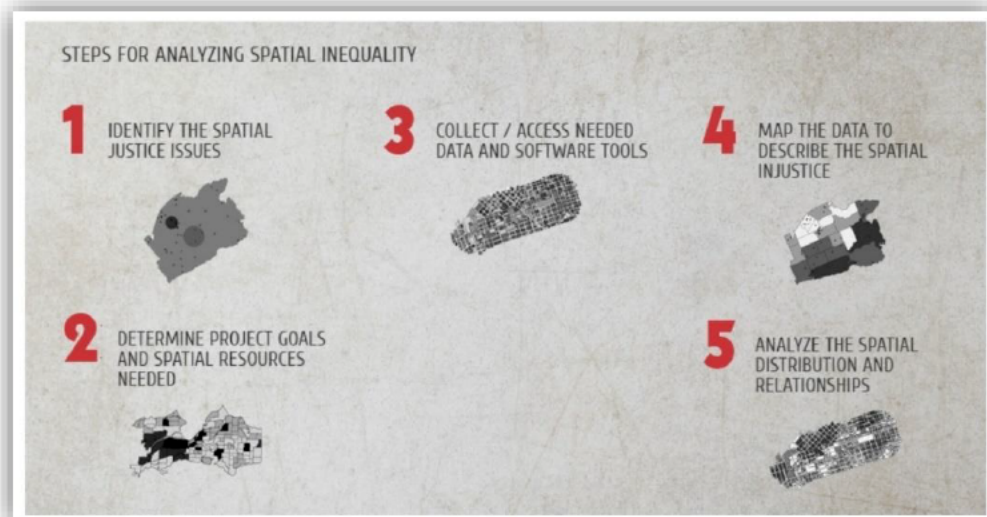


Figure 2.1.3.1 illustrating the five steps for analysing spatial inequality urban environment. (Source: Soja, 2009).

The concept of spatial critical thinking centres around three principles:

- The ontological spatiality of being (as human or inhabitants on this earth, we are all spatial, social and temporal beings).
- The social production of spatiality (a space is socially produced and as a result can be socially changed).

- The socio-spatial dialectic (the spatial forms the social as much as the social forms the spatial).

In an urban setting, examples of spatial inequality and spatial injustice identify facilities or activities that cause harm to communities where space is unfairly or unjustly controlled through an uneven distribution within the built form. On the other hand, Author David W. Harvey (1973) defines spatial relationships as urban spaces:

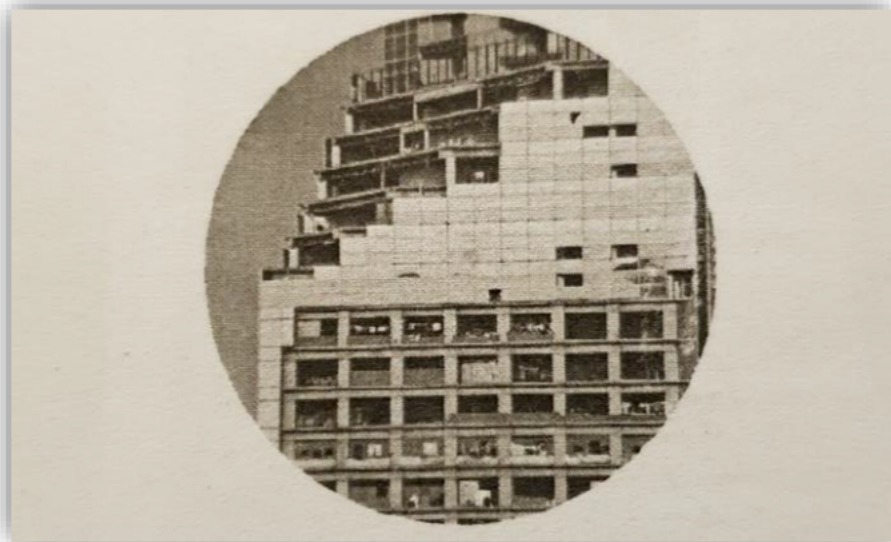
- Absolute space: fixed position on an unchanging organized system.
- Relative space: the distance to a common reference point(location) in time and space.
- Relational space: the position within a symbolic system perceived by a particular group or person.

2.2.4 HYBRIDITY IN ENVIRONMENTAL SPATIAL JUSTICE BETWEEN ARCHITECTURE AND NATURE

Hybridization and environmental spatial justice play an integral part in identifying complex environments where different kinds of activities are incorporated together, improving the habitable conditions and the revitalization of the surrounding context we live in. Author Felipe Hernandez defines the concept as one within the built environment which coexist as one with the built form. This concept is defined as a multifaceted approach where different elements that share the same space which gives rise to alternative forms within the architectural built form (Hernandez, 2002:79). Thus, hybridization as a phenomenon produces results that manifest different or synthetic characteristics whereby different elements are fused together to form one cohesive element.

This hybridization of space within the built form is an expression of space which shows a radical shift from an ordered system to a more formal approach of permeability and connectivity where reality manifests within the built form where the physical represents the interconnection of form and space (Figure 2.1.4.1). Furthermore, with this concept space is rather molded towards a way of living, its inhabitants, a life support system that can sustain the environment and its inhabitants. The phenomenon of hybridization within the environment must coexist as one regardless of the physical state of a space or place whether it be informal or formal in its context. This will prevent a shift in order whereby one dominates the other, one must influence and adapt to another. Thus, there is a perceptual transference of reality which is reflected in the step from a bipolar

structure of opposition of material or immaterial to a multi-layered structure as well as interconnected systems which represent the physical as one of those layers. The concept theory of hybridisation, space is often represented as a sort of living, breathing organism which can be redesigned, reworked and adjusted according to the demand of that specific situation within a specific context. On an urban scale, the environmental quality of a hybrid space is defined by its multifunctionality, accessibility, comfortability and services pertaining to its living mechanisms (eco-systems). Moreover, the concept of hybridization within the built environment will look at how an existing surrounding context can encapsulate certain aspects of theories and concepts which defines the character of a space. In this research the hybridization of space within an existing municipal landfill site will be explored in the process of identifying the social-economic structure that is housed within the community of Bisasar, Springfield in Durban as seen in figure 2.1.4.2 and figure 2.1.4.3.



Architectural Hybridization- Torre David, Caracas, Venezuela. Source:

<http://www.vice.com/read/atlas-hoods-venezuelas-skyscraper-slum>.



Urbanistic Hybridization- Sri Nivasapuram, Chennai, India. Source:
<http://www.vice.com/read/atlas-hoods-venezuelas-skyscraper-slum>.



Territorial Hybridization- Shipai Village, Guangzhou, China. Source:
<http://www.vice.com/read/atlas-hoods-venezuelas-skyscraper-slum>.

Figure 2.1.4.1 illustrating formal/ informal hybridization of space for the Torre David, Caracas (Venezuela), Sri Nivasapuram, Chennai (India) and Shipai village, Guangzhou (China).



Figure 2.1.4.2 illustrating the Aerial hybrid space of the Bisasar Landfill in Springfield, Durban.

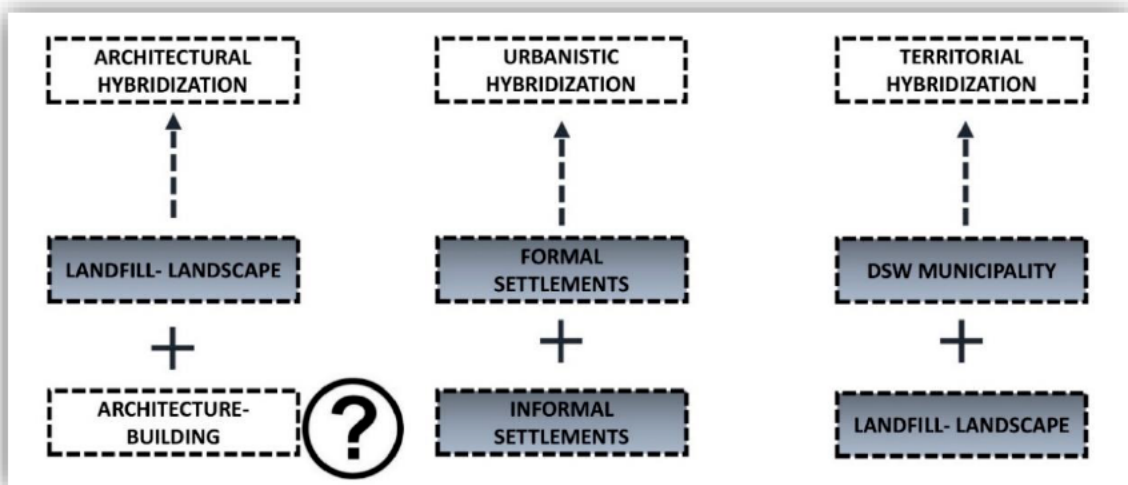


Figure 2.1.4.3 illustrating the conceptualization of incorporating architectural hybridization as the missing link for built form within the landfill by Author, 2022.

2.1.5 CONCLUSION

This subsection of chapter 2, clearly highlighted that the concept of environmental spatial justice in urban contexts is a multi-layered sphere of how space and context connect by identifying different spatial patterns of conflict within the urban fabric and how these spaces are influenced by a juxtaposed conflict of spaces within environmental contested spatial relationships in densified urban settings. Moreover, environmental spatial justice in urban contexts is shaped by the formalities of Apartheid spatial planning in South Africa (Statistics South Africa, 2012), which dictate the spatial configuration of spaces in the urban form which highlight the concept of environmental spatial justice in densified urban settings which provides an understanding which encapsulates an understanding between an existing relationship between man and the environmental issues which give rise to protests and movements within the urban fabric contesting such disproportional spaces. It is clear, in response to spatial patterns that are discussed in this chapter, in an urban setting of contested spaces should be an exploration initiative that can liberate existing communities who are impacted by environmental spatial justice and further utilize the concept as one in response to communities suffering from unequal impacts of environmental problems (environmental inequality).

2.2 CONTEXTUALISING URBAN RESILIENCE AND AFRICAN CONTEXTS

2.2.1 INTRODUCTION

‘Resilience is based on the shifting relationships between scales, and between autonomy on the one hand and connectivity on the other.’ (Allan, P. & Bryant, M. 2011). The phenomenon of urban resilience can be simply described as the ability of communities (agents), cities, institutions, businesses, and systems within a city to survive, adapt, and grow (Figure 2.2.1.1). According to Wilbanks (2007) urban resilience is defined as “The capability to prepare for, respond to, and recover from a significant multi-hazardous threat with minimum damage to the public safety and health, the economy, and security of its inhabitants”. Moreover, the phenomenon of urban resilience does not only expand on the multi-hazardous threats that come from different uncertainties and challenges experienced within the environment such as waste management, it is predominantly related to the social, spatial and environmental component of this framework (Figure 2.2.1.2). Architecture within the urban resilience framework further argues that as cities continue to grow and deal with uncertainties and challenges like environmental spatial injustice caused by the disproportionally located areas of landfill waste dumping zones as a result of disproportionate exposure of communities to pollution due the environment, waste management as well as climate change on an urban scale. On an urban scale, resilience focuses on the capacity to continue to learn, self -organization and development within dynamic environments confronted with uncertain and unexpected change. Resilient architecture within the built environment is one that is flexible, able to change in order to maintain balance or equilibrium in an urban space or settlement.

Urban resilience as a concept resonates within the built environment as one which include principles such as mobility, chance, connectivity, and diversity Davoudi and Strange (2008). Diversity, adaptability, modularity, innovation, rapid, reserves of social capital, and the ability of ecosystems to serve and the attributes of the decision-making process Allan & Bryant (2011). Moreover, it is through urban resilience within the built environment of cities to survive and adapt within their districts. Urban resilience as a phenomenon extends within multiple facets of the theory of place making paradigm where it looks at the approach to design, planning and the management of public spaces in the environment which is centred around people as seen in Figure 2.2.1.3. Moreover, the importance of how place making is a driver for resilient cities identifies the importance of integration through community-based processes. Author Jane Jacobs describes place making as one which fosters community connection to place through resilience. Thus, creating a process of nurturing and building a relationship between individuals and the environment inhabited. In the built environment the concept of placemaking linked to urban resilience acknowledges the idea of creating a sense of ownership in urban areas of cities because it houses communities with large population groups. Thus, the identification of spaces within the urban environment are essential as areas they can identify as their own (PPS, 2015). Moreover, spaces within the built form connect through interactive dialogue and function. Author (PPS, 2015), identifies four qualities of successful public spaces within the built form:

- Accessibility and linkages
- Activities and the user
- Comfort
- Sociality

On an urban scale place making can be identified through a diagram that demonstrates how these four qualities can be implemented to create public spaces of interest (PPS, 2015).

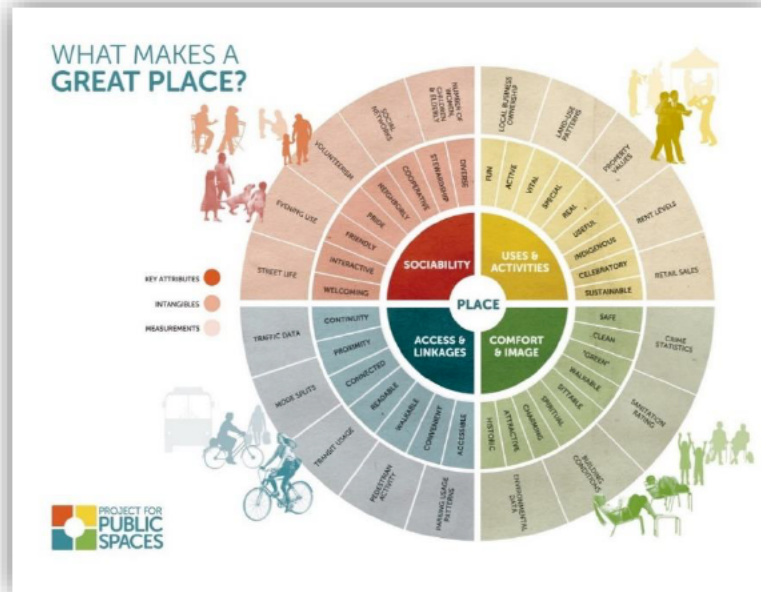


Figure 2.3.1.1 illustrating a diagrammatic image of placemaking. Source: <http://www.pps.org>. 2015

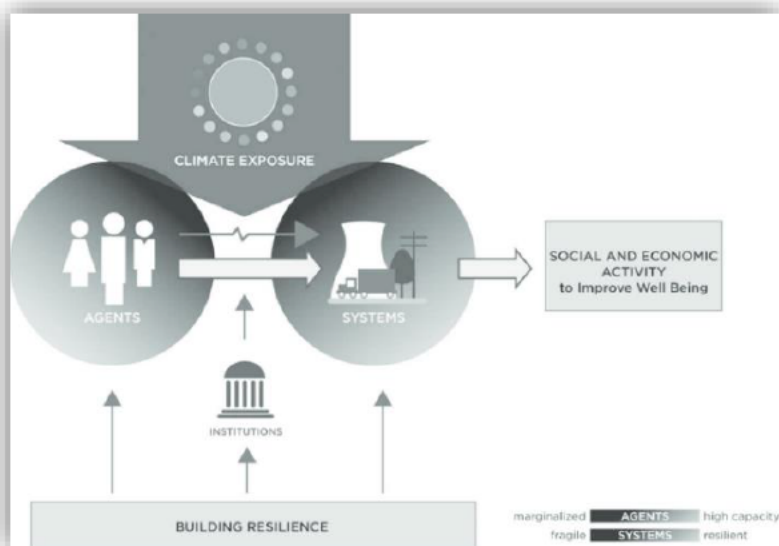


Figure 2.2.1.2 illustrating a diagrammatic sketch for the concept of the phenomenon of urban resilience. Source: Allan, P. & Bryant, M. 2011

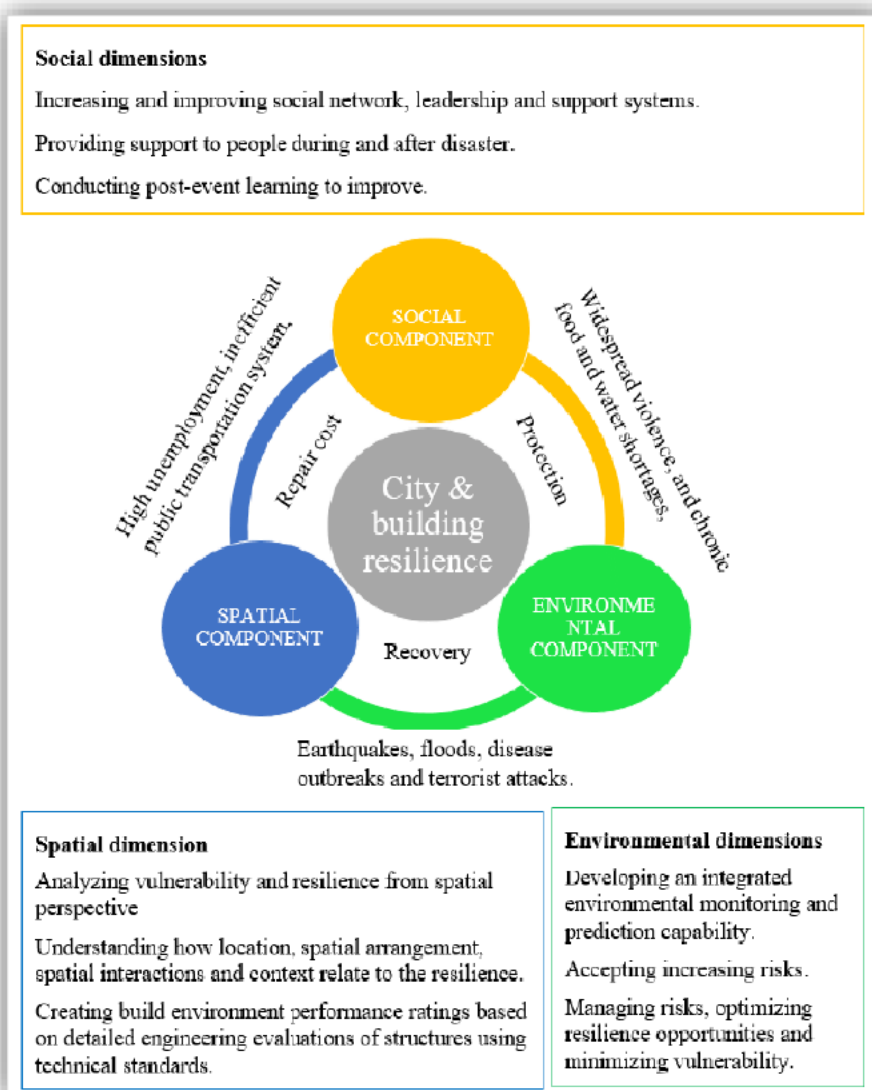


Figure 2.2.1.3 – illustrating conceptual framework with components, dimensions, events and elements for evaluating, designing (create), and achieving built environment and city resilience.2017

The conceptual framework for city and building resilience are further discussed as reference can be made from figure 2.1. According to Bejtullahu. F (2017) of the three components of city and building resilience are broken down into 3 categories and they are as follows:

Social Component

The elements that are related to chronic stress which are condition that affects people who are unemployed, have inadequate access to public transportation, and are suffering from violence and other social issues. The various components of this issue need to be evaluated and treated in order to build a resilient city.

- Support systems and social networks should be improved and increased in the built environment.
- Providing support to inhabitants during and after environmental change such as disasters or environmental issues (waste management).
- Conducting post-event learning facilities to improve the well-being of inhabitants.

Spatial Component

The spatial and environmental elements that threaten urban and city settings need to be analysed and treated in order to improve their resilience. This includes assessing and treating the different social dimensions of the affected areas.

- Provide an analysis of resilience and vulnerability using a spatial perspective.

- To understand and explore how spatial relationships, context, and location affect resilience.
- To create built environment performance ratings for built environments based on detailed engineering assessments and technical resolutions.

Environmental Component

The elements that are linked to the threatened environment in a city. These components need to be evaluated and treated in order to build a resilient framework.

- It involves identifying and prioritizing opportunities for resilience, managing environmental risks, and reducing vulnerability.
- Accepting the increase of risks
- This process involves developing an integrated prediction and monitoring system for environmental hazards.

2.2.2 THE HISTORY OF URBAN RESILIENCE IN AFRICAN CITIES

On an urban scale, the concept term of urban resilience or city resilience gained popularity before the 1970s. It was mainly used to refer to the characteristics of a certain place or region. During the 1980s, the term became more prevalent, especially when it was used to

refer to communities of low-income individuals who are focused on resilience against environmental issues such as natural disasters and environmental spatial injustices caused by waste management practices facing the built environment in the 21st century. The phenomenon of urban resilience stems from the field of ecology however, is traditionally defined by Canadian ecologist C. S. Holling (1973) as an aspect which refers to the persistence of connections within a system and measures the capacity of these systems to absorb changes or shocks Folke (2006). Moreover, urban resilience as a concept in relation to the natural environment and the built environment, or more precisely to ecosystems, originated as a concept proposed by C. S. Holling (1973) as a means to understand the capacity of ecosystems to captivate change and to persist developing in relation to disturbances and ever-changing conditions Holling (1973). The phenomenon of urban resilience as a concept within the building industry specifically focusing on architecture accentuates the conservation and restoration of the physical environment's in terms of function in the face of shocks and disturbances M. Laboy and D.Fannon (2016). The conceptual approach of urban resilience has been used as a framework in vast multiple disciplines which evaluates the ability or capacity of an individual or persons, objects, entities, or systems to persist in the face of difficulties as well as disruptions in ever-challenging contextual locations. Authors M. Laboy and D.Fannon (2016) describe the term resilience conceptually as an elastic material's ability to '*spring back*' or '*rebound*' subsequently due to compression. Moreover, the term as a concept has since been adopted by a diverse range of disciplines in order to further define the different mechanisms which can enhance the ability to manage hazards and vulnerabilities within densified communities as well as the capacity to absorb shocks form uncertainties and ever-growing change through renewal, adaptation and reorganization of spatial patterns within the built form.

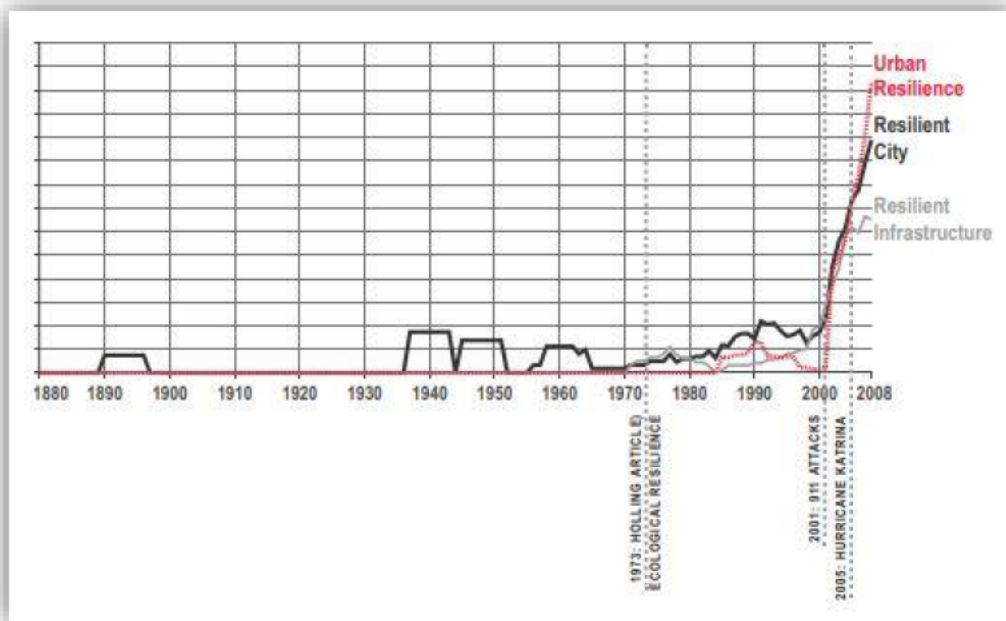


Figure 2.2.2.1 illustrating the historical timeline graph of urban resilience.

To further understand the concept of urban resilience within the built environment, the urban theory as a phenomenon is directly linked to urban resilience as a theoretical construct to further understand its dimensions or scales (Figure 2.2.2.2).

Attribute	Resilience definition	Evidence of attributes in urban theory
Diversity	a major source of future options ...the more diversity, the better the capacity for a system to adapt to a wide range of different and sometimes unpredictable circumstances. (Walker & Salt 2006: 145)	mixed use, short blocks, variety of building age and density (Jacobs 1993), spatial heterogeneity (McGloth 2007), functional diversity (Mathur 1999, Dovey 2006, Ramirez-Lovering 2008, Anderson 1978).
Modularity	allows individual modules to keep functioning when loosely linked modules fail, and the system as a whole has a chance to self-organise... (Walker & Salt 2006: 146)	polycentric urban form (Batty 2001, Kloosterman & Musterd 2001), flexibility of the grid (Ramirez-Lovering 2008, Moudon 1989), architecture and cities (Sudler 2005)
Innovation	an emphasis on learning, experimentation, locally developed rules and embracing change. (Walker & Salt 2006: 147)	as a strategic intervention (Dadds 2008, Sola Morales 1999, Decombes 1999).
Tight feedbacks	social networks play key roles in determining rightness of feedbacks. Centralized governance and globalization can weaken feedbacks. (Walker & Salt 2006: 146)	traffic (Jacobs 1993), diversity (Jacobs 1993), polycentric urban form (Batty 2001), the capacity of a system to self-organise (Sola Morales 1999, Decombes 1999) bottom up civil action (Dadds 2008).
Overlap in governance	institutions that include redundancy in their governance structures. (Walker & Salt 2006: 148)	creating diversity (Healey 1997), community and urban development (Moudon 1989).
Ecosystem services	include...unpriced ecosystem services in development proposals and assessments. (Walker 2006: 148)	ecological urbanism (Mostafaei & Doherty 2010), urban density and sprawl (Bolund & Hunhammar 1999, Tratalos, Fuller, Warren, Davies, Gaston 2007).
Social capital	the capacity of people to respond together ...to change any disturbance... depends on social capital. (Walker & Salt 2006: 147)	small places with definite boundaries (Oliver 2000, Oryx 2000, Putnam 1993), public sidewalk life, diversity and settings for casual public contact (Jacobs 1993), encouraged by lack of state control (Dadds 2008), heterogeneous neighbourhoods (Jacobs 1993, Oliver 2001 Putnam 1995), institutional infrastructure (Tomlin 1998).
Variability	embrace variability rather than attempting to control or reduce it... (Walker & Salt 2006: 146)	ecological engineering (Berges, Bolton & Fridley 2001), redundancy (Graham & Marvin 2001).

Figure 2.2.2.2 illustrating the link between Urban Resilience and the Urban Theory.



Figure 2.2.2.3 illustrating the United Nations statistics about urban densification in African cities specifically in South Africa by Author, 2022

In the 20th century, the rapid sprawl of urbanization in Africa is growing and urbanizing drastically on an urban scale resulting from densified urban fabrics which are dominated by informal settlements which house urban resilient communities. Urbanization is the central driver of global environmental change. The growth of informal settlements and the failure to provide housing which meets the needs of low-income demand are natural indicators of the urbanisation process. Moreover, the rate at which inhabitants are increasing rapidly into urban centres in African cities has led to urban densification (Figure 2.2.3.4). The need to build sustainable African cities within current environments of informal contexts depend on an architectural response to urban resilience in very dynamic and unique changing conditions in urban areas of African cities. Moreover, the way in which we as inhabitants think about building cities is different in an African context (Afrocentric) and differs from the approach that western European or North American

(Northern centric) think about building cities. On an urban scale, the population of African cities portray the characteristics of resilient communities on an informal level due to the history of obstinate conflicts which exist in our societies.

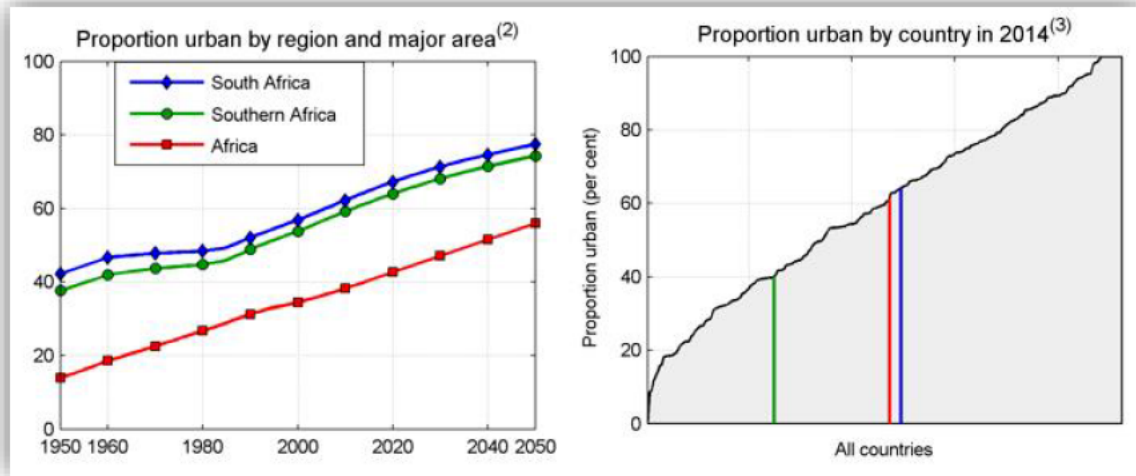


Figure 2.2.2.4 illustrating the United Nations statistics about urbaan densification in African cites specifically in South Africa. Source: StatsSA (Statistics South Africa), (2012).

2.2.3. IDENTIFYING CHARACTERISTICS OF RESILIENT URBAN COMMUNITIES

In most cities in Africa, environmental change is induced by climate change, waste management, natural hazards and disasters which arise on a global scale. These impacts within these ever-growing cities impact the environment negatively and this has led to the urban sprawl of these environments of physical, economic, social development, loss of life, assets, resources and destruction within in the urban fabric Ainuddin and Routry (2012). Moreover, the growing tendencies of rapid urbanization in most cities has led to the wide

horizontal urban expansion and the increase of the population of its inhabitants resulting in an urban decline capacity in managing the environment and an ever-increasing vulnerability of inhabitants and communities within vast and dynamic cities Tomalla, Downing, Spanger-Siegfried, Han and Rockstrom (2006). Moreover, these vulnerabilities and changes stem for the phenomenon of urban resilience in cities both on a global and local scale to further aid cities to prepare for, react to, respond to and cope with different changes in densified communities Pike, Dawley and Tomaney (2010). Moreover, Berkes, Folke (2006) describes city systems as integrated ecological systems where social systems and ecosystems within the built form are recognized as interdependent to one another Folke (2006). Therefore, it is through the phenomenon of urban resilience in cities that one can identify the characteristics of resilience in urban communities (Figure 2.2.3.1), (Figure 2.2.3.2), (Figure 2.2.3.3) and (Figure 2.2.3.4).



Figure 2.2.3.1 illustrating Urban Resilience communities in African cites specifically in South Africa. Source: Digest of South African Architecture, 2015



Figure 2.2.3.2 illustrating Urban Resilience communities in African cites specifically in South Africa. Source: Digest of South African Architecture, 2015



Figure 2.2.3.3 illustrating Urban Resilience communities in African cites specifically in South Africa. Source: Digest of South African Architecture, 2015



Figure 2.2.3.4 illustrating Urban Resilience communities in African cites specifically in South Africa. Source: Digest of South African Architecture, 2015

Community resilience as a concept needs to be better understood and realized through a concrete carrier a resilient community model (Figure 2.2.3.5) where certain paradigms or dimensions express the characteristics of resilience further identifying characteristics of community resilience, establishing the core foundations that shape community resilience in cities. Moreover, on an urban scale the physical environment is seen as a fundamental layer of the resilient community model because inhabitants coexist and inhabit environments where spatial patterns exist within these densified urban spaces. The physical environment within the built form is comprised of layers which includes two performance dimensions of what characteristics define resilient communities and they are as follows:

- Spatial patterns which include, traffic roads, residential buildings, activity sites and landscaping in the community.
- Environmental component which includes Infrastructure for living and recreation, municipal public services, municipal network, information and communication.

These dimensions which define the physical environment act as physical support systems of entire resilient communities dealing with all sorts of natural and man-made hazards within the environments of urban cities.

- Public Service is seen as a core layer of the community model which includes public services that provide all residents with information distribution, education and training, culture, entertainment, medical care, psychological counselling and other services.
- The management system is seen as a top layer of the resilient community model which includes dimensions consisting of local governments, property, self-government or organizations and community residents which collaborate with each other and also perform their own functions.

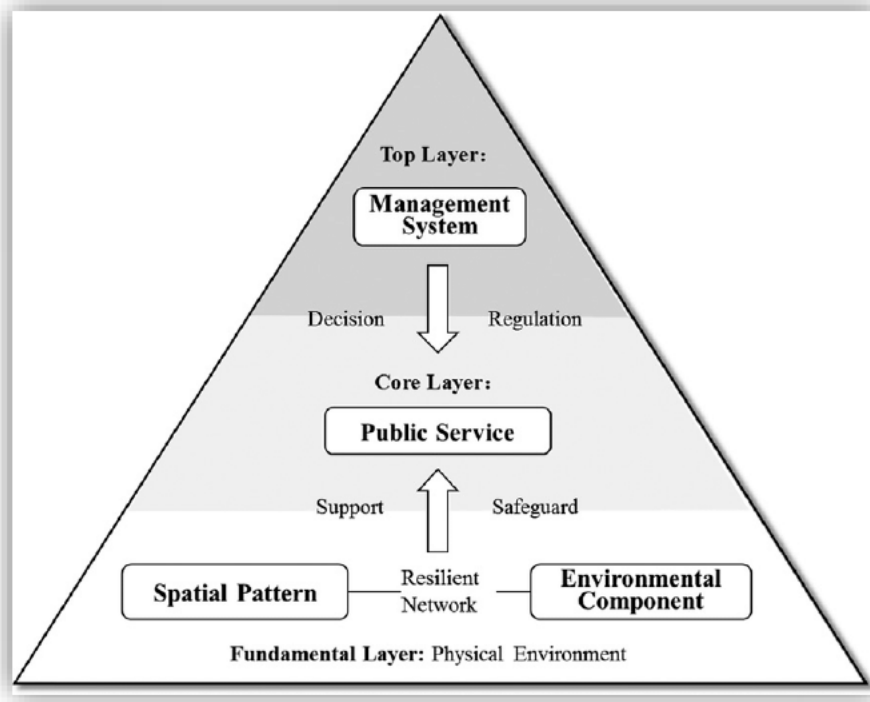


Figure 2.2.3.5 illustrating the resilient community model consisting of four performance dimensions of resilience.

- **The multi-functionality of space** - The concept of multi-functionality allows people to use different spaces for their needs. It's because the built environment has dynamic environments which accommodate different needs having multiple functions of transitional spaces.
- **The flexibility of spatial processes** – The ability of space to accommodate changes in the environment is also beneficial to systems' functions. It allows them to maintain their flexibility and adapt to the changes brought about by the environment. The flexibility of the urban fabric helps in identifying the spatial

functions of the process. In order to ensure that the process can continue to change, each process has to rely on the support of different spaces.

- **The interactivity of facilities** – On an urban scale, A facility's interactivity helps community members interact with its surroundings. This concept is driven by the need to meet the changing needs of individuals and the complex environments they live in. This concept allows various types of facilities to interact with the natural cycles of the environment, such as water, air, and energy. They can then absorb and digest different types of resources. Through this interactivity, a facility can also change its function depending on its location.
- **The diversity of components** – The facility's diversity of components allows it to function as a multi-functional space, which can switch between different tasks within an urban setting. In addition, this allows for the exact same function to be replicated as a series of prototype units, making the facility adaptable to different environments.
- **The intelligence of public services** – On an urban scale, the ability of public services to respond to the changing needs of communities is a vital part of their operations. In order to effectively serve the public, they need to develop effective strategies and procedures that are geared toward meeting the varying requirements of their users. The technological advancements that have occurred in the field of public service have also changed the way they operate.

- **The humanity of public services** – On an urban scale, the concept of humanity in public services emphasizes the need for resilient urban communities to consider and meet the varying needs of their users in a dynamic environment. This can lead to the development of new services that meet their customers' needs.
- **The prediction is based on management concepts** – This prediction is based on the various management concepts that are used in the field of public services. These concepts help develop effective strategies and procedures designed to address the changing needs of communities.
- **The collaboration of management institutions** – The management process is typically carried out through a collaboration between management institutions. This type of approach involves using responsive tools and methods.

Furthermore, characteristics of urban resilient communities is seen as an integrated system which involves both ecosystems and inhabitants together within densified urban environments. Moreover, these urban communities of resilience are regarded as subsystems of the urban fabric in cities and are defined by the characteristics of diversity, dynamic, and Adaptation Xiang (2013) and Cumming G et al (2008). Urban communities within the built environment are responsible for providing the foundation for urban planning and nurturing resilience at numerous spatial scales within specific contexts Steiner and Forman (2020). Urban community resilience practices are seen as ecosystems

in urban communities for change and to adapt to a certain situation where this change is seen as a successful preparation Liao et al (20102). Therefore, urban resilience in urban communities is characterized by the underlying principles which define or identify resilient communities in cities. Moreover, these principles are defined as characteristics which drive change in hazardous environments within the built form such as municipal landfills. Authors, Wardekker, Jong. Knoop and Sluijs (2010) describe these characteristics of resilience which consider *“foresight and the preparedness of inhabitants”*, *planning*, *“compartmentalization”* and *“flexible planning”* and design as practical principles for urban resilience in cities. On the other hand, authors Ahern, Qin and liu (2011) argues that there are five planning and design strategies in achieving urban resilience in cities which include, multifunctionality, redundancy and modularization, social diversity, multiscale networks, connectivity, adaptive planning and design. Furthermore, Margis (2010) argues that communities within densified urban environments have maintained their existence over time through the ability to recognize rapid changes by adaptation rather than specific outcomes of change or circumstance. To further understand or identify characteristics of urban resilient communities in an urban space, one must recognize that communities within an urban scale exist on a spectrum. Moreover, the lens can be identified or categorized into three types of community networks in an urban space (Figure 2.2.3.6):

Centralized Community Network

- The centralized community network is controlled or owned by the central node (urban space).

- All relationships and power are connected through a central node which can be seen as an organization or individual.

Decentralized Community Network

- A central node where all relationships on an urban scale and environment are organized or collected. The central nodes empower other sub- groups or forms building independent groups which support the central node.
- Scale and diversity broadens the network through enabling the nodes to create other sub- groups. Identity becomes shared among each other in an urban space.

Distributed Community Network

- There is no central node. Every node is connected through a series of webs in the form of spatial relationships.
- No central power and control. All spatial relationships are shared through identity. This results in long- term sustainability and resilience to shocks.

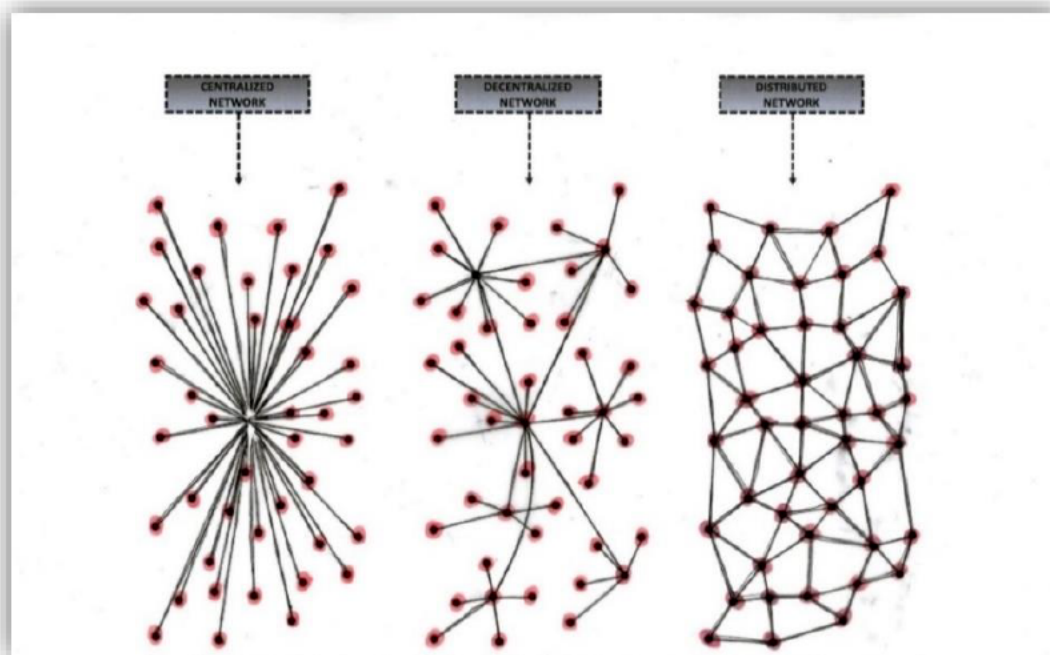


Figure 2.2.3.6 illustrating Urban Resilience Multiscale Networks- Centralized Network, Decentralized Network and Distributed Network by Author, 2022

2.2.4 THE ROLE OF URBAN RESILIENCE IN ADAPTIVE-SOCIAL ECOLOGICAL SYSTEMS, AND SUSTAINABILITY.

Sustainability plays a crucial role in the approach towards urban resilience. According to Matsen et al (2016) and Clark (2007) sustainability is defined by the problems it addresses rather than by the disciplines it employs. The main focus of sustainability is driven by transitions toward sustainability where the capacity of a society is heightened to utilize the earth as means to simultaneously encounter the needs of an ever growing but stabilizing human population that sustains the life support of the universe where sustainability is able to reduce hunger and poverty Matsen et al (2016) and Clark (2007).

The social- ecological system as an integrated resilience approach as a concept was used as one for humans -in-nature. Moreover, in relation to this approach towards social- ecological systems the social aspect is rather referred to as one of which human dimensions of people, communities, societies within diverse facets of economic, political, institutional, cultural and ecological realms act as the thin layer around the planet earth where ones can find life as well as human life Berkes and Folke (1998:4). Moreover, the approach towards social-ecological systems emphasizes that people, communities, economics, societies, cultures are rooted parts within the system that shape our ecosystems on a local but global scale within the urban fabric we inhabit. Furthermore, the author argues that it is within people, communities, economics and diverse cultures where these facets are dependent on the system to sustain human development within the built environment Folke et al (2011). On the other hand, Biggs et al (2015) defines the resilience of social-ecological systems as one that sustains the well-being of inhabitants in the face of certain changes and circumstances and this is achieved by buffering shocks through adapting or transforming in response to that change (Figure 2.3.4.1).

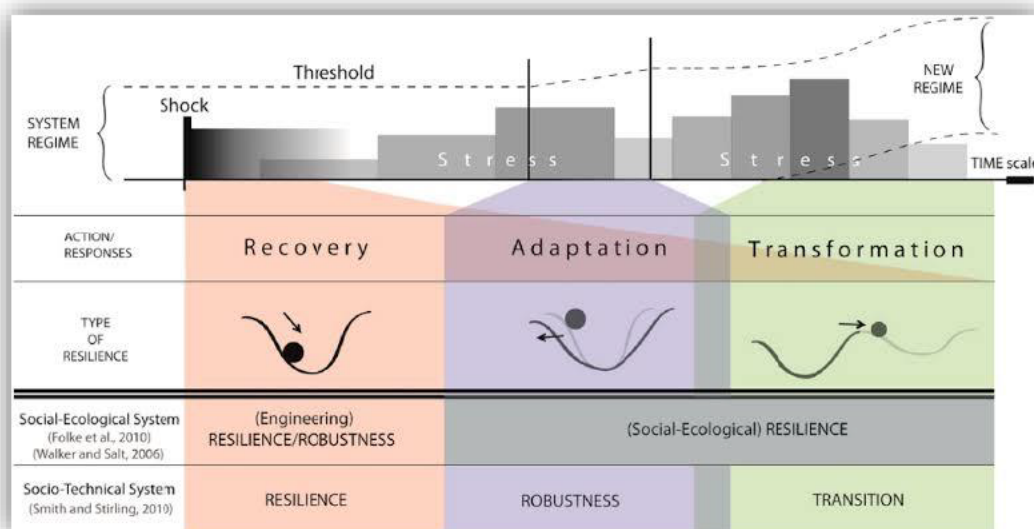


Figure 2.2.4.1 illustrating diagram of the resilience of socio-ecological systems.2010

To further understand the complexity and dynamics of social-ecological systems one must take into account that the very nature of systems changing over time Carpenter et al (2015), whereby complex adaptive system within the urban fabric stem from these social-ecological systems which come into focus Norberg and Cumming (2008). These complex adaptive systems possess dynamic thresholds of multiple drivers of change between social and ecological mechanisms within the built environment.

On an urban scale, challenges such as environmental and natural resources tend to be reinforced by the absence of recognition where ecosystems as well as social systems that use inhabitants as an interdependent mechanism that is directly linked with one another Reyers et al (2013) and Biggs et al (2015). According to Gunderson and Holling (2002) and Berks et al (2003) the resilience approach towards these systems can be emphasized through humans and nature whereby phases of change interplay with that of rapid change and how they interact with spatial scales within the built envelope. Furthermore, Carpenter (2003) and Scheffer (2009) emphasize that it is through rapid shifts that take place in ecosystems where such shifts cause an increase in the loss of resilience through human actions and disturbances within the urban fabric. Moreover, Authors, Holling, Ramaswami and Redman et al. all propose examples of these systems which are broken down into three categories: social, environmental and ecological. On an urban scale, these are the drivers that define a socio-ecological system within the built environment (Figure 2.2.4.2):



Figure 2.2.4.2 illustrating diagram of the three components of socio-ecological systems
by Author, 2022

Man, nature and the environment are interconnected systems which inhabit the same space in urban contexts. Socio-ecological systems explores the opportunities of fostering or creating architecture which connects people and the environment through these systems to influence both the social and ecological environment, Berkes et al. (2008). Due to environmental problems within the built form accumulating through the rise of rapid population growth, waste and consumption resulting from mankind, architecture is rather design for the people and is used by society with a disregard of an ever-changing environment. Author, Redman et al (2004) asserts that humans are reliant on nature to survive. He further argues, in order for a system to endure sustainability there needs to be an interdependent relationship between society and the environment we inhabit. On the otherhand, author Lindsey (2011) asserts that all systems within the urban environment need to be effective and resilient, implementing much more effective system enhances sustainability (Figure 2.2.4.3). The interconnections of the environment, man and nature are crucially important and need to be understood in manner where successful systems within the built form are created. Moreover, sustainability within a system can be sustained through a symbiotic relationship between both the environment and society thus architecture becomes the threshold which brings balance between inhabitants and the ecological environment. Authors Laboy and Fannon (2016) acknowledges Architecture and time play an integral part in the framework for social-ecological resilience in the built environment through multiple physical scales requiring the consistency of adaptation in ever-changing contexts on a technical, organizational, social, and economic realm (Figure

2.2.4.4) and (Figure 2.2.4.5). Moreover, on an urban scale buildings (architecture) thrive in many contexts as a result of spatial flexibility and structural robustness. Social-ecological resilience is driven by term resilient, describing cities which are complex in nature, dynamic, interconnected within an environment. Therefore, the idea of ecological systems conveys a focus on relationships between components and their surroundings.

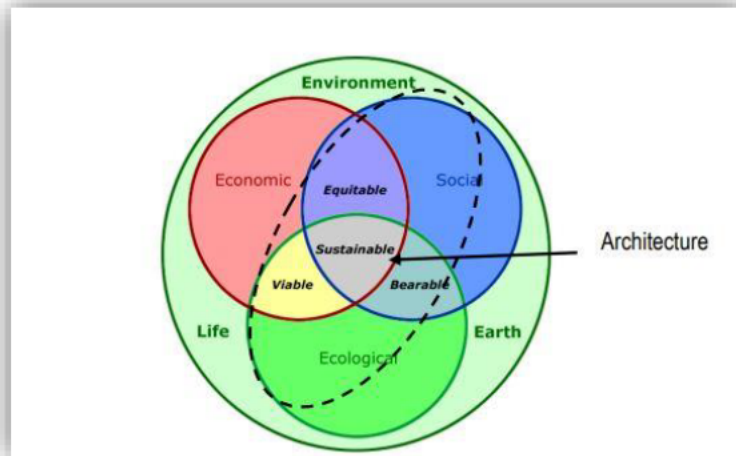


Figure 2.2.4.3 illustrating diagram of the three components of sustainability Source:

<http://www.thwink.org/>.

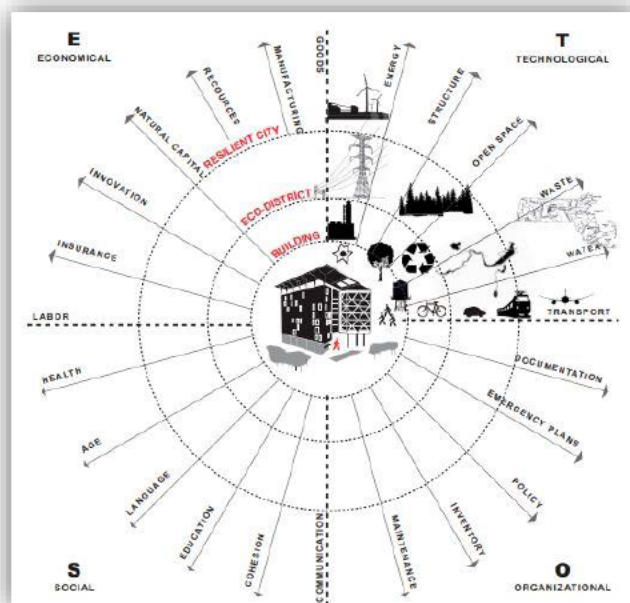


Figure 2.2.4.4 illustrating diagram of the three components of socio-ecological systems.

Source: Laboy, M. and Fannon, D. 2016

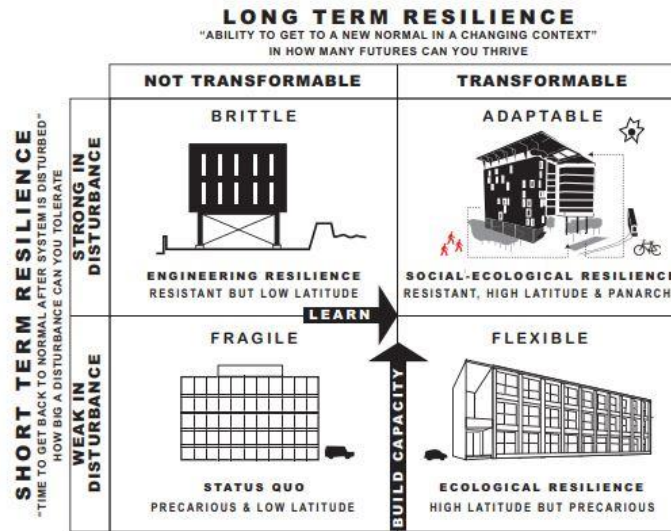


Figure 2.2.4.5 illustrating diagram of the three components of socio-ecological system.

Source: Laboy, M. and Fannon, D. 2016

2.2.5 INTEGRATING RESILIENCE, ADAPTABILITY AND TRANSFORMABILITY

The term resilience thinking or integrated resilience has manifested into a lens in relation to the environment where it has rather emerged as a lens for examination which allows a platform for interdisciplinary dialogue, collaboration and implementation. According to Folke, C (2006) urban integrated resilience is seen to be an educating capacity to further sustain environmental development in the face of anticipated and surprising change and diverse pathways for development and potential thresholds between those facets. Moreover, the evolution of integrated resilience is joined with social-ecological systems and the human environmental envelope Folke, C (2006). The Author establishes that

integrated resilience as a conceptual framework which is focused on the adaptability and transformability of complex adaptive social-ecological systems which stem from the individual, to community, society as a whole, are rooted as one within the built environment Figure 2.3.6.1. Through observation, one can see a connection between adaptability and transformability within integrated resilience through achieving sustainability within the urban fabric (Figure 2.3.6.2.) Furthermore, within the integrated resilience phenomenon, the need for the improvement of human well-being for people and the universe is framed within a context whereby one can understand and govern existing complex social-ecological dynamic forces for sustainability on an urban scale where finding ways for people and institutions to govern social-ecological dynamics can be achieved locally and across on all levels and scales globally Folke. (2006).

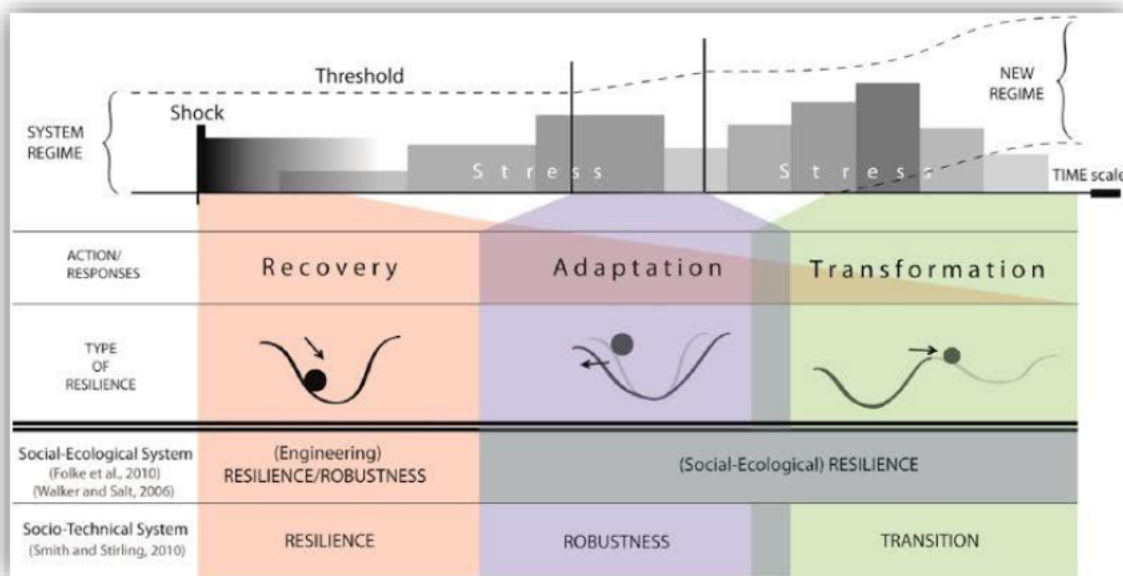


Figure 2.3.6.1: illustrating Urban Resilience, Adaptability and Transformability.2010

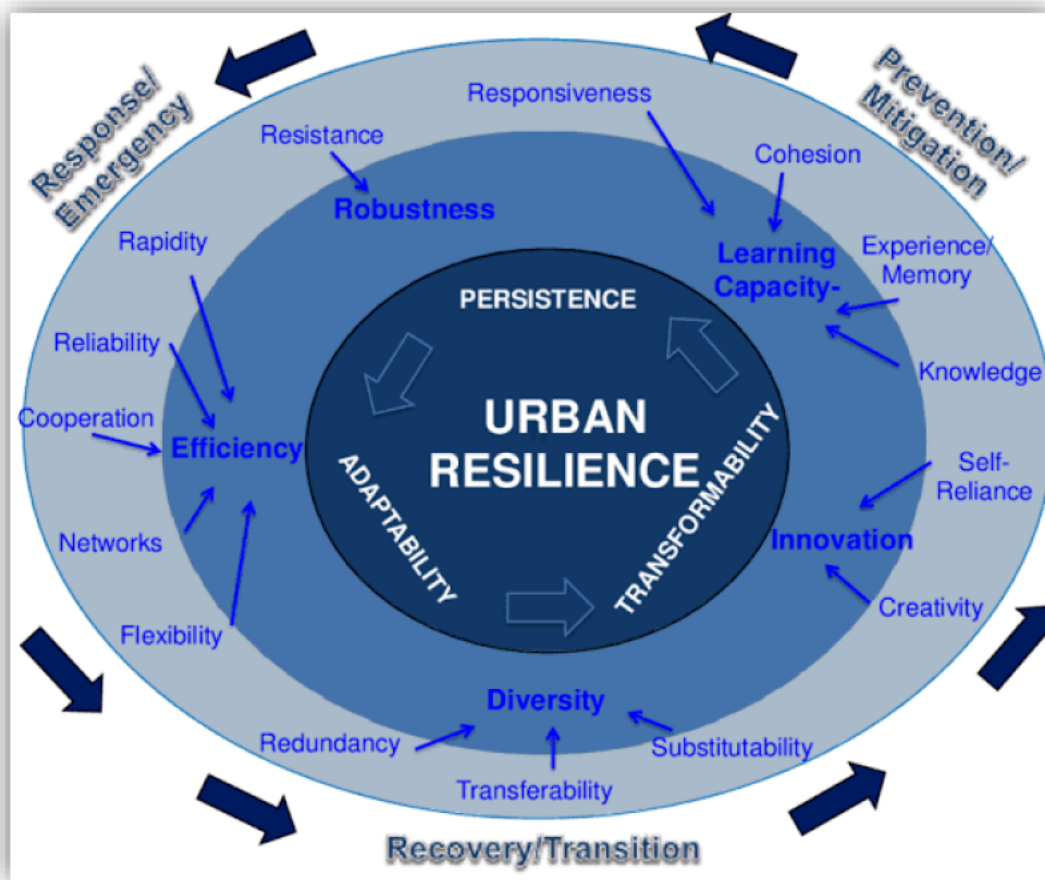


Figure 2.3.6.3: illustrating Urban Resilience, Adaptability and Transformability.2006

The phenomenon of integrated resilience is an approach where it tends to reflect the ability of inhabitants, communities, societies, and cultures to coexist and develop with change Folke. C (2006). Furthermore, Olsson at el (2006) views the concept of integrated resilience as a persisting change on the current path of development within the built environment where adapting, improving and innovation are seen as a method to continue to learn, self-organize and to further develop dynamic environments that are faced with unexpected circumstances or disturbances. On the other hand, Cummings at el (2013) suggests that the system of integrated resilience has become too robust and rigid in manner whereby the challenge is to break the current threshold system of resilience that exists to

allow for a shift within the current pathways that coexist in the environment into new alternative means that attract new pathways of resilience Carpenter and Brock (2008). It is through transition that these new pathways of integrated resilience may be smooth or somewhat ground-breaking Scheffer and Carpenter (2003). Moreover, the author suggests that a possibility of resilience unfolds in a manner of which it declines however, for this shift to occur a smaller disturbance may arise where it can push the current system of integrated resilience into a different regime Scheffer and Carpenter (2003). According to Walker et al (2004), folke et al (2010) urban integrated resilience can be seen as a dynamic and vast concept which focuses on inhabitants being able to persist with change and evolve from that change within an environment. Furthermore, the author singles out that resilience as an embedded system may which absorb a certain disturbance within the environment while undergoing that change nonetheless retaining its similar function, structure and therefore its identity in order for it to sustain that particular change within the urban fabric.

One must recognise that adaptability focuses on how to evolve from a certain change within a system whereby human actions that sustain development result in adaptability. Moreover, integrated resilience identifies the capacity of people in a social-ecological system where learning, combined experiences, knowledge, innovation and adjustments to responses to changing external drivers and processes defines the concept of adaptability within the framework of integrated resilience Walker et al (2004). Furthermore, Berks et al (2003) argues that adaptability as a concept through integrated resilience is fundamental to persistence whereby it can turn changes and surprises into opportunities which plays an integral part of social-ecological resilience. Informal settlers within urban areas can be seen as thresholds within a system to influence resilience through adaptability.

According to Walker et al (2004), and Folke et al (2010) transformability is defined as the capacity of new system when ecological, economic and social structures within the built environment make the currently existing system unsustainable. Moreover, transformability can be seen as shifting development into new pathways of approach where on other levels and scales it is the driving force for resilience Marshall et al (2012). Therefore, the author argues that it is through crisis where open space for transformation may transpire in new ways of operating or thinking Folke et al (2009). According to Chapin et al (2010) the urban resilience approach towards transformation is more or less set back from the ideologies of planning and controlling conditions however, its about preparation for opportunities to transpire or creating living conditions for that opportunity of transformation within the built form. Moreover, this approach within the built environment allows for a new identity of social-ecological systems to develop through the process of individual interaction, communities, and societies within all realms and facets across all scales through development Cumming and Collier (2005) and Folke et al (2010). This process involves or allows platforms for encouragement grounds for facilitating different transformative experiences at small scales whereby cross-learning and new enterprises emerge on an urban scale on a sustainability perspective which can sustain societal development and human well-being Wesley et al (2011). Therefore, if one enhances resilience the transformation approach can be seen as one of stability where these social-ecological systems may present opportunity for change Chapin et al (2010). Moreover, Moore et al (2014) and Park et al (2012) suggests that within the social-ecological system of transformation comprises of several different ways in the approach of transformations within the urban fabric.

The container mall within Christchurch city in New Zealand became an iconic cornerstone of the existing city centre during the rebuild phases of the area resulting from an earthquake disaster. The idea of a temporary or transitional shopping district was implemented after the ordeal of an earthquake that transpired within the heart of New Zealand. The idea of this temporary space demonstrates a sense of economic value of urbanism and resilience where it becomes a supporting mechanism for the central city retail economy. Moreover, it is through adaptability and transformation within environments where inhabitants persist with ever growing change resulting from certain disturbances within communities, and societies on an urban scale Folke et al (2010).



Figure 2.3.6.2: Illustrating the location of New Zealand and Christchurch.



Figure 2.3.6.3: illustrating The Re: Start Mall, a temporary container mall located in Cashel Mall, adaptability and transformation transpired from a certain change within a system resulted from an earthquake. 2013

2.2.6 CONCLUSION

This subsection of chapter 2 explores conceptualizing of urban resilience as a dynamic concept which is reflected in the characterisation of community resilience as the existence, development, and the engagement of community resources by members of the community whom thrive within environments which are characterized by change, uncertainty, unpredictability, adaptation and transformation Margis et al. (2010). Moreover, the focus on complex adaptive systems are interconnected to social-ecological systems of inhabitants, communities, economics, societies, cultures interrelating across spatial scales with consideration of eco-systems which form part of the environment (biosphere). Furthermore, social-ecological resilience acknowledges that buildings exist in dynamic relationships between the natural environment, human practice and urban space.

2.3 THEORY OF EMPOWERMENT IN COMMUNITY AND TRANSFORMATIVE LEARNING

2.3.1 INTRODUCTION

Empowerment is the process of building the autonomy, confidence, power and the means to enact transformation for a meaningful future for inhabitants within the built environment. The term empowerment originated from American community psychology and is allied with social scientist Julian Rappaport (1981). The roots of empowerment theory encompass further into history a link to Marxist sociological theory (also known as Critical Theory), forming a perspective called “*conflict theory*”, highlighting that a capitalist society is based on inequalities between the working class and the ruling capitalist class resulting in a struggle between social classes as illustrated in figure 2.3.1.1. The theory is seen as an approach to social philosophy which focuses on societal and cultural aspects to reveal, investigate and challenge existing power structures resulting from social problems. He identifies the theory as a key concept in endorsing civic engagement. Rappaport (1984) defines the theory as one which is viewed as a process or mechanism by which people, organizations and communities gain mastery over their lives. Moreover, this theory recognizes that oppression is the key primary contributor to disempowerment, which is encountered across a number of marginalized groups in the built environment we inhabit. The theory seeks to empower individuals and communities to better improve personal and political power to better their livelihoods and strive to challenge systems that hinder these groups from attaining their needs Martinez (2022). She identifies the theory of empowerment on a social platform which looks at both the individual and collective level.

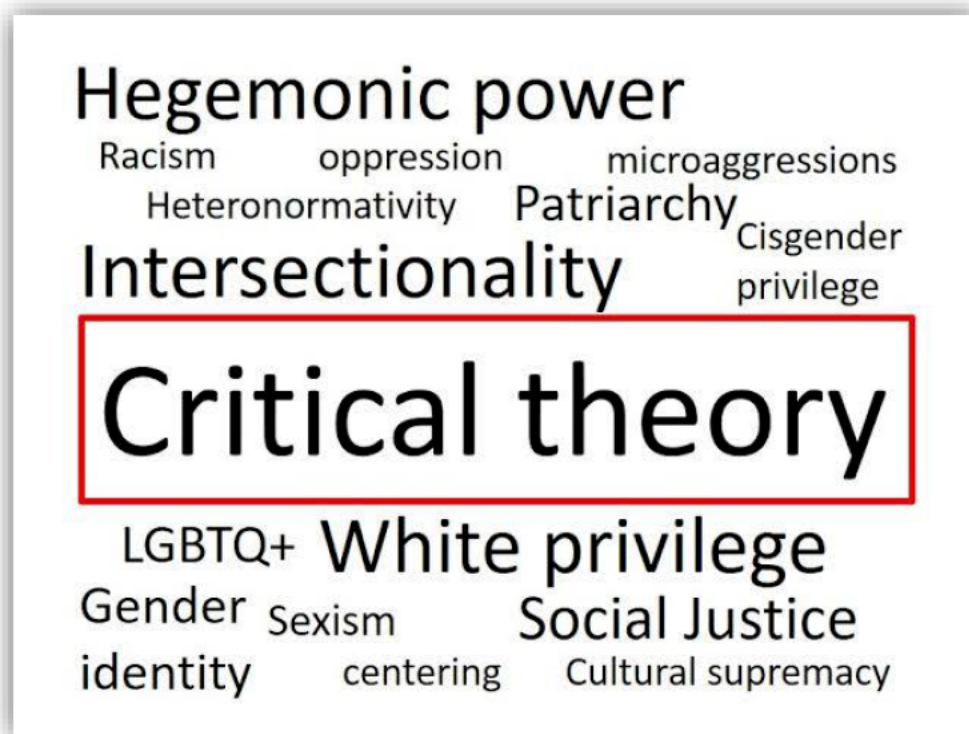


Figure 2.3.1.1 illustrating the Marxist sociological theory known as Critical theory.

Source: Martinez, 2012

Individual level

On an individual level, social empowerment expresses the need for gaining resources to make personal choices and other decisions which allow the human individual to control the environment we inhabit.

Collective level

On a collective level, social empowerment associates organizations and institutions which support marginalized groups of individuals through gaining resources to be empowered, such as economic opportunity, social belonging, material assets and educational assistance.

On an urban scale, the outcome of social empowerment is to give those individuals who lack access to these resources a sense of identity, community and security to thrive and to eliminate systems within the environment which disseminates marginalization. Furthermore, the theory provides a framework for identifying marginalized individuals and communities within the built form to thrive to instil certain skills, such as education, resources and community engagement in these groups Martinez (2022). The theory of empowerment identifies a five-step framework to aid marginalized groups or communities:

- Identify problems
- Define strengths
- Set built environment goals
- Implement interventions
- Evaluate success on a collaborative level

To further understand community engagement within marginalized groups within the built environment, the concept of alternative knowledge systems in society, individuals and collectives gaining a master over their lives through adaptation and seeking new avenues of skill development (learning processes). The need to consider the struggles faced by individuals and collectives for social justice and empowerment are centred around the concept of changing power relations towards equality within the urban fabric Rappaport

(1981). On an urban scale, roots of the theory of empowerment in the 1960's is exemplified through activism through assisting oppressed groups by changing the social structure of societal relationships between groups helping individuals and collectives to take control of their own lives.

According to Parsons (1981), the theory of empowerment is broken down into three themes:

- Empowerment is seen as a developmental process which starts from the individual growth of a person thus bringing social change.
- Empowerment is noticeable through heightened feelings of self-esteem, efficiency and control.
- Empowerment may lead to a sense of liberation, resulting from social movements and protests through an educational and politicization of immobilised people in a collective attempt to gain power and change existing oppressive structures.

2.3.2 THRESHOLD CONCEPTS IN TRANSFORMATIONAL LEARNING

Physical learning from the individual or collective requires walking into the unknown, where space appears in transformation learning. To further understand learning within communities, threshold concepts in transformational learning and educational based settings builds on the ideas of learning experiences of individuals in which both learning

and the learner are transformed Land. F, Meyer J. H. F and Baillie. C (2010). Moreover, this concept embodies a transformed way of understanding, viewing something, or interpreting without which an individual learner cannot develop. Authors Land. F, Meyer J. H. F and Baillie. C (2010), suggest that these learning thresholds can be seen as reference points at which individual and students experience difficulties. Moreover, transformation is a transition over a period of time to understand knowledge insight involving troublesome knowledge of understanding. The authors further argue that thresholds in learning depend on the context where knowledge might be troublesome because it is seen as method which is ritualised, inert, conceptually challenging and tactic Land. F, Meyer J. H. F and Baillie. C (2010). A new understanding of knowledge enquiry, the learner crosses over an intangible boundary into a new conceptual space or reality of a post liminal state of being in which both learning and the learner are transformed Land. F, Meyer J. H. F and Baillie. C (2010). The characteristics of threshold concepts and learning thresholds are viewed as a drive towards the pre-liminal, liminal and post liminal state which are represented relationally as seen in figure 2.3.2.1. The liminal stage of learning can be applied in the built environment where spaces of reflective thinking by act of doing suggests fostering spaces for transformation (design) in response to the environment through a participatory experience between other spaces of shared learning through integration. Author Zimmerman (2008) describes liminal stage of learning as one of transition from one to another, in learning.

Transformative learning is seen a process of constructive as well as meaningful learning that extends past simple knowledge acquisition, supporting critical ways in which learners, individuals and collectives consciously give meaning to their lives. Moreover, it leads to

reflective changes in our feelings, thoughts, perspectives, behaviours and beliefs creating a radical shift which enduringly alters our way of being in this universe we inhabit. Author Zimmerman identifies Transformational learning as a theory as one which consists of three dimensions:

- Psychological (changes in understanding of one's self)
- Convictional (reconsideration of belief systems)
- Behavioural (changes in lifestyle)

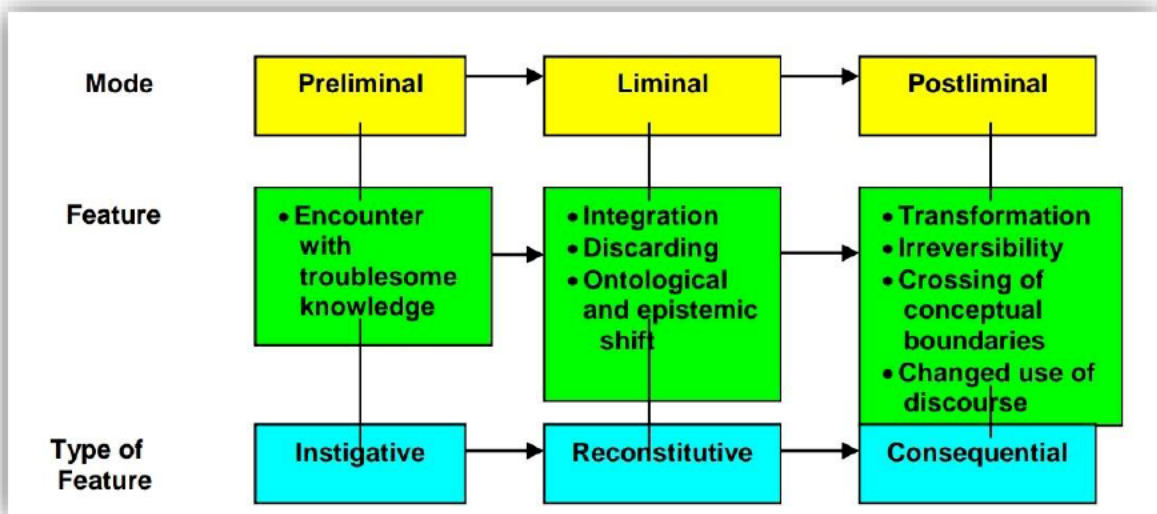


Figure 2.3.2.1 illustrating a rational view of the structure of threshold concepts. Author:

Land. F, Meyer J. H. F and Baillie. C (2010).

2.3.3 ALTERNATIVE KNOWLEDGE SYSTEMS

During the 21st century, an ‘age of knowledge’ between waste management and waste reclaimers has played a fundamental role in providing these waste pickers and collectors with opportunities to integrate economic, environmental, social as well as technological methods as they further define or develop their technical literacy in the form of manipulative skills (learning) within the built environment. Furthermore, Author John Williams and Kay Stables (2017) exemplifies the concept of alternative knowledge systems as a framework which identifies a clear role for analysis in the context of technological education related to technology, product, process or material as seen in figure 2.3.3.1 and figure 2.3.3.2. On an urban scale, technological education in the form of waste picking should accommodate indigenous knowledge systems which reflect different knowledge forms existent in the vast changing world we live in today. Moreover, these different knowledge forms in terms of learning are informed by diverse cultures and contexts of African cities. It is through indigenous knowledge forms within the urban contexts of cities to give rise to such knowledge forms which help sustain societies within densified urban fabrics. Author John Williams and Kay Stables (2017) comprehends that it is through such knowledge forms where one can examine technology as an aspect driven by culture and is predominantly practical in nature (alternative knowledge systems). Moreover, informal waste recyclers extract salvaged materials with a positive market value from different fragments of the waste management system within the built envelope.



Figure 2.3.3.1 and 2.3.3.2 illustrating the idea of how waste reclaimers and the scavenging of waste material connect as a form of alternative knowledge systems as a means to adapt or survive by Author, 2022

2.3.4 COMMUNITY LEARNING PROCESS- WASTE AND ARCHITECTURE

During the 20th century, the relationship between architecture and waste collection centres developed from the relationship that transpired between architecture and the industry within the urban fabric. Moreover, in recent years according to author Kara H. (2017) many architects have rather developed important structures of prominence whereby a transformation of an “ugly” space into the form of an opportunity of making these mundane waste collection centres more human (Kara H. (2017). On the other hand, the urban growth in most African cities is expanding rapidly due to the increase in population of its inhabitants. This is caused from the rapid urban sprawl of urbanization within expanding cities. Moreover, thinking about architectural responses as a broader understanding and process first requires the individual to reflect on the role of architecture in urban transformation. It is possible to shift focus towards a new way of distinguishing architecture as a device for change and social cohesion through waste architecture for the community Maria Luna (2018). Author Maria Luna explores the main idea of waste architecture for the community as one to conceive waste recycling centres as not only being for their function but then again for public spaces for the community within the urban context of cities as illustrated in figure 2.3.4.1.

Author Kara H. (2017) highlights that the idea of architecture on a built environment perspective can add more value in the design of waste management facilities, specifically those in urban cities where rapid urbanization manifests. Moreover, waste recycling centres can be apprehended as spaces not only as services for the public but facilities which can be associated with new types functions within its typological structure such as laboratories,

market, exhibition areas and room for educational activities. Nonetheless, within the built form associated with recycling collection centres are seen as one which are located in the city on an urban scale. Therefore, it is through social integration within an urban fabric to integrate this inconvenient function (recycling collection centre) within the city centre as well as in urban contexts, connecting these mechanical eco-systems with other activities intended for community use which can be integrated with the existing function and size of these recycling collection centres specifically in urban areas. Moreover, the existing function of these waste recycling collection centres are seen as spaces of contamination as inconvenient functional spaces for inhabitants in cities however, can increase the social values and aspects of these places through connecting the informal settlements within urban areas to the formal city through waste architecture for the community Kara H. (2017). Therefore, it is through the citizens, the economy and the environment that make these essential elements crucial within the urban fabric. Moreover, public spaces for community participation and waste house a dialogue for engagement to learn from trash as an integrated community learning process within the built urban fabric as seen in figure 2.3.4.2. The current isolated and linear process of waste management and the lifecycle of trash deteriorates rapidly within landfill sites adding no value on waste and a disconnected relationship between waste, the environment we inhabit and architecture. The theory of waste and architecture will be used in the research, to investigate the interlinkages and relationship between waste management, architecture and urban space. It will be used as justification in bridging the gap between waste and architecture fostering spaces for community engagement through integrated learning processes (waste management) within municipal landfill sites and the urban fabric.

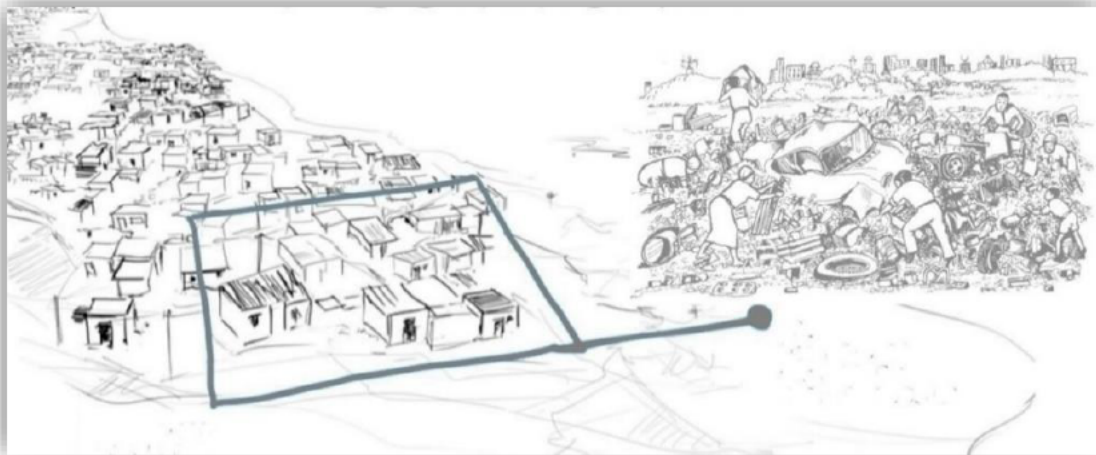


Figure 2.3.4.1 illustrating sketch of the idea of connecting waste and the community in urban areas by Author, 2022.

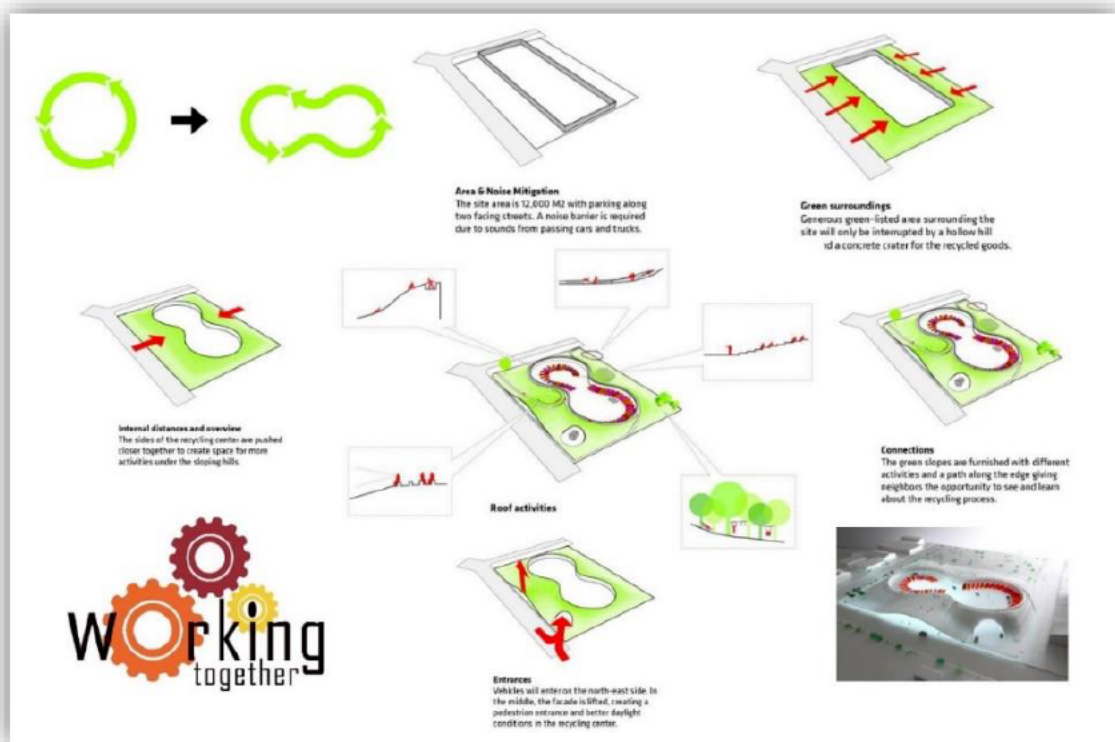


Figure 2.3.4.2 illustrating sketch of the idea of connecting waste and the community in urban areas. Source: <http://www.archdaily.com>

2.1.5 CONCLUSION

This subsection of chapter 2, clearly highlighted that the theory of empowerment and community and transformative learning within the built form identifies this process as a means of transformation within existing communities through providing a social platform through empowerment on an individual and collective level which people, organizations and communities gain a sense of mastery over one's lives. Moreover, the theory focuses on individuals and collectives within the built environment specifically the waste reclaiming community within urban settings highlights that transformative learning and spaces(design) to further develop individuals and collective groups within the environment fosters technological education in the form of learning and skills development for the less privileged. It is clear, in response to waste and architecture as a community learning process drives the concept of alternative knowledge systems to integrate economic, environmental, social as well as technological methods that is discussed in this chapter, in an urban setting where an ugly space such as a recycling facility can be transformed into a space of opportunity through public participation and dialogue to further learn about waste and its process within the built environment.

CHAPTER 3

KEY PRECEDENT STUDIES (INTERNATIONAL).

3.0 INTRODUCTION

The sub section below in the form of precedent studies critically selected will further comprehend the ideologies that are cited from the previous chapters and to contextualise an understanding of the concepts as well as the theories in relation to its context. The objectives of this chapter are to explore Western building typologies that are best articulated to highlight the principles, theories and concepts mentioned from the previous chapters of the discourse. In addition to this, the chapters explore a succession of 3 precedent studies that will help aid an understanding of the research topic mentioned in the previous chapter. Furthermore, because the research attained aims to contextualise urban resilience in African cities through shared spatial dynamics of environmental injustices within the built form make the study relevant to African cities. The selection criteria of the relevant precedent studies are influenced by the primary question of the research and the topic cited from the previous chapters. The first precedent study explores the concept of urban resilience, the spatial hierarchy of contested spaces in the built envelope (hybridization). The second precedent study explores the idea of architecture integrating the environment and waste management to facilitate waste architecture for the exiting communities in an urban western centric context. The third precedent study explores the influence of recycling on community architecture which facilitates public spaces through architecture of re-use and landscape restoration which focuses on an existing landfill site within an urban context. On the other hand, all relevant precedent explored in this chapter are uniquely diverse and provide alternative perspectives in how different typologies respond in different contexts on a community level through utilizing waste management and its influence on community architecture as well as identifying typologies which explore the driver of the research discussed in the previous chapters of the document.

3.1 ARCHITECTURE OF URBAN RESILIENCE, HYBRIDIZATION AND URBAN INFORMALITY: TORRE DAVID- INFORMAL VERTICAL COMMUNITIES.

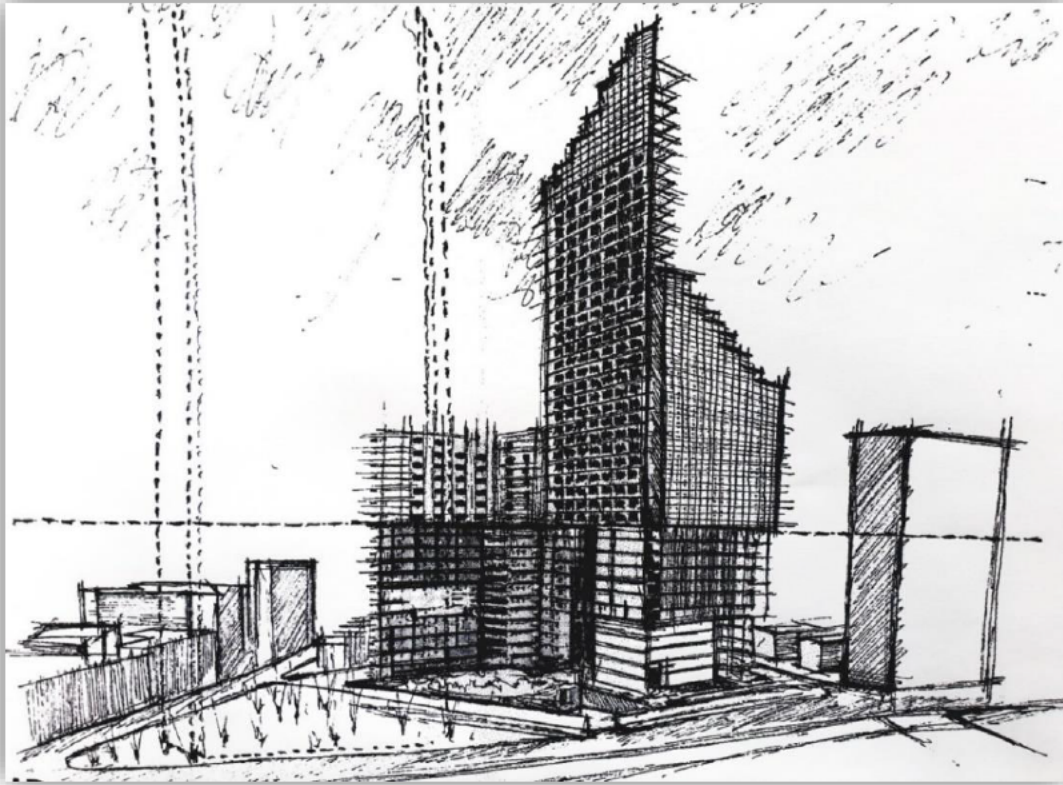


Figure4.1 illustrating the Torre-David Tower- informal vertical communities which was initially designed as a bank. Source: Urban -Think Tank, 2012

3.1.1 INTRODUCTION

The building typology will look at architecture of urban resilience, hybridization and urban informality in the peri-urban area of Caracas, Venezuela through inclusive innovation and adaptive re-use design which is driven by the key concept mentioned in the previous chapters of the discourse. The Torre David-informal vertical communities tower was intended to be designed as a bank for the inhabitants of the city which bridges the gap

between informal settlements and the formal city through the design of a freeway linking both contexts. Moreover, the tower was regarded as an informal vertical slum which was abandoned by its own government and as a result of the density of the population the users invaded this architectural space and adapted the spaces into their homes as their own. Moreover, the building typology of the tower within the informal city of Caracas, Venezuela stretches like fingers, reaching towards the urban center or metropolis of Caracas. There is a clear division between the rivers of the city and the actual highways and this in a sense separates the informal cities ends and the barrios (slums) Figure 4.1.2. Moreover, the informal, formal city ends as well as the barrios form a disproportional urban fabric which deprives residents as a result of the disproportioned exposure of vulnerable communities.

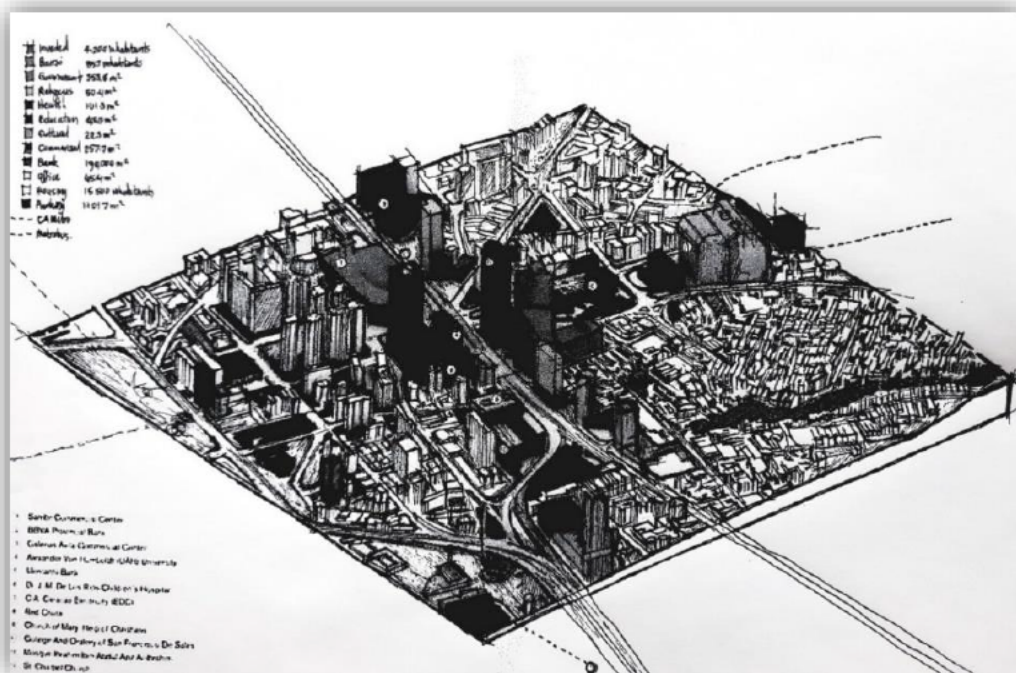


Figure 3.1.2 illustrating the informal city of Caracas, Venezuela which is divided by a bridge separating the formal city to the barrio's (slums). Source: Urban -Think Tank,

3.1.2 JUSTIFICATION OF PRECEDENT STUDY

On an urban scale, although the typology of the design differs from the topic variable of the discourse, the Torre David Tower exemplifies the lens within chapter 2 and 3 of the dissertation. In the city of Caracas, architectural hybridization is evident through the occupation of formal buildings from the 20th century modernity whereby the actual occupation of these spaces is led by inhabitants of poor communities who reside from *barrio's* (informal Slums) Urban informality in Caracas, Venezuela and other cities around the world due to the experience of rapid growth as a result of the migration and dense population of people seeking for a better economic opportunity. Furthermore, approximately forty percent of the inhabitants of the capital city of Venezuela, Caracas, live in informal settlement 'slums'. As a result low income inhabitants of the city find themselves invading vacant buildings within the city therefore creating a vertical slum. This is due to a failed system of economic, social, environmental challenges that are faced by the government through environmental spatial justice within an urban resilient community. Caracas located within a valley and dense topography, the once vacant land of the city has become restricted, as the population growth has increased. Venezuela as a whole is prone to floods and landslides as a result the rain destroys the various areas that people inhabit thus, resulting in hundreds of people without shelter or homes. Furthermore, with the issue of loans being limited due to these natural disasters less land is available to be invaded by the user because of the tolerant attitude that the government has towards the idea of invasion and illegal takeovers. As a result squatting has become one of the only options for low cost-income living for the inhabitants of Caracas (Lopez, 2011). The poor inhabitants of Caracas decided to invade abandoned buildings and structures that were unfinished. As a form of response to address a solution, the government of the city obligated that most of the

buildings that are vacant are to be free accommodation for the homeless people thus, encouraging these invasions of abandoned buildings within the city to thrive.

3.1.3 LOCATION AND BACKGROUND CONTEXT

Architect: Enrique Gomez and Associates

Client: J. David Brillembourg, Corpolago C.A

Size: 121,741m²

Location: Torre David- informal vertical communities, formal city of Caracas, Venezuela

Background Context: The Torre-David -informal vertical communities tower is situated in the heart of Caracas, Venezuela which is in the business district of a metropolitan city in the formal suburb city of Caracas, however it houses informal settlements that divide informal barrio settlements and the formal city separated by a freeway in and amongst the city centre and business district of the town , with a large span of shack dwellers operating the spatial configuration of the urban context through the invasion of buildings and the inhabitants that reside in the areas of Caracas arise from marginalised environments (barrio's) due to the spatial planning laws of the post-colonial Spanish colony (Figure 3.1.3).

3.1.3.1 World map, locating the South American continent. (image by author, 2020).

3.1.3.2 Map of Venezuela locating the city of Caracas. (image by author, 2020).

3.1.3.3 Map of the city of Caracas. (image by author, 2020).



Illustration 3.3.3.1- 3.1.3.3 Map locations of the precedent study. Source:

<http://earth.google.com>



Figure 3.1.3 illustrating the site plan showing the locality of Torre David- Vertical

Tower. Source: Urban -Think Tank, 2012



Figure 3.1.3 illustrating freeway divides both the formal city and informal barrios of caracas. Source: Urban -Think Tank, 2012

3.1.4 HISTORICAL AND SOCIAL CONTEXT OF PRECEDENT STUDY

Caracas, Venezuela is a post-colonial city which was established in 1567 whereby it gained full rights to independence from former Spanish colonial dictatorship. The Torre- David tower situated in the heart of Caracas, Venezuela was seen to be a country with relatively high standard of life and living. This country was one of the richest countries that produces oil, thus this attracted many immigrants. The Capital city of Venezuela, Caracas, this was one of the most modern and attractive cities of the region of South America. This city bloomed and became a metropolis and this was showcased within its buildings and impressive highways. Caracas experienced a rapid shift in growth as a result of the migration of people from other parts of neighboring countries looking for better economic opportunities. During 1968, Caracas had about 1.1 million habitants and this has increased to 4 million in 2013. This shows a rapid urban growth within the city of Caracas and this

urban population growth was not only because of the rural migration but this was also due to the arrival of thousands of immigrants looking to be part of this metropolis oil boom of Venezuela. Furthermore, approximately 40% of the inhabitants of Caracas live in self-built informal settlements. As a result of this rapid growth and density the poor invaded public and private land to build shacks, and over time this manifested to form relatively successful neighborhoods within the city of Caracas. Moreover, most of the informal settlements are located within the heart of Caracas however, the city once experienced devastating floods which was a common occurrence that threatened the actual stability of the barrios and the safety of the residents of the city. These barrios were situated on the hillsides of Caracas, a rather neglected part of the city where poverty flourishes due to the failed economy that once bloomed in the city of Caracas, the demands and needs of the people were not met due to the greed of unstable political system that was in place this was mainly because the city was once under colonial rule. Furthermore, in response to the devastating crisis of floods offered up space for the homeless people that reside in Caracas and these invaded buildings were mostly government owned buildings. In the above statement there is a clear concept of, 'urban rearrangement' where people or the social structures within Caracas start to take ownership of these lost spaces that have been abandoned by its own government. To further support this argument further estimated 155 office, apartment, and government building in Caracas were occupied by squatters, and among this building was Torre David tower (Figure 3.1.4.1).

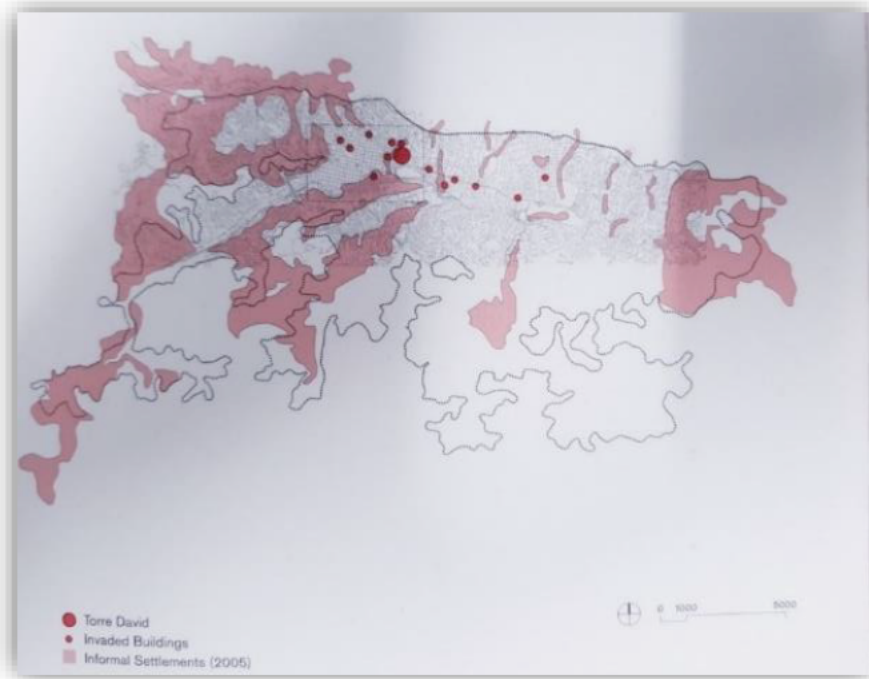


Figure 3.1.4.1 illustrating the number of invaded buildings and the spatial configuration of the informal settlements. Source: Urban -Think Tank, 2012

3.1.5 ARCHITECTURAL ELEMENTS OF THE DESIGN

In total around sixty percent of Caracas' population lives in the barrios, and this covers less than forty percent of the cities land which is not occupied. The partly finished Torre David vertical slum is the third tallest building which resides in Venezuela. This building comprises of five structures that actually compose this vertical slum complex. This comprises of the 'Edificios' residents of the complex A, B, K, parking garage and the atrium. The design implementation of the Torre-David tower forms part of the many high-rise buildings that were executed and positioned in such a way that the buildings were more orientated towards the city center. There is a distinct relationship between the built form and how it responds to its context. As a result, the high-rise buildings of Caracas would be situated within the lowest part of the cities topography and low-rise buildings would

disperse outwards because the topography was higher. Therefore, centralizing the building footprints on lower ground creates ease of construction but at the same time creating a central business hub districts (Figure 3.1.5.1) and (Figure 3.1.5.2). However, due to the government's lack of maintenance of these existing buildings within the area, the people forcefully moved into these vacant buildings because it was also close to the city center business hub. Therefore, ease of access to work would be more convenient since the vacant buildings that were abandoned were within the central node district of Caracas, and these buildings were built around massive highways that cut through the city center of Caracas. The urban foot print of Caracas was design around the transport network system were ease of access was needed to further gain access within this densely populated city of Caracas.

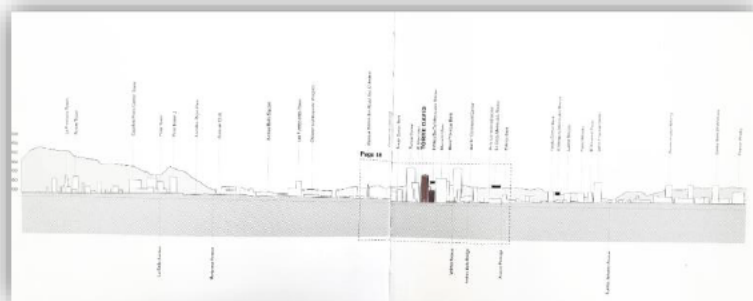
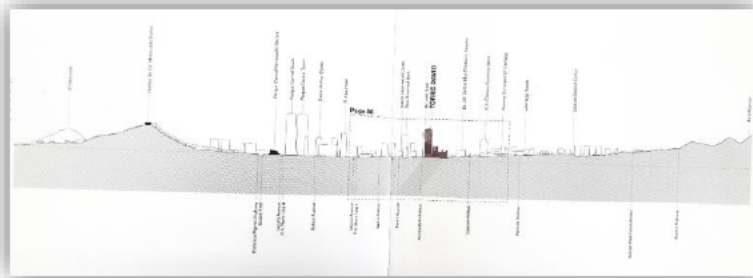


Figure 3.1.5.1 and Figure 3.1.5.2 shows how the built form emerges from the ground and sits perfectly within its context. However, it's clear that most of the built form is within the lowest level of the vast steep terrain that is Caracas. Source: Urban -Think

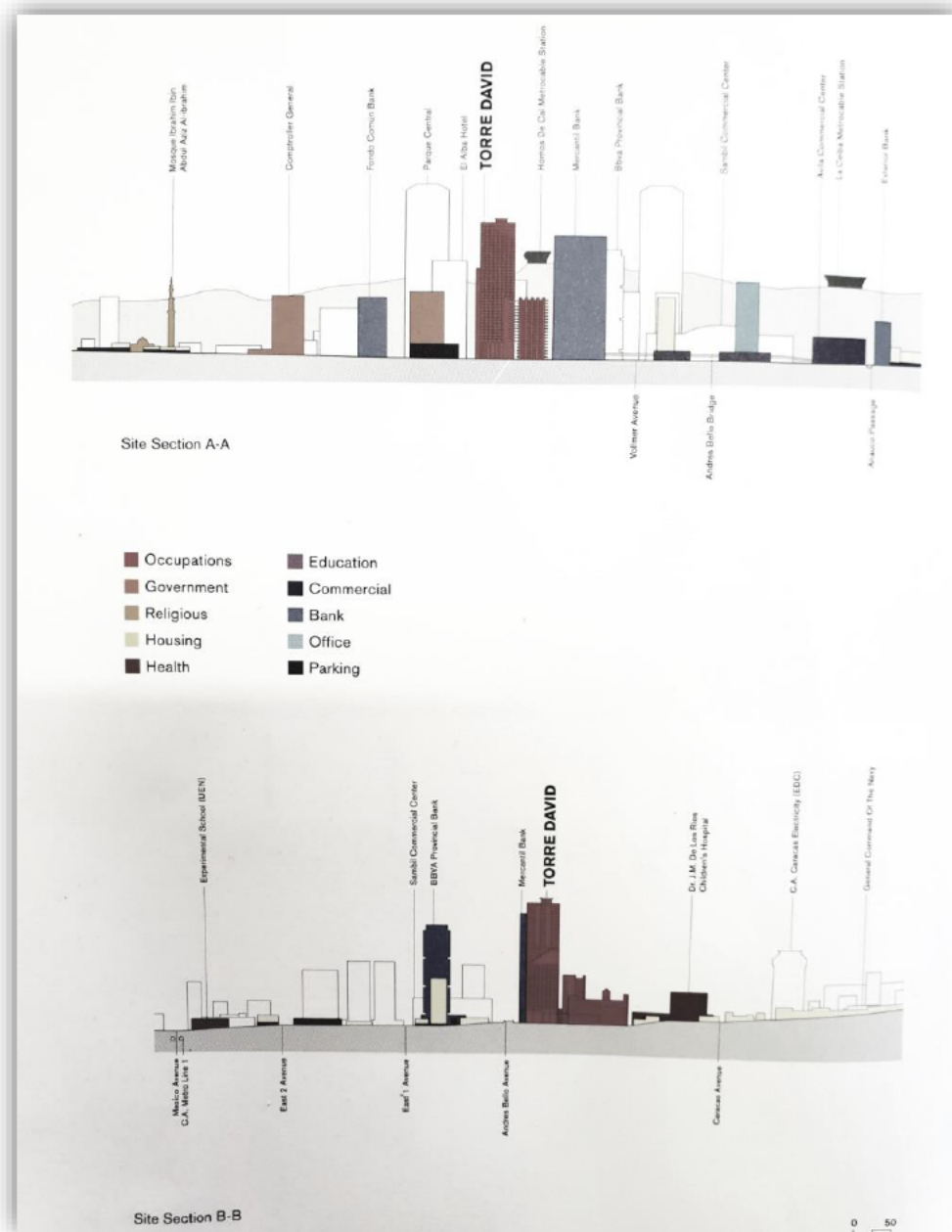


Figure 3.1.5.3 shows the diverse zoning typologies within Caracas, ranging from health, housing, religious, government owned buildings, building that have occupational, education, commercial, banks, offices and parking zones. This gives a clear indication that the city of Caracas indeed was transformed into a metropolis city due to the ever-demanding growth of the dense population that resides within this sub-tropical city. Source: Urban -Think Tank, 2012

The Torre-David Torre identifies spaces that have been used for adaptive re-use and spaces that have been invaded by the inhabitants of this vertical city. Furthermore, the spaces were occupied due to the immediate threat of eviction from the barrios and as a result its inhabitants began to explore the whole complex, evaluating the potential impact that these lost spaces can have on the people of Caracas. A form of community was formed through communal based initiatives from the residents of this building to clean and remove all the rubble that was accumulated since the towers abandonment. As a result of this, spaces were allocated for each family and this building currently houses over 700 families (Figure 3.1.4.2). Furthermore, a gradual step was taken in organizing the construction of balustrades and painted communal spaces and private apartments. This was achieved through group organization and hard work.

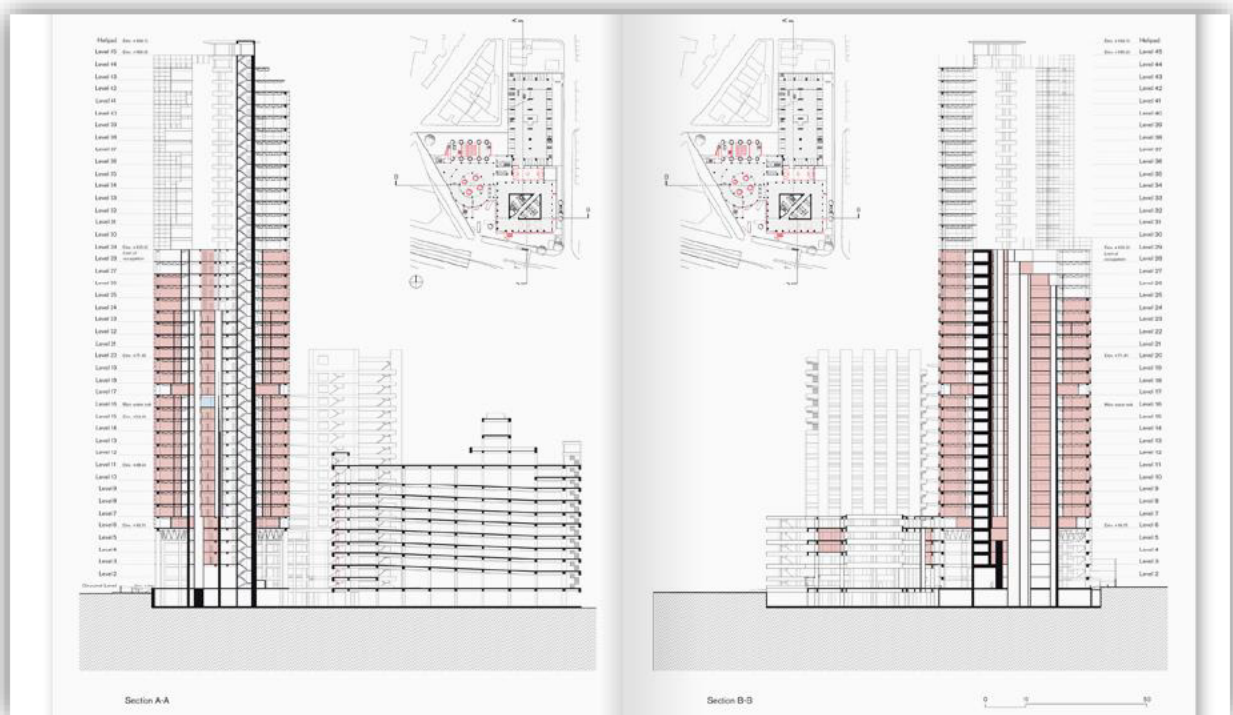


Figure 3.1.4.2 illustrates the integrity of the invaded spaces for people to inhabit through forced occupational activity. Source: Urban -Think Tank, 2012

The internal spatial configuration layout of the vertical tower has been repurposed for different function within its built form. Furthermore, how a bedroom unit can also be seen as a multifunctional space internally. This space shows how the grocery store as a functioning space is linked within the bedroom compartment as a means of income for the residents of Torre David (Figure 3.1.4.3).

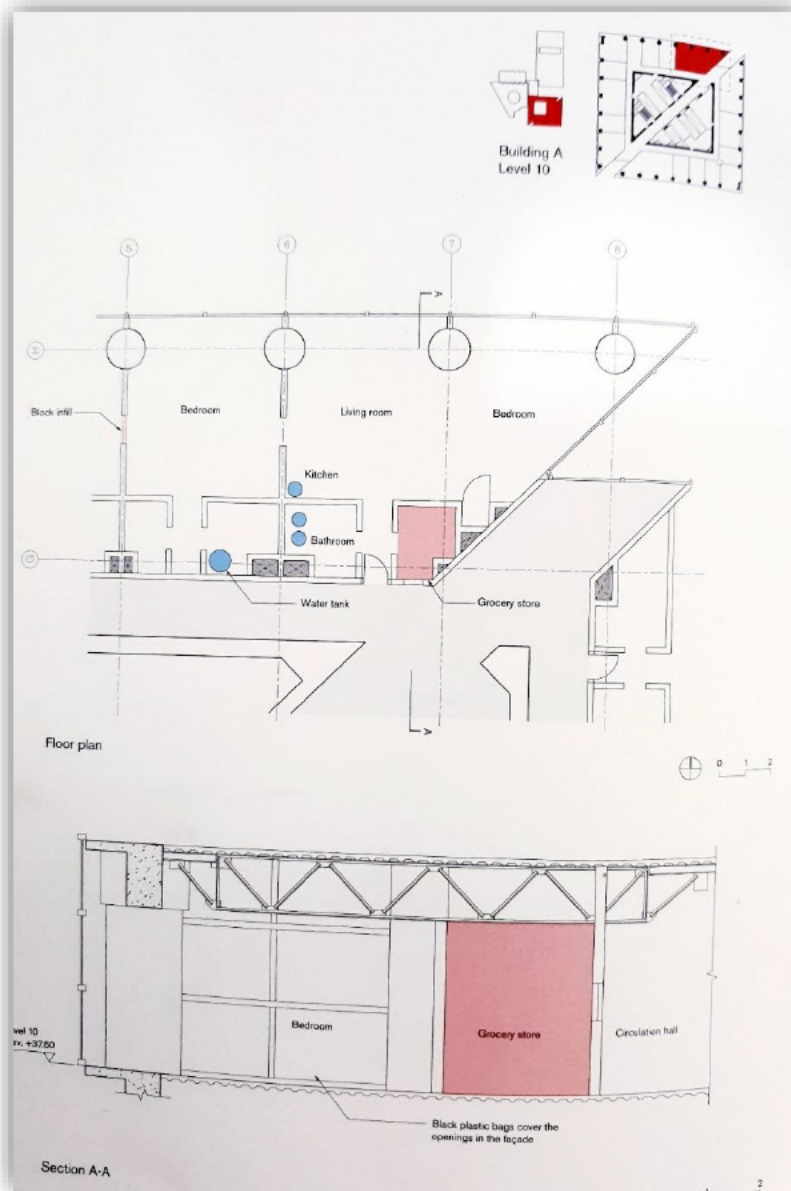


Figure 3.1.4.3 illustrates the spatial configuration of adapted spaces within the tower to house residences. Source: Urban -Think Tank, 2012

The internal space layout of the tower exemplifies spaces that have been repurposed for different function within its built form. Furthermore, how a bedroom unit can also be seen as a multifunctional space internally. This space shows how the grocery store as a functioning space is linked within the bedroom compartment as a means of income for the residents of Torre David.

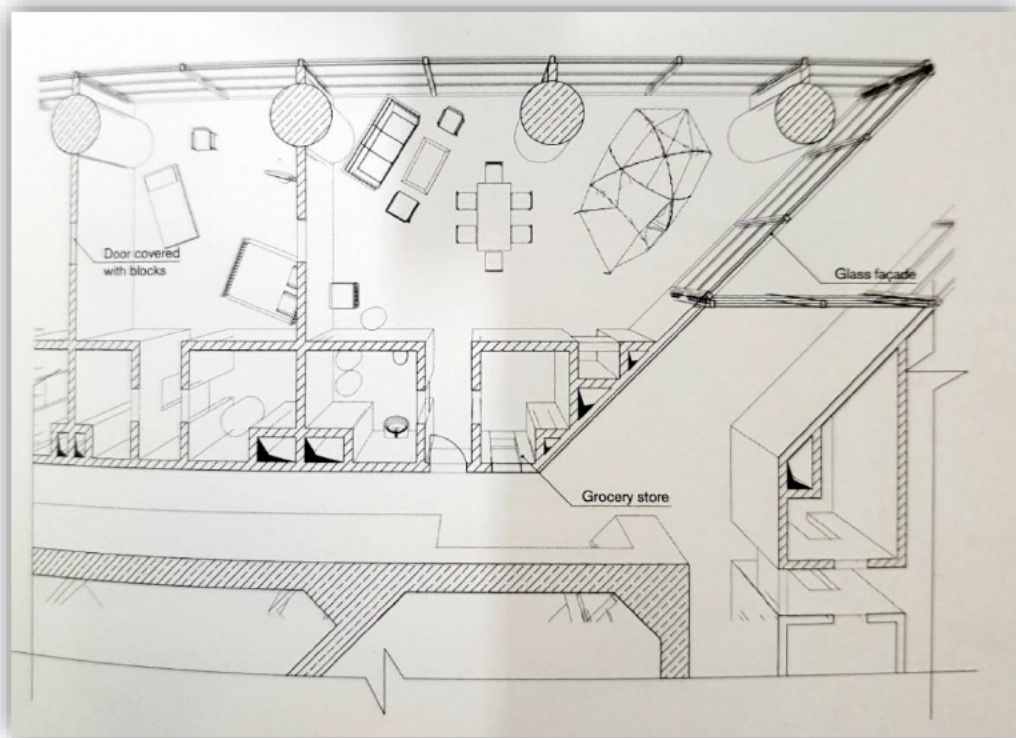


Figure 3.1.4.4 illustrating a typical bedroom layout housing different functions catering for the needs of residential inhabitants. Source: Urban -Think Tank, 2012

Torre David tower could be seen as a mixed-use building where the residents of this specific building have taken ownership of certain spaces to generate income and provide services for its inhabitants. A number of small grocery stores, are situated on different floor levels of the vertical slum where its inhabitants sell the necessary essentials, sparing the residents long trips to local stores in the vicinity of Torre David. Furthermore, the actual

tenants of this building control the prices in the stores from the ground floor up and this is controlled at prices that are regulated by the government. Other residents of this tower are also part of the entrepreneurial program that co-exists in the building and these range from hairdressing outlets, large grocery stores, salons, tailor shops and informal trading on the ground floor towards the street edge takes place as a means of income for those who are trying to make a living in this vertical slum. In a sense the buildings inhabitants for a sense of community where by entrepreneurial success of the individual that is selling is dependent on the residents that currently reside in these spaces (Figure 3.1.4.5). Through individual initiative and community participation Torre David is seen as a success in achieving its initial purpose and function for the people of Caracas.



Figure 3.1.4.5 illustrating the success of entrepreneurial stores within the buildings internal spaces. Source: Urban -Think Tank, 2012

3.1.6 CONCLUSION

For many years, the low-income residents of Caracas have lived on land that has been invaded in self-built dwellings. As a result, over the years the informal settlements have rather improved and are a typical example of communities that are able to thrive through participation and the will and desire to want equal and better opportunities for themselves. One seems to find that there are many positive elements in many squatters and settlements that are unauthorized, its inhabitants are able to make these improvements with no aid from the government. However, ‘Torre David’ is an unsustainable example of community development because of the negative leadership system that already exists in the tower and this in a sense mimics that of a prison in Venezuela. Furthermore, it is also important to understand that most of its inhabitants in other informal settlements in Caracas do not have occupancy of the land they currently occupy. However, there is a perceived land occupation security that the citizens believe which allows the householder to consider that the resources that are spent for the improvement of the existing dwellings is a good investment. ‘Torre David’ was seen as or intended to be a high-end office skyscraper in its initial design but instead it transformed and blended itself into a vertical slum in the sky. This was due to the illegal invasion of the building, knowing very well that its inhabitants could be evicted within any moment if the attitude of their government changes. The tower is facing too many challenges in this current day, as much as its residents appreciate the space provided to them and the availability of ease of public transportation within the area but the tower faces the possibility of further implementing effective design resolutions and solution due to the state that the building is currently in. Furthermore, issues such as crime, lack of elevator services, inadequate electrical and sanitary services are a major concern for its inhabitants. The concern for Torre David is about how an unfinished building or

dwelling, originally projected as an office complex, is now transformed to a residential complex however, the buildings proportion and types of service spaces that it was intended to house is not adequate for the conceptual ideology of an adapted re-use building (plug and play) which has been invaded by residential dwellers.

3.2 ARCHITECTURE OF RE-USE AND ADAPTATION: NORTH TRANSFER STATION.



Figure 4.2 illustrating the pedestrian side walk entrance to the building.

3.2.1 INTRODUCTION

The North Transfer Station is also well known as the North Recycling and Disposal Station and it is a municipal waste collection and distribution facility situated in the heart of Seattle. The North Transfer Station is a state of the arts re-use and recycle building which is designed to improve the customer's safety, increase capacity and efficiency and reducing noise and the odour smells from solid waste within the environment of Seattle. Moreover, the design of the waste facility is directed towards inhabitants on a community level and

includes sustainable elements of design such as public open spaces, green storm water infrastructure, and solar panels (Figure 3.2.1.1) and (Figure 3.2.1.2). In addition to this, the facility incorporates a new re-use and recycling design which helps reduce the amount of waste which is dumped within existing landfill sites in Seattle.



Figure 3.2.1.1 illustrating the disposal waste truck entrances and the design element incorporating solar panels on the roof.



Figure 3.2.1.2 illustrating public open space within the facility of the station.



Figure 3.2.1.3 illustrating the design elements for community use; public open space for inhabitants and play area for children.



Figure 3.2.1.4 illustrating the design elements for community use; public open space for inhabitants and play area for children.

3.2.2 JUSTIFICATION OF PRECEDENT STUDY

The North Transfer Station is an ecosystem within the urban community of Wallingford in Seattle, Washington, United States. The facility addresses the issues of waste management and tectonic industrial architecture responding to the cities landfill capacity. The precedent study is relevant to the findings of the theoretical discussion in the previous chapters of the discourse. The facility provides insight into adaptive socio-ecological systems interconnecting the existing built form of the urban area of Wallingford, waste management and an architectural response to an environmental issue focusing on the social, environmental and ecological aspect of waste management within the urban fabric. The design encapsulates the concept of merging architecture, nature and waste management in the built form tackling a rapid urban sprawl of waste in the waste management economy. The building is sensitive within its landscape, allowing for the public to learn from waste management as a visual experience through engagement, foresight and viewing.

3.2.3 LOCATION AND BACKGROUND CONTEXT

Architect: Mahlum Architects

Client: SPU (Seattle Public Utilities).

Size: 15,200 m²

Location: Located in the Wallingford neighbourhood near the Gas Works Park in Seattle, Washington, United States.

Background Context: The North transfer Station is situated in the heart of a the thriving neighbourhood of Seattle, Washington in a urban community near the shore of lake Union,

however it houses a dump site in between two residential suburb zones and amongst industrial zones where a transfer station dealing with waste originally existing within the community an industrial neighbourhood housing residential components , with a large span of working-class citizens operating the spatial configuration of the suburban context of Seattle (Figure4.2.3).

3.2.3.1 World map, locating the North American continent. (image by author, 2020).

3.2.3.2 Map of America locating the city of Washington. (image by author, 2020).

3.2.3.3 Map of the city of Washington-Seattle. (image by author, 2020).

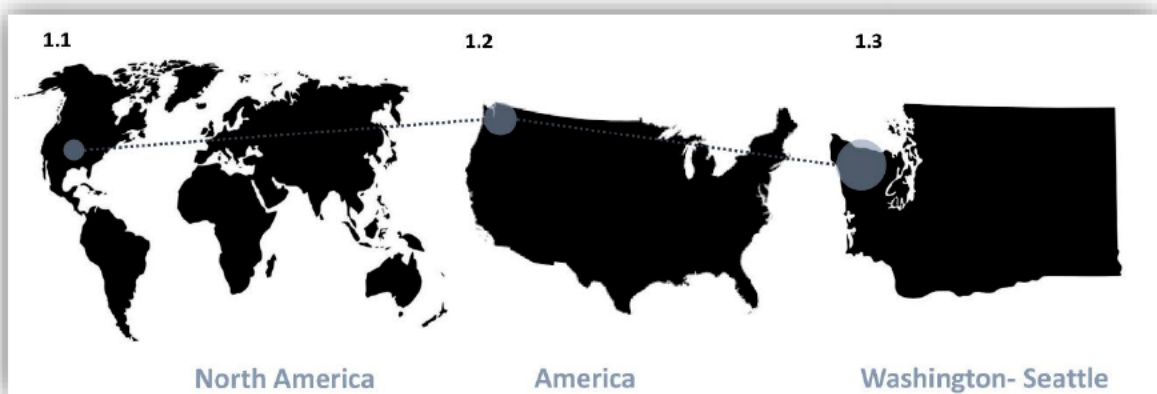


Illustration 3.2.3.1- 3.2.3.3 Map locations of the precedent study. Source:

<http://earth.google.com>

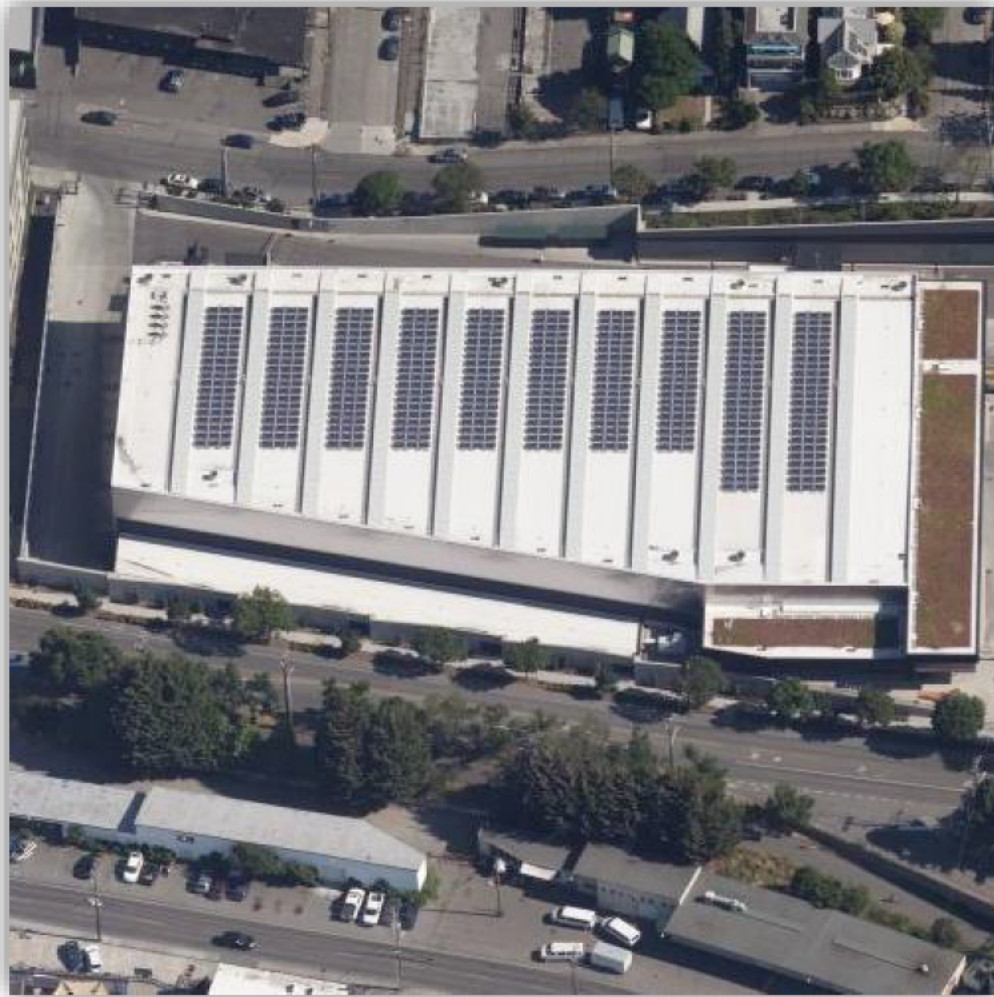


Figure 3.2.3 illustrating the site plan showing the locality of The North Transfer Station.

3.2.4 HISTORICAL AND SOCIAL CONTEXT OF PRECEDENT STUDY

The North Transfer Station is home to many thriving formal residential community areas surrounding the waste disposal facility in Seattle. The construction of the North Transfer Station is the first set of waste transfer stations commissioned and approved for construction in 1966 from the Seattle city government, following the shutting down of several in-city landfill sites resulting in an agreement to haul garbage to the Cedar Hills

Regional Landfill in close proximity to Kent Hills. The station is perfectly placed in South Park and east of Fremont on a 1.8-hectare site which was already being used for city maintenance shops that would be relocated to other lots of vacant land. Moreover, the South Park facility opened in 1966, while resuming development of the Fremont facility however, delayed by an unsuccessful proposed add on rooftop tennis court. Approval for the plans of the North Transfer Station deemed successful in December 1966, consisting of a (37m by 73m) building proposal replacing the landfill on Union Bay. The socio-economic structure housing the residential community nearby Wallingford submitted a petition to the city council in the prevention of the construction of the transfer station however unsuccessful to the city council. On-site construction proceeded in May 1967 with the demolition of the Edgewater Stables housing workhorses for the city's maintenance departments. The North Transfer Station opened on January 2, 1968 however, the station limited to operating during daylight hours of the day and only imposed a charge in fees on commercial trucks and vehicles with trailers as a cost to maintain the stations expenses. Moreover, the facility began tolerating recycled materials without any additional charges shortly after opening the facility to the public. On a social level, criticism for its lack of safety barriers separating people from the compactor pit, the noise generated by the constant movement of trucks and various machines, and unpleasant odours permeated towards nearby residential communities, prompting Wallington residents to appeal to city hall government for stronger smell controls which effects the surrounding communities leading to a protest against the continuation of the North Transfer Station. The North Transfer /station site later proposed as the location of a household hazardous waste collection facility however, the lack of existing suitable land shifted the proposed collection facility to Haller Lake. Since 1990 SPU (Seattle Public Utilities) has contracted with waste

management to house waste from the transfer stations to the Agro rail yard in South Seattle and ship it by rail to the Columbia Ridge Landfill in Oregon which converts electricity from landfill gas emissions at the landfill site. Through active movements of protest among residential communities proposed the closing of the North Transfer Station, along with other modernization procedures and replacing the station with a new intermodal transfer and export centre developments deemed unsuccessful due to negligence from the city government leading to a conflict with existing and planned developments within the strong integrated identity of an existing residential community. The local community and community councils of Fremont and Wallingford appealed for the project's environmental studies as a form of protest against the expanding of the North Transfer "Station, and as a result forming a stakeholder advisory group to address the community's concerns for the expansion of the station to accommodate recycling and other types of waste within the residential community of Seattle. Despite the community's resistance towards the expansion of the station, the renovated transfer facility opened on November 28, 2016 as an integrated outdoor public community engagement facility for the public to interact on a community educational level through the interaction between waste and the user within the urban fabric.

3.2.5 ARCHITECTURAL ELEMENTS OF THE DESIGN

The design of the North Transfer Station facility has been given praise by critics for its environmental-friendly spaces for public amenities and community engagement which are not normally housed within waste facilities (Figure 3.2.5.1). Moreover, the sloped campus includes a main building particularly for waste processing, an administration office, and a separate facility for re-use and recycling and spatial programming (figure 3.2.5.2). The

main entrance of the building is on 34th Street which has of five scales and queuing space for up to approximately 50 vehicles occupying the space. The main building within in the site is two stories high and features a (6,000m²) of floor space, including a tipping floor and underground compactors which feed into transport trailers (Figure 3.2.5.3) and (Figure 3.2.5.4). The building design consists of environmentally friendly features, which include a green roof, skylights, solar panels on the rooftop, enhanced ventilation, and as well as an on-site storm water treatment. The main building's roof design is sunk below the northern street level utilizing a series of tri-chorded steel member trusses which allow for an open tipping floor (Figure 3.4.5.5). The waste facility of the North Transfer Station and adjoining re-use and recycling building is estimated to house 750 tons of material per day.



Figure 3.2.5.1 illustrating the design elements for public and community engagement on site as part of the renovations altered to the existing North Transfer Station.



Figure 3.2.5.2 illustrating the sloped campus, section drawings of the main building, for waste processing, administration offices, and a separate facility for re-use and recycling which is divided into 2 levels.



Figure 3.2.5.3 illustrating the truck entrance to waste processing area and the tipping floor.

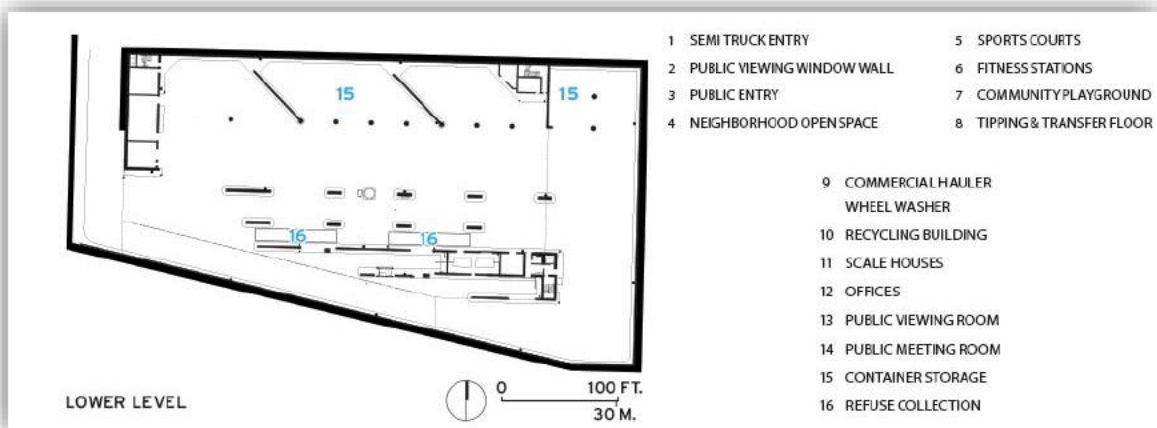
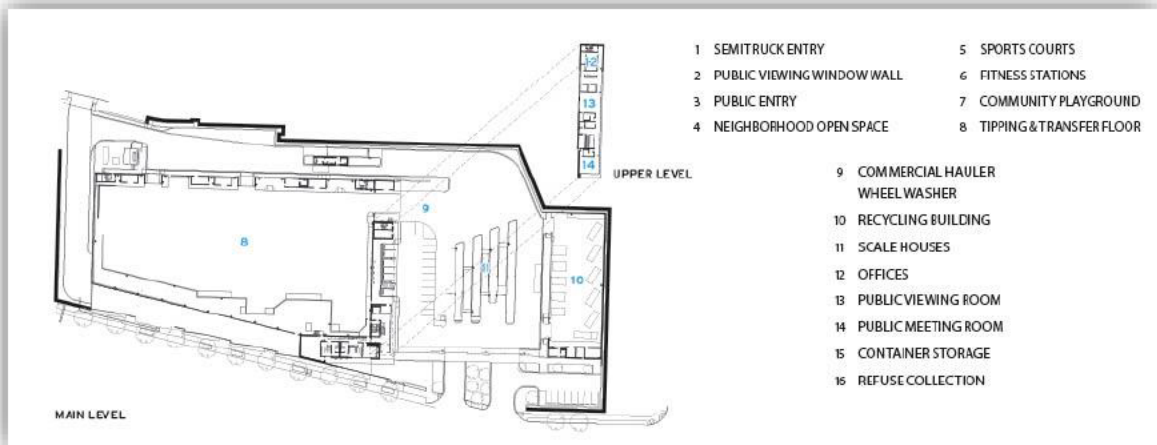
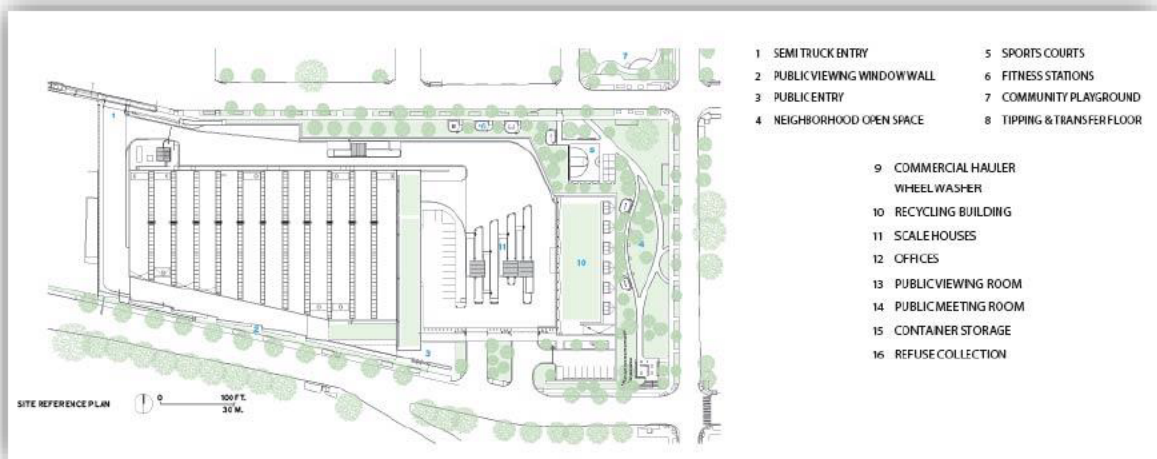


Figure 3.2.5.4 illustrating the design plans of main building of the North Transfer Station.

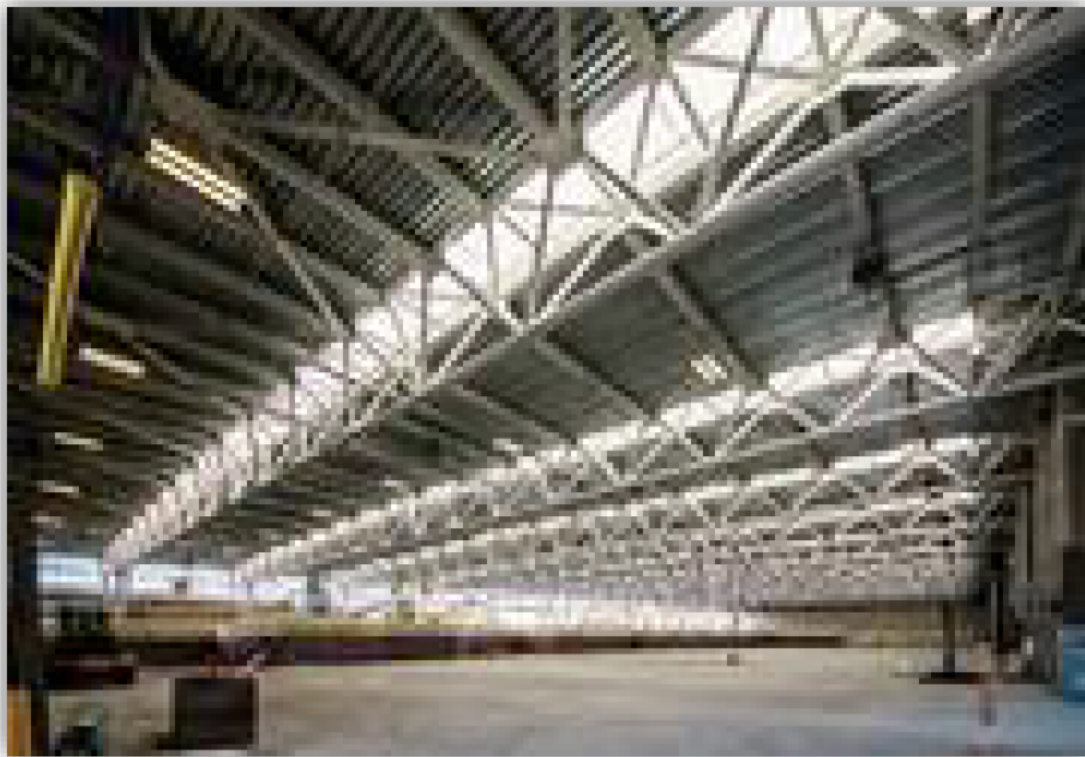


Figure 3.2.5.5 illustrating the building's roof design sunken below the street level.



Figure 3.2.5.6 illustrating the design plans of main building of the North Transfer Station.

3.2.6 CONCLUSION

The North Transfer Station is seen as one of the most community-friendly dumps within the American neighbourhood. The building forms part of the Seattle Solid Waste Facilities Master Plan in compacting waste management in the city. The project targets the critical need for upgrading waste management processing more effectively through environmental awareness and community integration on a large-scale infrastructural platform. The challenge facing the design team was to replace the out-dated facility with one that was larger in size and more efficient in meeting the demands of two adjoining residential communities. The building design addresses the need for waste recycling on community households, integrating household waste, the people and architecture. Although the

building is visited by the public as frequently as many city halls, libraries, civic centres or fire stations, the visibility of the site and the scale of the building footprint allows for the typology to not remain concealed within the environment. Thus, allowing for permeability and ease of access for public usage as well as educational visits improving public awareness of the significance of proper waste management for sustainable cities.

CHAPTER 4

KEY CASE STUDIES (LOCAL CONTEXT).

4.0 INTRODUCTION

Authors Yin (2009) proclaims that case studies within the built form are seen as an investigational analysis which examines the construct of its contemporary existence within in its realm. This chapter of the discourse focuses on attaining relevant information from building which are completed within an Afrocentric context to further dissect the previously mentioned topic of the dissertation with focus on community architecture and its influence on waste management. Moreover, the analysis pertaining to the selected case studies focuses on how the building within their realistic setting relate and how waste architecture for the community has been interpreted in the chosen case studies. The study of the chapter is limited to four building typologies but different within its setting and urban community. The first case study is sourced from the Durban central CBD (central business district) Precinct focusing in on the informal activity of waste picking and identifying an exiting community of waste reclaimers within the formal economy of waste management. The second case study to be analysed is situated in an urban context of Gugulethu, Cape Town. The location of the study is influenced by the urban informal settlements of Gugulethu where architecture, waste management and integrating community intervention which brings social cohesion further targeting marginalized areas or groups within its existing context driven by the needs of the communal inhabitants. The third case study to analysed is situated on the periphery of the Point Precinct in Durban. The location of the study is influenced by the concept of waste and architecture mentioned in the previous chapters of the discourse. The fourth and final case study to be analysed is situated on the periphery of the research site chosen, it looks at architecture of the environment and waste management forming part of an adaptive re-use element for the project. The similarities

as well as the differences in terms of the contextual selection process is done intentionally to help inform the research within the discourse of the document through waste and architecture further identifying spaces in the built form which can foster community engagement. In addition to this, even though the selected criteria of the studies are coherently situated in different contexts, this chapter aims to investigate

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4.1 ARCHITECTURE OF THE ENVIRONMENT (COMMUNITY ARCHITECTURE): WASTE PICK-UP AND RECYCLING FACILITY.

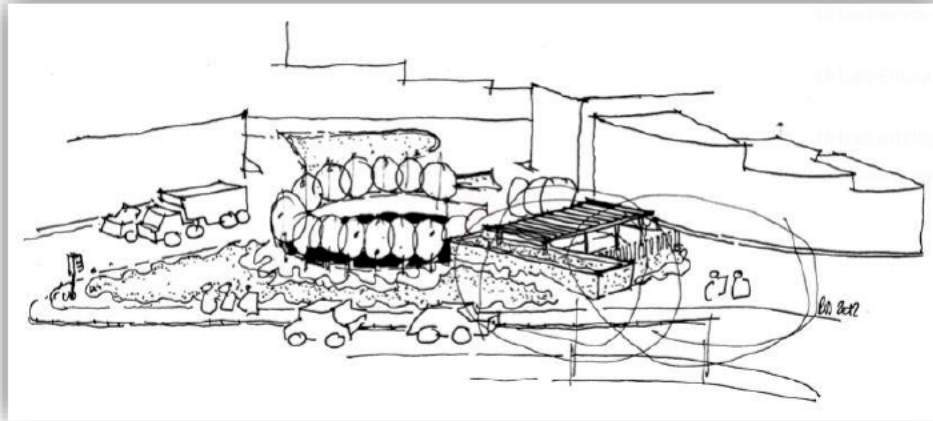


Figure 4.1 illustrating a motivational sketch design of the waste pick-up and collector recycling station by Richard Dobson. Source: <http://aet.org.za>

4.1.1 INTRODUCTION

The building typology will look at architecture of the environment (waste management) within the suburban city of Durban central CBD (central business district). The waste pick-up and collector recycling station is a project which recognizes the informal sector's role in poverty reduction through a response associated with informal waste recycling within the city of Durban. The project's typology caters for informal waste recycling which is seen as a well-established activity in the inner city of Durban. Moreover, the essential function that the building portrays is the use of recycling paper as well as cardboard (waste material) which is seen as an important element within the domestic paper-making industry as well as playing an integral part to the governments contribution towards the green economy strategy. The facility on an urban scale, directly responds to the informal waste

pickers whom salvage cardboard and paper within public spaces (built environment) as well as attaining the recycling scraps from local shops in and around the Durban central CBD (central business district). A centralised facility in terms of the function of the building is introduced as a mechanism that provides infrastructure for the informal waste pickers in the city through the process of salvaging and bailing the volume of material recycled which is then collected by these informal waste pickers as seen in figure 4.1.1.1.



Figure 4.1.1.1 illustrating the waste pick-up and collector recycling station before and after design execution. Source: <http://aet.org.za>

4.1.2 JUSTIFICATION OF CASE STUDY

The waste pick-up and collector recycling station in Durban CBD (central business district) demonstrates the ability of a structure to bring social change within the urban core of eThekweni through social inclusion of informal waste pickers. Though innovation and design, the facility empowers the community of waste pickers on a social and economic scale as well as a response to the green economy of cardboard recycling in the waste economy of Durban. The facility deals with the critical intervention in compacting quantities of waste generated by urban life. Moreover, the focal point of the structure responds to the environmental conservation of nature (trees) and tackling the challenges faced by informal recyclers, where existing municipal systems fail to prioritise the issue of waste reduction in urban settings.

4.1.3 LOCATION AND BACKGROUND CONTEXT

Architect: Rodney Choromanski Architects

Client: EThekweni Municipality, Asiye eTafuleni

Size: 268sqm

Location: The waste pick-up recycling facility, Durban central CBD (central business district) in KwaZulu-Natal near to the Durban ICC at the intersection of Shepstone Street and Palmer Street on Monty Naicker road.

Background Context: The waste pick-up recycling facility is situated in the heart of multi-cultural suburban area in the CBD (central business district) of Durban, KwaZulu-Natal housing commercial, retail and residential zones, with a large span of formal and informal inhabitants operating the spatial configuration of the context. The inhabitants that reside

from this area arise from a fragmented legacy of Apartheid spatial planning laws due to the result of an ever changing social and economic challenges within the context of Durban (Figure 4.1.3).

4.1.3.1 World map, locating the African continent. (image by author, 2020).

4.1.3.2 Map of South Africa locating the province of KwaZulu-Natal, South Africa. (image by author, 2020).

4.1.3.3 Map of the city of Durban, KwaZulu-Natal. (image by author, 2020).

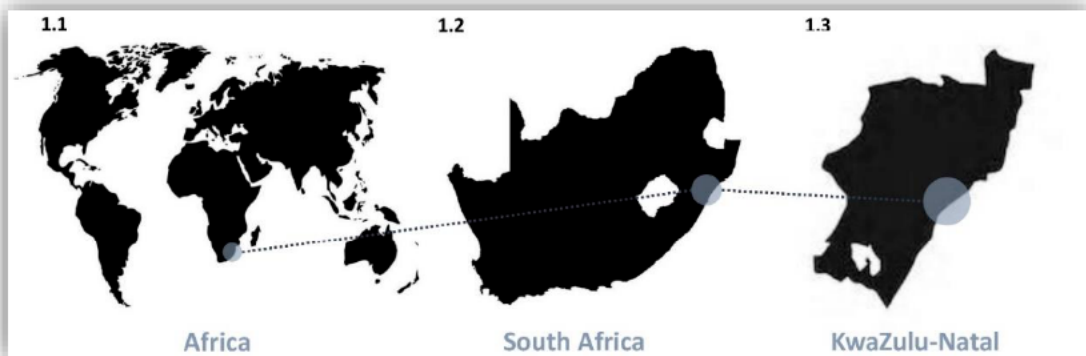


Illustration 4.1.3.1- 4.1.3.3 Map locations of the precedent study. Source:

<http://earth.google.com>



Figure 4.1.3 illustrating the site plan of the proposed intervention area to be built for the waste pick-up and recycling facility. Source: <http://aet.org.za>

4.1.4 HISTORICAL AND SOCIAL CONTEXT OF CASE STUDY

The waste pick-up recycling facility is placed within a busy CBD (central business district) of Durban, KwaZulu-Natal which house informal and formal trading businesses due to the rapid industrialisation Post-Apartheid. The intervention resides in one of the fastest - growing urban areas within the world and plays host to Durban's informal recyclers within the CBD (central business district) of the city centre. Furthermore, within this precinct there are approximately 500 waste pickers whom are operating in the Durban inner city on an informal platform. The waste pick-up station is surrounded by the Durban harbour port which is one of Africa's busiest import and export trading enterprises. On an urban scale, the centre looks to empower informal cardboard waste pickers and dignify their activities

as a support service for eThekweni Municipality and government since the year 2001. Moreover, on a social economic structure, waste pickers play an integral key part of the broader green economy strategy and is purposefully accessible to marginalized inhabitants as a low-barrier to an entry trade.



Figure 4.1.1 illustrating the construction of the design on site for the waste pick-up and collector recycling facility. Source: <http://aet.org.za>

4.1.5 ARCHITECTURAL ELEMENTS OF THE DESIGN

The architectural design of the of the waste pick-up and collector recycling facility is a significant element within the domestic paper-making industry (recycling paper and cardboard) which focuses on informal waste pickers. The facility is designed to facilitate the salvaging of cardboard as a waste material which is flattened and baled to buy-back center's (middle agent). The facility is an alternative practice for informal waste pickers in their daily rounds spent collecting the waste material. Moreover, a centralized facility was proposed by providing the appropriate infrastructure (built form) in response to the

salvaging and bailing process of waste cardboard material. In addition, the waste pick-up and collector recycling facility provide the informal waste pickers with a dignified working environment (space). The pick-up station on an urban scale caters for 150 tons of cardboard waste material salvaged a day within the inner city of Durban (Figure 4.1.5.1) and (Figure 4.1.5.2). The pick-up station acts as a base which provides a place to store prototype trollies providing accessibility to ablutions and changing rooms (Figure 4.1.5.3), (Figure 4.1.5.4) and (Figure 4.1.5.5). Furthermore, an adjoining landscape park incorporates the retro-fitted shipping containers and resource rooms which give rise to opportunities for meeting with the informal recyclers (Figure 4.1.5.7) and (Figure 4.1.5.8). The Centre is designed to empower the waste pickers and dignify the collecting of waste material as an activity for the urban poor. The target completion date in terms of construction was completed on the 4th December 2019 (Figure 4.1.5.6).

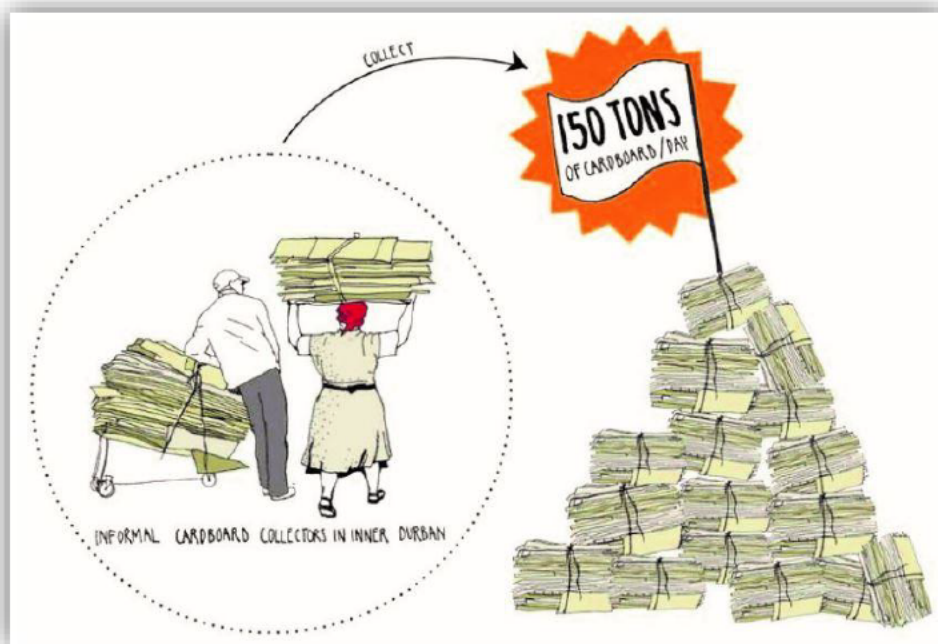


Figure 4.1.5.1 illustrating the site plan of the design and the urban layout (park) for the waste pick-up and collector recycling facility. Source: <http://aet.org.za>

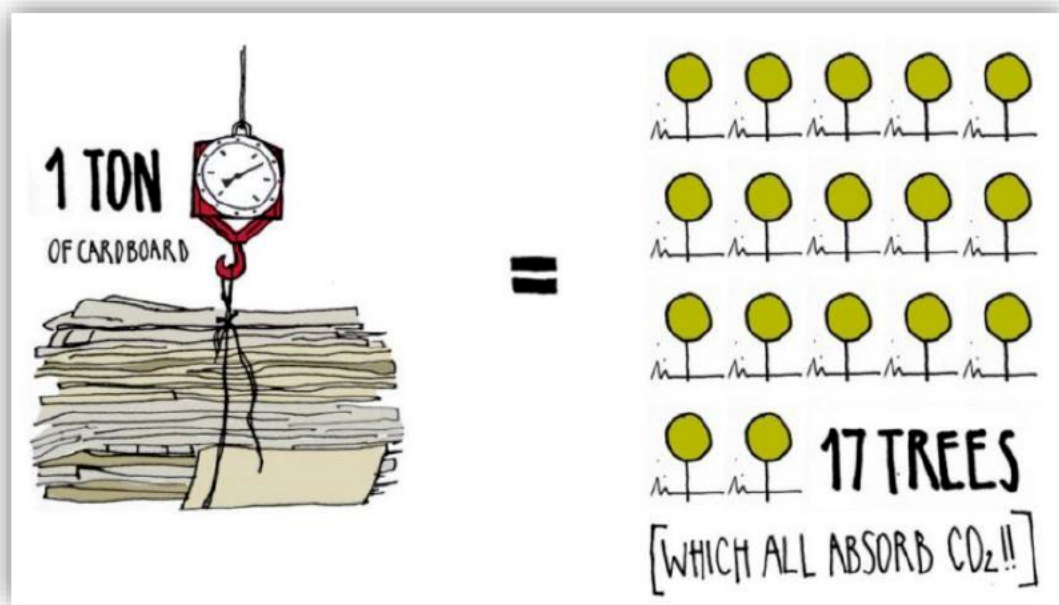


Figure 4.1.5.2 illustrating the site plan of the design and the urban layout (park) for the waste pick-up and collector recycling facility. Source: <http://aet.org.za>

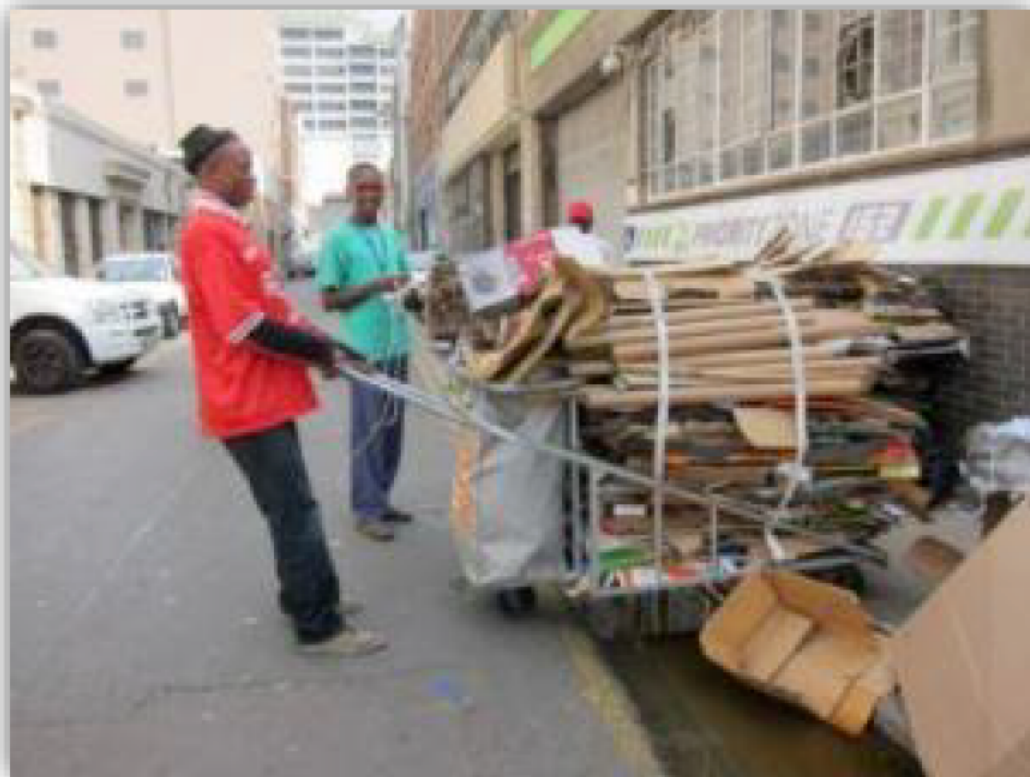




Figure 4.1.5.3 illustrating the Palmer Street waste pickers testing the two different prototype trolley design for transporting the waste material in the form of cardboard and paper. Source: <http://aet.org.za>

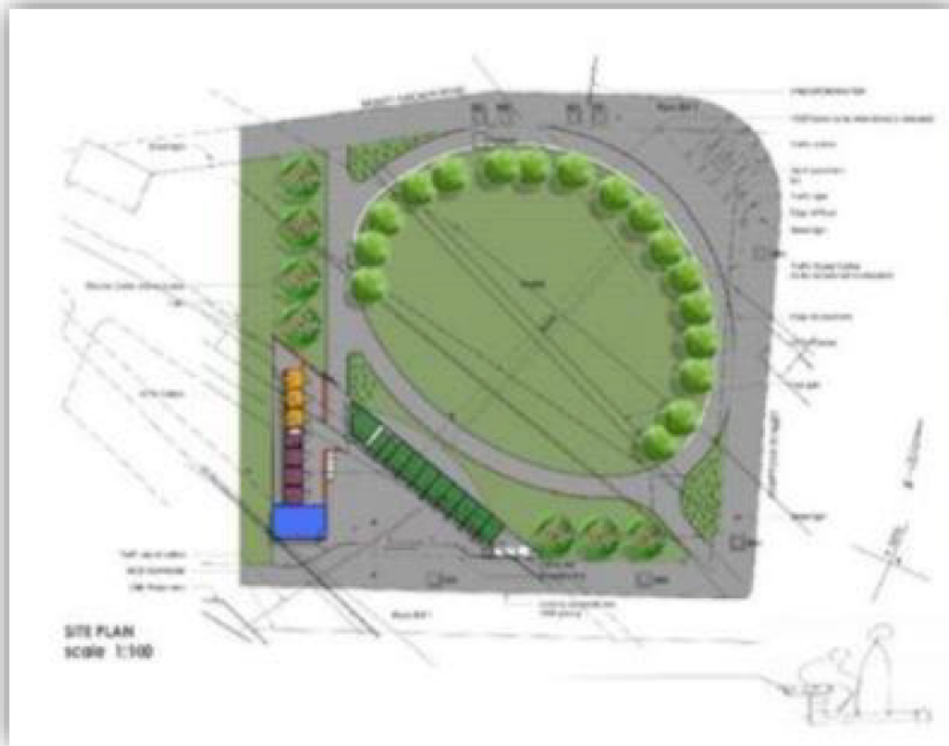


Figure 4.1.5.4 illustrating the site plan of the design and the urban layout (park) for the waste pick-up and collector recycling facility. Source: <http://aet.org.za>

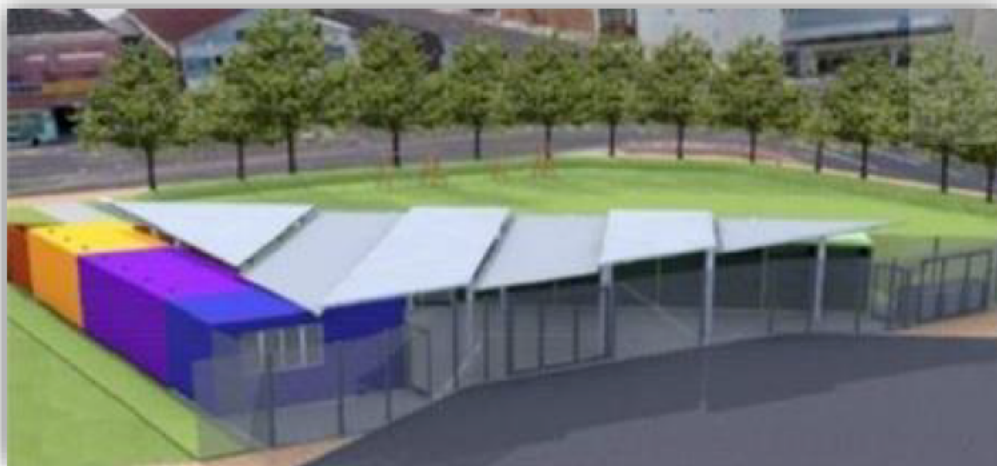


Figure 4.1.5.5 illustrating the waste pick-up and collector recycling facility perspective of the design, the trees buffering the view from the Monty Naicker road. facility. Source:

<http://aet.org.za>



Figure 4.1.5.6 illustrating the construction of the design on site for the waste pick-up and collector recycling facility. Source: <http://aet.org.za>



Figure 4.1.5.7 illustrating the completed construction of the design for the waste pick-up and collector recycling facility. Source: <http://aet.org.za>



Figure 4.1.5.8 illustrating the completed interior spatial construction of the design for the waste pick-up and collector recycling facility. Source: <http://aet.org.za>

4.1.6 CONCLUSION

The waste pick-up and collector recycling facility are relevant to the findings of the theoretical discussion, and therefore is most applicable to the research. The building typology provides insight into the informal trade of waste recycling and the influence of waste management on community architecture on an informal and formal scale in the CBD (central business hub) of Durban. On a global scale as well as in South Africa, waste management systems within urban contexts foster spaces for existing communities for proper waste management which involves the collecting, transportation, sorting, recycling

and upcycling of waste in the community. The facility fosters spaces which respond to community social enterprise development, supporting start-up businesses for local waste-pickers and collectors. The waste pick-up and collector recycling facility are a typical example of how waste management, nature and architecture are interconnected as one. The simplest of solution in regards to responsive architecture towards waste management and the informal trade of waste picking integrate a meaningful built form in response to community architecture in the heart of Durban.

4.2 ARCHITECTURE OF UPGRADING INFORMAL SETTLEMENTS IN PERI-URBAN AREAS (INCLUSIVE INNOVATION): LOTUS PARK NEIGHBOURHOOD CENTRE & WASTE MANAGEMENT STATION.



Figure 4.2.1 illustration site photo street edge façade of the building. Source: Digest of South African Architecture, 2015

4.2.1 INTRODUCTION

The building typology will look at architecture of upgrading informal settlements in the peri-urban area of Gugulethu, Cape Town through inclusive innovation design which is driven by the key concept mentioned in the previous chapters of the discourse. The Lotus Park neighbourhood project is seen as a vision for the urban informal settlements of Gugulethu to build a safe and integrated community centre by upgrading the existing settlements without having to relocate inhabitants outside of the area of Gugulethu. Moreover, the centre is seen as a short-to medium- term “catalyst” for design intervention

in the upgrading of informal settlements within peri-urban contexts. The project was a design implementation response to the desperate need and vulnerability of inhabitants for a community facility within Lotus Park to address the needs of the people who reside within the area. Moreover, the project is driven by the increase of social cohesion in marginalized areas and prepares the community of Gugulethu for incremental infrastructure upgrading in a process that is owned and driven by the communities needs seen in figure 4.2.1.1.



Figure 4.2.1.1 illustrating site photos of the design intervention of community participation within urban spaces. Digest of South African Architecture, 2015

4.2.2 JUSTIFICATION OF CASE STUDY

The Lotus Park Neighbourhood centre and the Waste Management Station within the informal settlements in Cape Town focuses on architecture for the community as well as the influence of waste management on community architecture. Moreover, Cape Town experiences rapid urbanisation within the built environment whereby around 146, 000

residential households within 437 pockets of informal settlement. The justification of this increase brings a variety of challenges which include poverty, unemployment, environmental degradation, overburdened public services and poor waste management practices. The case study chosen correlates with chapter 1 concepts and theories of the discourse mention in the previous chapters. The waste management station provides a lens in which waste management is a significantly and largely untapped opportunity for transformative change in a manner whereby the community through waste gain a sense of mastery over their lives (Theory of Empowerment) and engage with the idea of waste as an alternative means to learn from waste management practices (Alternative Knowledge Systems). Furthermore, the waste management station in Gugulethu conveys abundant opportunity in alternative material recovery, recycling and the sorting of waste within informal settlements. This is achieved through establishing extensive partnerships between community-based groups and the city of Cape Town. Therefore, it is through architecture for community-based intervention which bridges the gap between waste management and architecture within the urban fabric.

4.2.3 LOCATION AND BACKGROUND CONTEXT

Architect: Sustainable Urban Neighbourhood (SUN) Development.

Client: VPUU (Violence Prevention Through Urban Upgrading) Programme.

Size: 500m²

Location: Lotus Park Neighbourhood Community Centre, Gugulethu, on the periphery of Western Cape.

Background Context: The Lotus Park neighbourhood centre is situated in the heart of the rural (Township) peri-urban areas of Gugulethu, however it has informal settlements in and amongst industrial zones, with a large span of shack dwellers operating the spatial configuration of the context and the inhabitants that reside in the areas of Gugulethu arise from marginalised environments due to the spatial planning laws of the Apartheid regime (Figure 5.3.3).

4.2.3.1 World map, locating the African continent. (image by author, 2020).

4.2.3.2 Map of South Africa locating the province of Cape Town- Western Cape, South Africa. (image by author, 2020).

4.2.3.3 Map of the city of Gugulethu, Cape Town- Western Cape. (image by author, 2020).

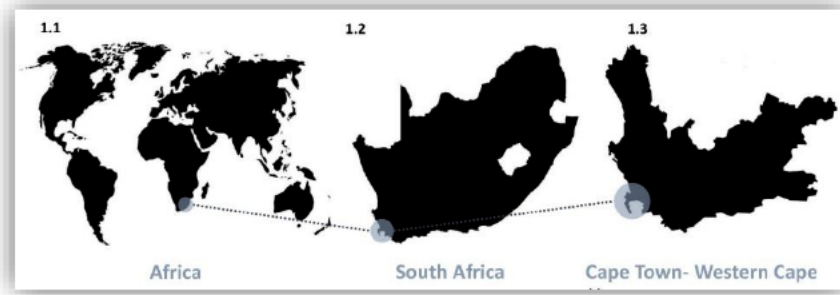


Illustration 4.2.3.1- 4.2.3.3 Map locations of the precedent study. Source:

<http://earth.google.com>



Figure 4.2.3.1 illustrating the Apartheid regime spatial planning, housing informal settlements and industrial zones. Digest of South African Architecture, 2015

4.2.4 HISTORICAL AND SOCIAL CONTEXT OF CASE STUDY

The Lotus Park centre in Gugulethu is home to many colonial settlements in the city of Cape town. The urban setting of the centre suffers from an extensive urban sprawl of a multi-cultural and fragmented city and also houses a patchwork of disconnected business districts, affluent gated communities and poor townships which spread across and beyond the city which is defined by the Bay Harbour and Table Mountain. Moreover, it is through densified urban fragmentation that creates spatial barriers of conflict however, social, physical and administrative barriers are evident within the urban planning of Gugulethu, Cape Town. Furthermore, the physical planning interventions with the built form were instrumental in the execution of racial segregation during the Apartheid regime while it continued until 1990. Therefore, the Lotus Park neighbourhood centre stems from the ideologies of existing Apartheid spatial planning laws that determined the spatial

configuration of poor communities in informal settlements of Gugulethu (Figure 4.2.4.1). The site was identified by the community leaders from the area which was an existing “dumping” site, with a small informal kick-about space to the northern side of the informal settlements of Gugulethu (Figure 4.2.4.2) and (Figure 4.2.4.3). The VPUU (Violence Prevention Through Urban Upgrading) Programme was responsible for the implementation of the project within the community where the Lotus Park community would take on all responsibilities and ownership of the space to help improve safety as a personal and public need which decreases the crime rate and violence within these peri-urban areas of Gugulethu. The focus for the response of the building design was placed on the idea of violence prevention and the VPUU’s (Violence Prevention Through Urban Upgrading) life cycle approach, which seeks to improve the life of its inhabitants. Therefore, it is through social cohesion that the socio-economic and environmental aspect of issues within informal settlements is achieved through the responsive design for community-based participation.

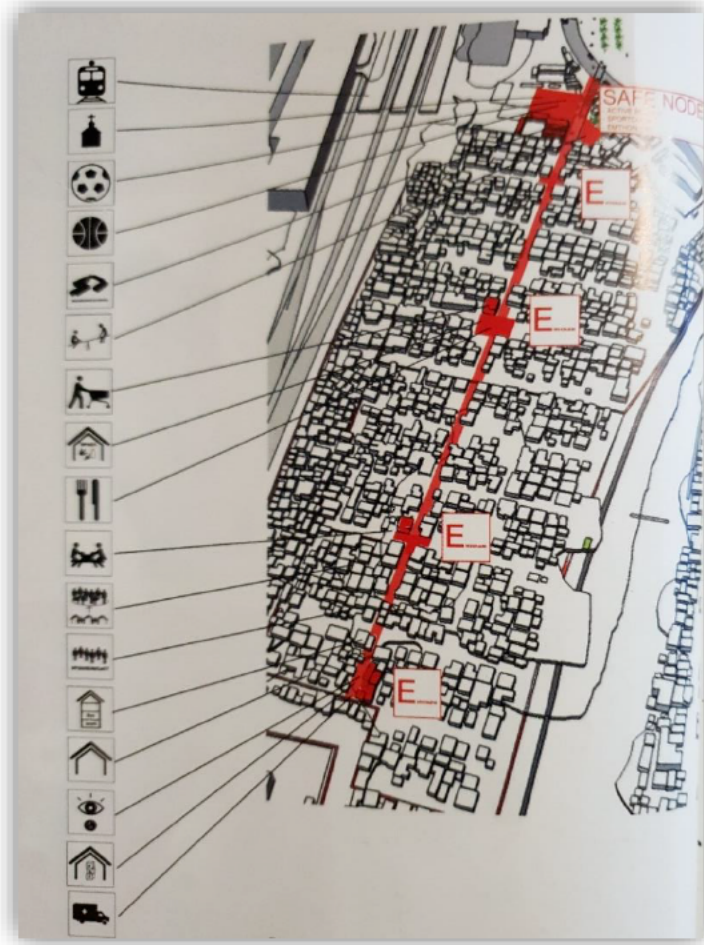


Figure 4.2.4.1 illustrating the concept sketch phasing of spatial configuration of densified urban communities within informal settlements. Digest of South African Architecture, 2015



Figure 4.2.4.2 illustrating the existing dumping site before intervention. Digest of South African Architecture, 2015



Figure 4.2.4.5 illustrating the design of the Lotus Park neighbourhood centre. Digest of South African Architecture, 2015

4.2.5 ARCHITECTURAL ELEMENTS OF THE DESIGN

The Lotus Park neighbourhood centre acts as a landmark for the inhabitants of Ggugulethu and is fundamental to the public domain in terms of the notion of “breaking down fences” in peri-urban areas of informal settlements. The building has been designed to be conceptualized as an “active box” within the densified urban fabric of Gugulethu. In response to the conceptualization of the design, a comprehensive early childhood development facility was provided which is currently operational in the building. Moreover, the building is utilized by a youth group for after-school learning and gathering, and also houses an enumeration office which allows for the development and verification of a community register. The building comprises of the following elements: a meeting room/ hall; office space for the community facilitator; leadership groups, VPUU (Violence Prevention Through Urban Upgrading) partners (Legal Aid, Sikhula Sonke, Mosaic); ablutions; storage; a General Workers flat; a Facility Guardian space; Kitchen; business opportunity for a plaza; a recycling room and a youth space for the community through spatial elements of the design (Figure 4.2.5.1), the hard surface sports court for public use

(Figure 4.2.5.2), and site plan of the Lotus park neighbourhood centre (Figure 4.2.5.3). The lotus park neighbourhood centre and the waste management station in terms of design link to enhances the circular economic structure for informal settlements for transformative change (Figure 4.2.5.6).

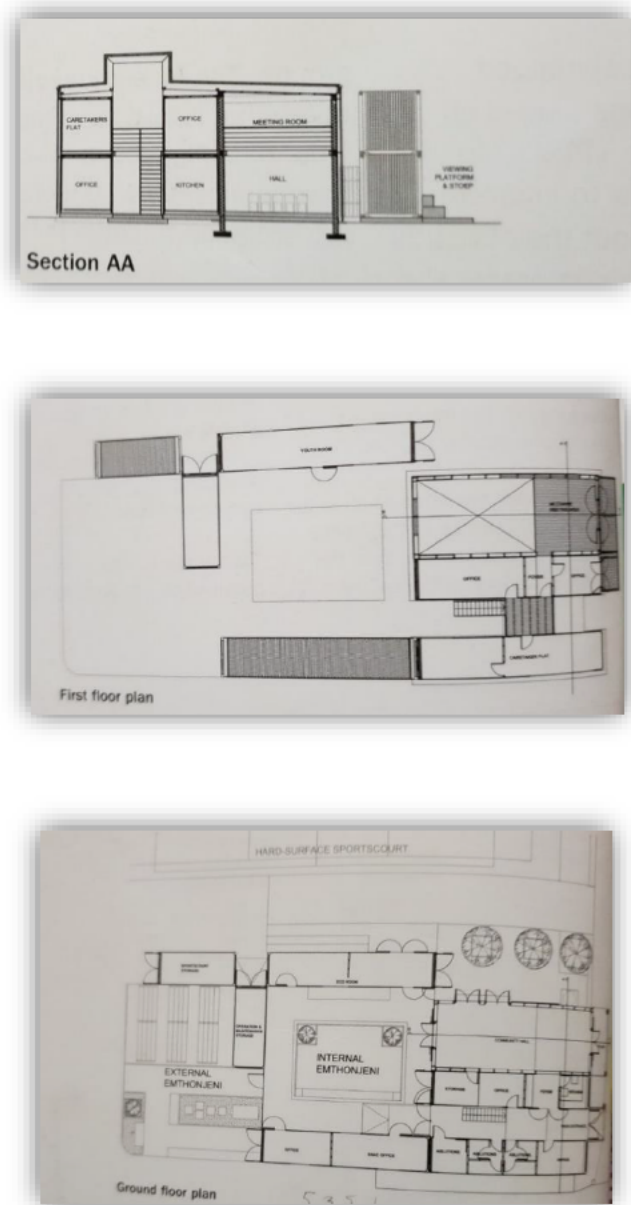


Figure 4.2.5.1 illustrating the spatial elements of the design through ground floor plan, first floor plan and design section of the building. Digest of South African Architecture,



Figure 4.2.5.2 illustrating the hard surface sports court as well as recycled shipping container incorporated into the design structure. Digest of South African Architecture, 2015



Figure 4.2.5.3 illustrating the site plan of Lotus Park neighbourhood centre.

The construction method of the building is made from eco-beam construction comprising of sandbags and recycled shipping containers. Furthermore, it has a separate (off-grid) sewerage system and the water collection system from the roof supplies the ablutions within the facility. Moreover, phase 2 and 3 of the neighbourhood centre is a catalyst for the development of public space for inhabitants such as ECD (Early Childhood Development) and youth group participation in the form of study groups within the spatial configuration of the building implementation diagram (Figure 4.2.5.4) and the spatial reconfiguration plan of the centre (Figure 4.2.5.5). Digest of South African Architecture, 2015

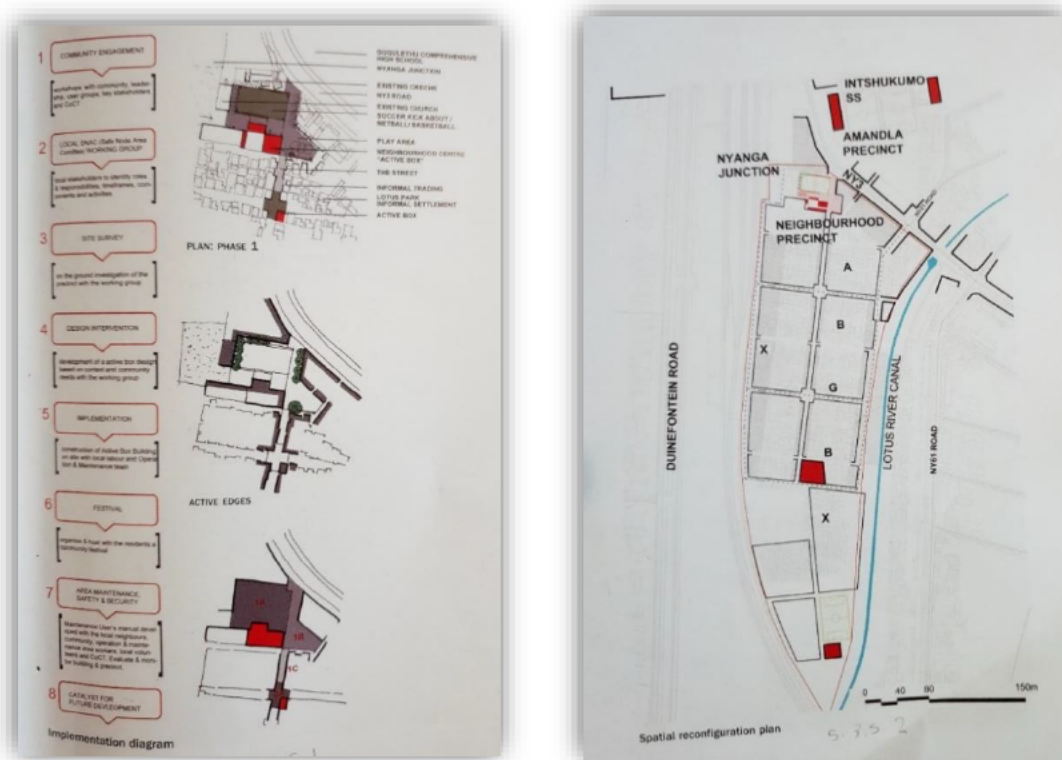


Figure 4.2.5.4 illustrates the spatial implementation diagram sketch phase 1 (left) and Figure 4.2.5.5 illustrating the spatial reconfiguration plan of Lotus Park neighbourhood centre (right). Digest of South African Architecture, 2015



Figure 4.2.5.6 illustrating the site plan of Lotus Park neighbourhood centre. Digest of South African Architecture, 2015

The architectural design of the of the waste management station provides the community an alternative point for proper waste management which involves the collection, transportation, sorting, recycling, upcycling of ideal waste material which can be utilized and sold to buy-back centres as a means of extra income for the informal residents of the lotus park neighbourhood precinct. The waste management station is built alongside a church for the community of Lotus Park. Furthermore, the waste management station assists with waste management system which tackles fundamental aspects of composting,

organic waste generation, organic waste treatment, transportation of organic waste to processing centres as well as organic waste drop offs at nearby waste management stations and collection from household residents (Figure 4.2.5.7). The construction method of the typology encapsulates a steel beam channels for light weight assembling and retro fitted shipping containers as a sustainable element of ease of construction design (Figure 4.2.5.8). The primary operation waste system of the station comprises of an effective and efficient collection system suitable for community to encourage participation in waste to resource tactic. The design is based on the principles of a range of recycling opportunities through promoting community owned solution, environmental educational and social enterprise opportunities to empower the residents of Lotus Park. Furthermore, the core waste material which is used as an alternative means to foster opportunity is the organic waste transformed into a composting fertilizer. The waste management stations spatial configuration layout consists of a waste station, swop shop, retail, scrap yard, recycling separation, recycling and tool storage, reception and offices and business incubators (Figure 4.2.5.9), (Figure 4.2.5.10) and (Figure 4.2.5.11). Moreover, these spaces facilitate community members, entrepreneurs, businesses, uplifting and upgrading informal settlements as well as the metropolitan area within its urban fabric (Figure 4.2.5.12) and (Figure 4.2.5.13).



Figure 4.2.5.7 illustrating the types of waste management systems in place site plan for the Lotus Park neighbourhood waste management station. Source: <http://www.vpuu.com>



Figure 4.2.5.8 illustrating the construction material implemented in terms of design for the Lotus Park neighbourhood waste management station. Source: <http://www.vpuu.com>

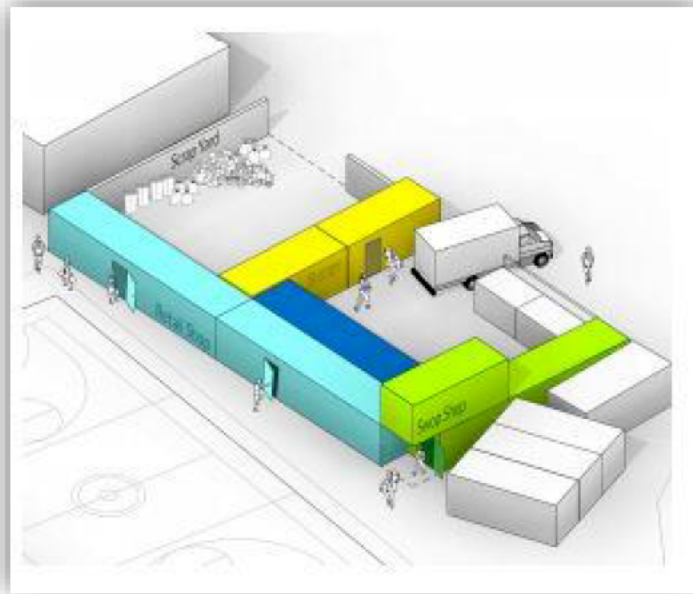


Figure 4.2.5.9 illustrating the hard surface sports court as well as recycled shipping container incorporated into the design structure. Source: <http://www.vpuu.com>



Figure 4.2.5.10 illustrating the plan design of the programming component spaces (functions) of Lotus Park neighbourhood waste management station. Source:

<http://www.vpuu.com>

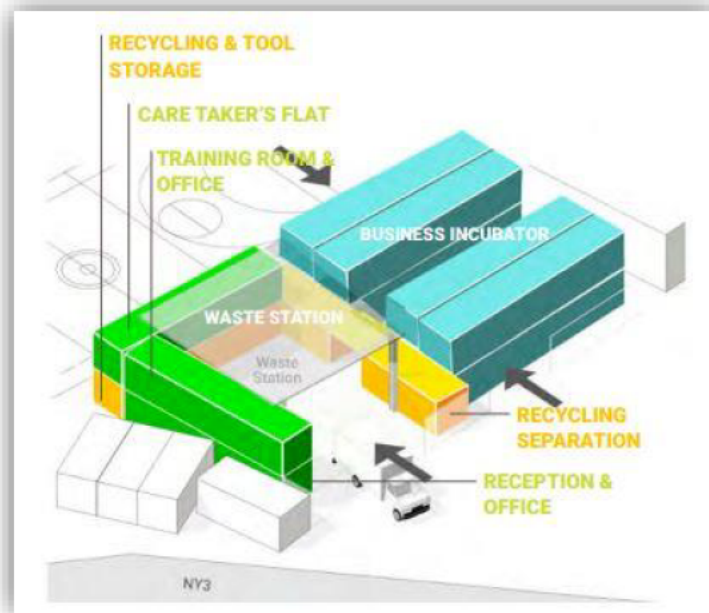


Figure 4.2.5.11 illustrating the 3D conceptual design of the programming component spaces of Lotus Park neighbourhood waste management station. Source:

<http://www.vpuu.com>

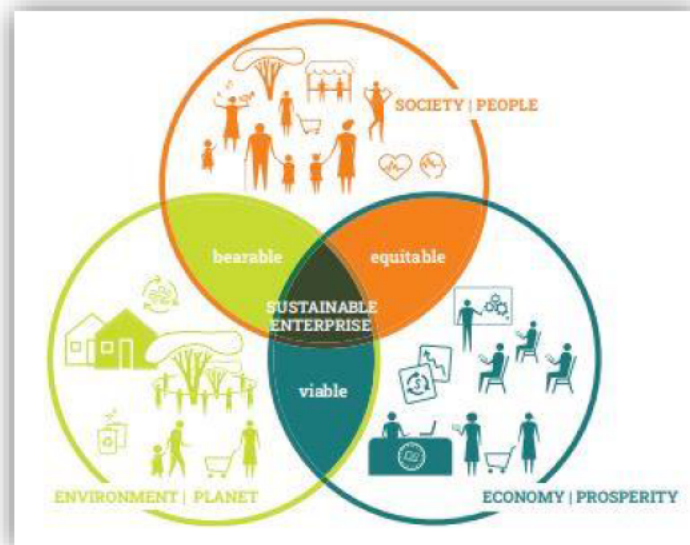


Figure 4.2.5.12 illustrating the food composting system (organic waste) utilized by the community of Lotus Park neighbourhood waste management station. Source:

<http://www.vpuu.com>



Figure 4.2.5.13 illustrating the food composting system (organic waste) utilized by the community of Lotus Park neighbourhood waste management station. Source:

<http://www.vpuu.com>

The community clean-up component of the design implementation or strategies provides a hands-on solution to solving the waste pollution within the households of informal settlements. Moreover, the idea of cleaning up the existing informal neighbourhood gives rise to further empower residents of Gugulethu and to take control of the situation of waste pollution within their own communities. This is achieved through an integrated system comprising of a food composting system (Bokashi food compost starting kit) which comprises of a waste bin with flakes and the community residents are then trained in terms of using the programmatic system to manage food waste within their homes (Figure 4.2.5.13). Moreover, the organic waste is collected weekly at the different sources of the waste management stations and is later transported to composting facilities. The main concept behind the intervention is to determine if the system is viable and scalable on larger platforms since the waste clean-up component is the first of its kind for informal settlements in the Western Cape, Lotus Park in Gugulethu (Figure 4.2.5.14) and (Figure 4.2.5.15).



Figure 4.2.5.13 illustrating the food composting system (organic waste) utilized by the community of Lotus Park neighbourhood waste management station. Source:

<http://www.vpuu.com>



Figure 4.2.5.14 illustrating the overload of waste consumption which is dumped illegally within informal zones of the urban area of Gugulethu. Source: <http://www.vpuu.com>



Figure 4.2.5.15 illustrating the overload of waste consumption which is dumped illegally within informal zones of the urban area of Gugulethu. Source: <http://www.vpuu.com>

4.2.6 CONCLUSION

The Lotus Park Neighbourhood centre and Waste Management Station in Gugulethu are typical examples of waste architecture which involves community participation in densified urban fabrics. Waste management in the informal context or urban settings looks at waste management which is focused on an individual level, relationship n level, community level and societal level on an urban scale. The response to enhancing existing community members, entrepreneurs, businesses, informal settlements and exiting metropolitan areas promotes an architecture sensitive to its nature and surroundings.

4.3 ARCHITECTURE OF THE ENVIRONMENT: DURBAN HARBOUR TUNNEL NORTH AND SOUTH ENTRANCE STRUCTURES & MAHATMA GANDHI ROAD SEWER PUMP STATION.



Figure 4.3.1 illustrating the birds eye view of the site which is located in the periphery of the harbour, Durban. Source: <http://choromanski.com>

4.3.1 INTRODUCTION

The building typology will look at architecture of the environment (waste management) on the periphery of the Point Precinct in Durban, KwaZulu-Natal through inclusive innovation design which is driven by the key concept of waste and architecture mentioned in the previous chapters of the discourse (Figure 4.3.1.1). The Durban harbour tunnel north and South entrance structures and Mahatma Gandhi road sewer pump station project is a

landmark within the Durban area. The building exemplifies a multi-disciplinary project that incorporates the various unique engineering responsibilities that are environmentally friendly and intricately planned in terms of design (Figure 4.3.1.2). The project is regarded as one of the largest pump stations within the province of KwaZulu-Natal and effectively transfers all the sewage waste from the Durban CBD (central business district) and the existing surrounding areas across the harbour point precinct including Berea and the Bluff.



Figure 4.3.1.1 illustrating the hard surface sports court as well as recycled shipping container incorporated into the design structure. Source: <http://choromanski.com>



Figure 4.3.1.1 illustrating the hard surface sports court as well as recycled shipping container incorporated into the design structure. Source: <http://choromanski.com>

4.3.2 JUSTIFICATION OF CASE STUDY

The Durban harbour tunnel north and South entrance structures and Mahatma Gandhi road sewer pump station in conjunction with Durban Point development Corporation's (DPDC) conveys a technical and methodological initiative to sustain the waste pollution within the Point Precinct in Durban, KwaZulu-Natal. The project embodies similar problematic factors of environmental pollution pertaining to waste management in relation to excessive waste in an urban context dealing with hazardous pollutants. Although the project accommodates engineering infrastructure and management, it symbolises attributes of the key concepts and theories explored in Chapter two, namely social-ecological systems in sustainability (eco-systems) in the urban environment, and environmental spatial justice. It also looks at the research question in chapter 1, identifying a relationship between architecture, waste management and nature.

4.3.3 LOCATION AND BACKGROUND CONTEXT

Architect: Rodney Choromanski Architects

Client: eThekweni Municipality

Size:

Location: The Durban harbour tunnel north, south entrance structures and Mahatma Gandhi road sewer pump station is located on the periphery of the Point Precinct in Durban, KwaZulu-Natal.

Background Context: The Durban harbour tunnel north, south entrance structures and Mahatma Gandhi road sewer pump station is situated in the heart of the industrial harbour context within the CBD (Central Business District) suburbs of Durban, however it houses residential and commercial zones in and amongst industrial zones of the Durban Harbour trade port, with a large span of industrial trade workers operating the spatial configuration of the context within the Durban Harbour precinct (Figure 5.1.3.1) and (Figure 5.1.3.2).

4.3.3.1 World map, locating the African continent. (image by author, 2020).

4.3.3.2 Map of South Africa locating the province of KwaZulu-Natal, South Africa. (image by author, 2020).

4.3.3.3 Map of the city of Durban, KwaZulu-Natal. (image by author, 2020).

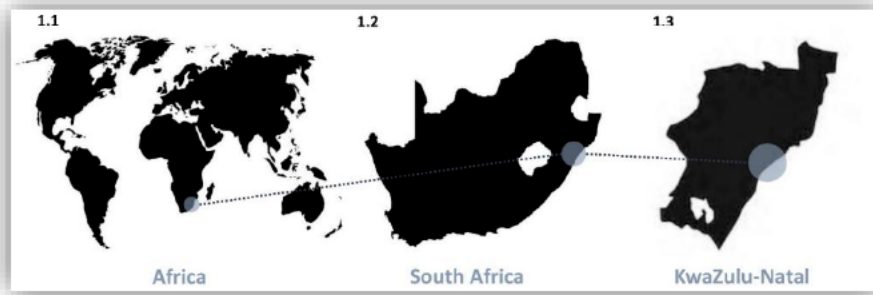


Illustration 4.3.3.1- 4.3.3.3 Map locations of the precedent study. Source:

<http://earth.google.com>



Figure 4.1.3.1 illustrating the Aerial view of the site which is located in the periphery of the harbour, Durban. Source: GoogleEarcth.com



Figure 4.3.1 illustrating the birds eye view of the site which is located in the periphery of the harbour, Durban. Source: GoogleEarcth.com

4.3.4 HISTORICAL AND SOCIAL CONTEXT OF CASE STUDY

The Durban harbour tunnel north and South entrance structures and Mahatma Gandhi road sewer pump station occupies a major site within the Durban Point development Corporation's (DPDC) up-market development zone which is bounded by Mahatma Gandhi Road and Albert Terrace since 1959. Moreover, the current pump station of the Durban Harbour Tunnel within the historical point precinct before intervention was relocated by request from eThekweni Water and Sanitation (EWS) to a new proposed site adjacent to the north shaft of the recently commissioned Durban Harbour Tunnel. The projects historical context is situated within the Durban Harbour in South Africa which is currently one of the busiest ports in Africa. Moreover, the national ports authority urgently requested the need to upgrade the port to accommodate bigger ships which required the harbour mouth to be widened and also deepened due to the modernization of the harbour (Figure 4.3.4.1). A new and deepened Durban Harbour Services Tunnel was then constructed which was the first of its kind in sub-Saharan Africa built and commissioned in the year 2006 and stands till this day as an architectural statement designed by the renowned Rodney Choromanski.



Figure 4.3.4.1 illustrating the Durban Harbour mouth showing the tunnel and widening of entrance channel which is located in the periphery of the harbour, Durban.



Figure 4.3.5.1 illustrating the birds eye view of the site which is located in the periphery of the harbour, Durban. Source: <http://choromanski.com>

4.3.5 ARCHITECTURAL ELEMENTS OF THE DESIGN

The architectural sensitivity design of the Durban harbour tunnel north and South entrance structures and Mahatma Gandhi road sewer pump station conceptually forms a capsule which allows workers and vehicular movement 24-hour accessibility within the periphery of the point precinct. Moreover, the scheme allows for service to the harbour tunnel and sewer pump station below as well as a public site above catering for public use and entertainment. The design responds to the industrial context of the harbour precinct and the sculptural roof proposal serves as an identifiable landscape placed within a significant water's edge of the harbour entrance. The exploration of material utilizes stone cladding which is reconstituted from waste collected from numerous local stonemasons. Furthermore, the materiality of the stone matches the local dark grey dolerite which historically served as a significant building material to the Durban harbour walls. On the other hand, emphasis is placed on the usage of waste as a building material which can enhanced as an alternative means to exploring construction materials sourced from left-over waste building material. On an urban scale the location of the top structure design in intricately placed at the end of point road which has been determined by the layout of the tunnel through a sensitive approach within the Durban Point Development Framework Plan.



Figure 4.3.5.1 illustrating the birds eye view of the site which is located in the periphery of the harbour, Durban. Source: <http://choromanski.com>



Figure 4.3.5.2 illustrating the birds eye view of the site which is located in the periphery of the harbour, Durban. Source: <http://choromanski.com>



Figure 4.3.5.3 illustrating the birds eye view of the site which is located in the periphery of the harbour, Durban. Source: <http://choromanski.com>



Figure 4.3.5.4 illustrating the birds eye view of the site which is located in the periphery of the harbour, Durban. Source: <http://choromanski.com>

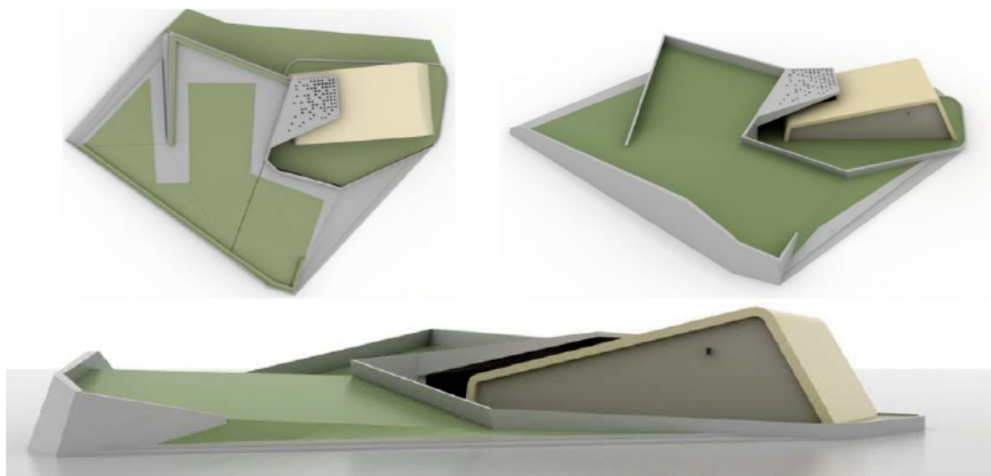


Figure 4.3.5.5 illustrating the birds eye view of the site which is located in the periphery of the harbour, Durban. Source: <http://choromanski.com>



Figure 4.3.5.8 illustrating the construction of the Durban harbour tunnel north and South entrance structures and Mahatma Gandhi road sewer pump station site which is located in the periphery of the harbour, Durban. Source: <http://choromanski.com>

4.3.6 CONCLUSION

The Durban harbour tunnel north and South entrance structures and Mahatma Gandhi road sewer pump station exemplifies architecture which responds to nature. Moreover, the objective of the initial project evaluates the techniques of tackling technical and social-environmental aspects in the built environment through innovation and design. On an urban scale, the facility provides services in the reduction of sewer waste within the point precinct district and the Durban harbour. The project is an awarded winning design in Durban officially reaching completion in November 2014, following a three-year plan of

dedication, industrial leading innovation and world-class management within the economy of waste management in the built environment. The buildings interconnected relationship between the built form, nature and architecture play an integral role in the environmental response to the point precinct, Durban.

4.4 ARCHITECTURE OF THE ENVIRONMENT AND WASTE MANAGEMENT: DURBAN BISASAR LANDFILL- METHANE GAS-TO-ELECTRICITY BISASAR ROAD.



Figure 4.4.1 illustrating the methane gas to electricity facility which is located in the periphery of the Bisasar landfill within the district of Springfield in Durban.

4.4.1 INTRODUCTION

The building typology will look at architecture of the environment and waste management within the periphery of the Springfield precinct which houses an existing municipal landfill site as well as a community which is surrounded by the landfill which houses the intervention design. Moreover, the facility in terms of response to the built environment is driven by the key concept of waste and architecture mentioned in the previous chapters of the discourse and how architecture can look at means to rehabilitate the landfill of Bisasar as seen in figure 4.4.1. The methane to gas electricity project is a landmark within the Durban area of Springfield and is the first of its kind to utilize alternative methods to

contribute to the green economy of the country through innovation, design and engineering possibilities beyond measure. Moreover, the methane to gas electricity project is seen as a vision for the urban informal settlements and the eThekweni municipality as an electric grid system which harnesses the methane gas to further transform it into a source of electricity distribution for the precinct of Springfield industrial park. The Bisasar landfill which houses this intervention, although unregistered, is a leading CDM (Clean Development Mechanism) project design. On an urban scale, the rapidly urbanization of the existing precinct of Springfield led to the birth of the toxic dumpsite due to the collection of waste imminent from residences and nearby industries. The intervention within the urban fabric led to the response to hazardous and harmful emissions released into the atmosphere as a facility which counter acts the dangers of waste management practices within the built environment. The project was designed as a procurement plan project, outsourcing the operation and maintenance.



Figure 4.4.1 illustrating the methane gas to electricity facility which is located in the periphery of the Bisasar landfill within the district of Springfield in Durban by Author,

4.4.2 JUSTIFICATION OF CASE STUDY

The bisasar landfill waste dumping area housing the methane gas to electricity project is chosen because it is relevant to the findings of the theoretical discussion, and therefore most valid to this dissertation. The building typology resonates within the difficulties of waste management within the built environment where urban space and waste can be combined using architecture specifically focusing on engineering services to respond to an existing community within the area. Landfill sites on an urban scale are disregarded from the environment we live and thrive from and the negative impacts which arise from these hostile environments. The design of the plant aims to solve the chaotic and problematic environmental exploitation of hazardous methane gas exposure to the atmosphere through means of diversion. The plant is situated within the periphery of the landfill which is seen as a dead and lifeless space within the urban fabric both giver and receiver of life where man and nature combined form and ecosystem (socio-ecological) in the environment. The field work, observed this case study on principles discussed within the theoretical framework providing insight into a complex system that exists within municipal waste management sites. The case study forms part of the process of rehabilitating the landfill through sustainability and design as well as an architectural response which impacts a community of informal waste pickers, informal and formal residential households which contribute to the waste cycle of the landfill through the collecting and dumping of waste in the dumping zones. The project is unique within the African context we inhabit and is designed to generate electricity from a dangerous gas using leachate catchment method to capture the hazardous gas. The plant forms part of a sustainability method within the built

environment of landfill sites to further respond to both physical and environmental aspects associated with municipal dumping areas.

4.4.3 LOCATION AND BACKGROUND CONTEXT

Architect/ Contractor: Fountain Civil Engineering and Environ Fill (Pty) LTD

Client: eThekweni Municipality

Size: 600m²

Location: The methane gas to electricity facility is located on the periphery of the Bisasar landfill within the Springfield precinct in Durban, KwaZulu-Natal.

Background Context: The methane gas to electricity facility is situated in the heart of the Springfield industrial district within the central region of the Durban CBD (Central Business District) in the peri-urban areas KwaZulu-Natal, however it houses commercial and residential zones in and amongst industrial zones of the Springfield industrial district, with a large span of formal and informal residential occupants, industrial trade workers, operating the post-colonial South African city spatial configuration of the context within the outskirts of the Springfield precinct (Figure 4.4.3.1).

4.4.3.1 World map, locating the African continent. (image by author, 2020).

4.4.3.2 Map of South Africa locating the province of KwaZulu-Natal, South Africa. (image by author, 2020).

4.4.3.3 Map of the city of Durban, KwaZulu-Natal. (image by author, 2020).

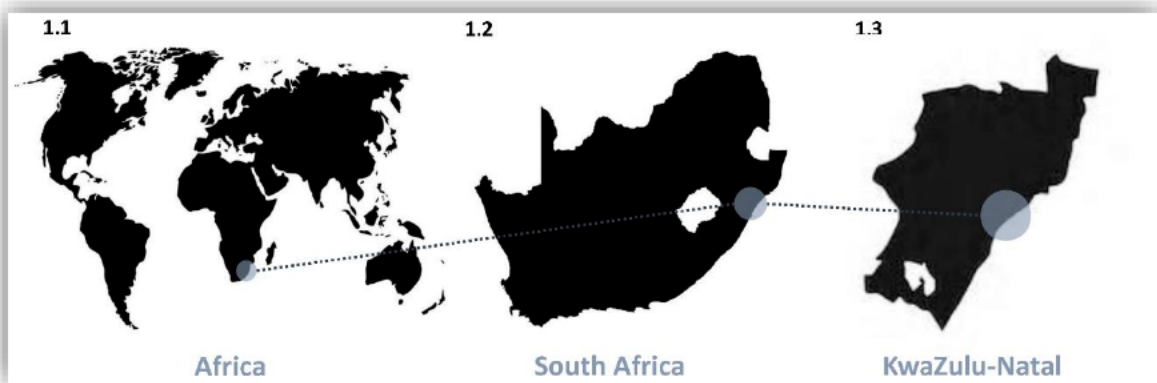


Illustration 4.3.3.1- 4.3.3.3 Map locations of the precedent study. Source:

<http://earth.google.com>



Figure 4.4.3.1 illustrating the birds eye view of the location of the methane gas to electricity facility which is located in the periphery of the Bisasar landfill within the district of Springfield in Durban.

4.4.4 HISTORICAL AND SOCIAL CONTEXT OF CASE STUDY

The methane gas to electricity facility occupies a major site within the district of Springfield which was established in 1980 during the apartheid years of South Africa, situated in a low income, Indian community which is surrounded by both informal and formal residential housing. Moreover, the site opened in May 1980 owned by Springfield DSW (Durban Solid Waste) under the Department of Trade and Industry formerly known as the eThekweni municipality. The site which houses the intervention is highly contested due to its proximity to the city centre and in terms of its political social structure with the urban fabric. Moreover, the district is dominated by activists and social movements which stem from the power struggle between government and its people. These inhabitants include the Abahlali BaseMjondolo (shack dwellers) who protest against equal rights to service delivery for its inhabitants of the Springfield precinct specifically, it's residents. The facility is constructively placed within an existing municipal landfill area which is formerly known as the Springfield landfill waste dumping site or better known as the Bisasar landfill. On the other hand, the social and political aspects of the site are derived from environmental racism, environmental spatial justice, community conflicts and the incompetence from the existing government which led to the urban sprawl of violence within the existing community of Bisasar, in Springfield district of Durban.

4.4.5 ARCHITECTURAL ELEMENTS OF THE DESIGN

The design project of the Bisasar landfill gas to electricity in Springfield is the pioneer in engineering and architectural retro-fitted design utilizing a series of shipping containers

generating not only power to the circuit grid of the eThekweni Municipality but also contributing to the green economy of Durban (Figure 5.4.5.1). The initiation of the project stems from Durban Solid Waste (DSW) early as 1994 because of low electricity prices which made such a project financially unviable. Furthermore, the gas to electricity project in terms of design is seen as a prototype for funding opportunities for this project and additional landfills within South Africa and around KwaZulu-Natal. The organic waste piled up within the Bisasar landfill uses a series of wells and pumping systems in the form of metal tube pipes similar to the Vall d'en Joan landfill precedent study in chapter 4 of the discourse. Moreover, as a result of these catchment and collection systems which absorb the leached fluids seeping from the landfills past waste material buried under the soil, the site resulted in reduced emissions of approximately 7.2 million tons of Carbon dioxide (CO₂). The intervention is made possible due to the landfills halt in receiving organic waste from the year 2015. However, the waste dumping site is estimated to continue its production of converting hazardous methane gas into electricity thus generating the product for another 15 years. The project harnesses the potential for income generation for the Municipality through a carbon offset project design (methane flaring and green electricity generation) by generating its own electricity produced from landfill gas to electrical energy supply for the city including the Abahlali BaseMjondolo (shack dwellers) of Bisasar (Figure 4.4.5.2), (Figure 4.4.5.3) and (Figure 4.4.5.4). The Bisasar landfill gas-to-electricity project as a design component captures the methane through the implementation of wells drilled into the landfill. These wells are connected by still tube pipes to a central collection point where the gas is then distributed into a spark ignition engine driven by a generator to produce the electricity. Moreover, the design as a whole in terms of climate benefits prevents the release of methane gas (greenhouse gas) more potent

than carbon dioxide and the electricity produces offsets coal emissions from other industries as an alternative method of outsourcing electricity.



Figure 4.4.5.1 illustrating retro-fitted shipping containers of the methane gas to electricity facility located at the Bisasar Road Landfill site within the district of Springfield in Durban by Author, 2022



Figure 4.4.5.3 illustrating retro-fitted shipping containers of the methane gas to electricity facility supplying electrical energy to Abahlali BaseMjondolo (shack dwellers) of the Bisasar Road Landfill site within the district of Springfield in Durban by Author, 2022

Bisasar Road is one of the biggest landfills in South Africa and receives approximately 3 500 tons of refuse waste per as well as peaking at a maximum of 5000 tons. The site composes of 77 vertical and horizontal wells each and utilizes 38 leachate pumps on a technical systematic level. Moreover, the organic waste component within the Bisasar landfill is 35% thus allowing for the technical intervention to be implemented programmatically (Figure 5.4.5.4). Moreover, the intervention allows for the production of electricity to be formed using a conversion of methane gas into electricity as a generator for the Durban municipal gridline distribution as a resource component which powers the electrical output sourced from the Bisasar Landfill.

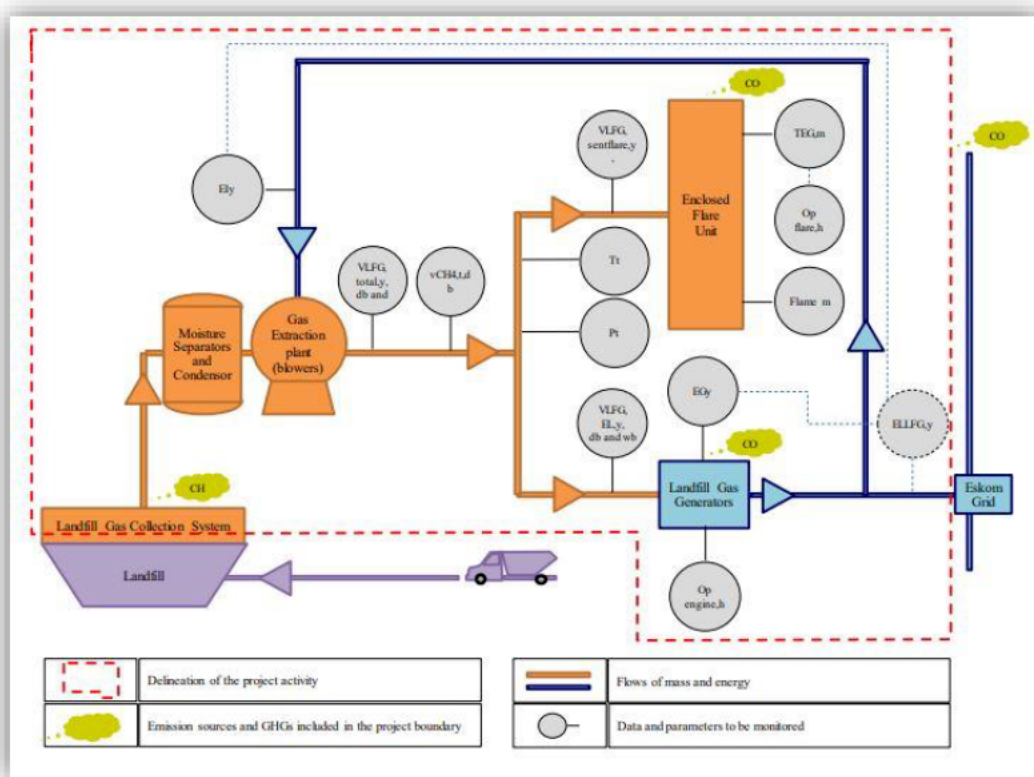


Figure 4.4.5.4 illustrating landfill gas flare located at the Bisasar Road Landfill site within the district of Springfield in Durban.

4.4.6 CONCLUSION

The Bisasar landfill gas-to-electricity project forms a major component of the design intervention for the proposal. The existing facility is designed to facilitate the recovery of useful discarded waste material dumped within the landfill. The project on a community level can provide formal jobs through the development of recycling where the dump site within the periphery of the landfill is run by the community on an informal platform instead of it being run by Durban Solid Waste (DSW). The informal waste pickers within the Bisasar landfill are the biggest contributors to the waste economy of the landfill and through intervention, the gas-to-electricity facility is an alternative contributor to the Eskom gridline.

CHAPTER 5

ANALYSIS AND DISCUSSION

5.1 INTRODUCTION

In attempts to further comprehend the dimensions related with urban resilience and adaptive socio-ecological systems in ecosystems that are triggered due to environmental spatial injustice, the research explored the development of the conceptual and theoretical discourse mentioned in the previous chapters in the context of the empirical data attained through the interview-questionnaires that were conducted specifically focusing on waste management and the study of the local buildings of designers who plan spatial arrangements of modern structures which speak to waste management and community architecture for existing informal waste pickers whom reside in densified urban environments. The interview schedules that the research explored are split 5-fold, the first interview was an interview based off of an interview-questionnaire conducted with an architect, Antonio Blanco- Montero, who is an environmental expert responsible for waste management in rapidly urbanized environments in complex cities. The second interview schedules were conducted with a landfill operators manager for the eThekweni Municipality(DSW), Durban Solid Waste, Mfundo Nhlengethwa, who operates the selected site for the intervention proposal design. The third interview schedules were conducted with a project manager at Asiye Efafuleni which is a non-profit organization which helps informal works in the CBD of Durban, Richard Dobson, who worked extensively on the Waste pick-up and disposal Facility for the informal waste card-board pickers. The fourth interview schedules(questionnaire) were conducted with an architect/project manager, Tiago Damasceno, who worked extensively on the Lotus Park Neighbourhood Centre and Waste Management Station in Gugulethu, Western- Cape. The fifth interview schedules were conducted with 5 informal waste pickers from the Bisasar

landfill in Springfield, Durban. The waste pickers identification remained anonymous due to personal reasons.

The research study conducted from the fieldwork, observed the two case studies and collected the empirical data through the utilization of interview-questionnaires with the relevant architects of the specific buildings in the built environment mention above. Please refer to the Data Analysis obtained further on this chapter. Furthermore, the research study analysed the Waste Pick-up and disposal Facility and the Lotus Park-Neighbourhood Centre and Waste Management Station based off of principles discussed within the theoretical framework to understand the relevance and applicability of the concepts defined from the investigation. Photographic images of case study are included the previous chapter discussed which shows the observations, findings, assessment of building spaces, and the experiences relevant to the study at hand. The research study collected these purely for evidence and data capture which further supports and proves the literature of the research study. In addition, drawings of the building typologies are obtained and analysed through supported photographic data.

It is clear from the fieldwork findings of the investigation that there is a diminutive integration between the environment and the natural environment Yeang et al (2008), identifying relationships between marginalized groups (community) and environmental issues within the urban fabric. Furthermore, it is also clear that the threshold of urban resilience in adaptive-social ecological systems and sustainability can be identified through integrating resilience where the social, environmental and spatial components can influence community architecture as a learning process in existing environments.

5.2 INTERVIEWEE'S DEMOGRAPHICS

The first interview schedule conducted, aimed at focusing on the site selection of the design intervention in the Bisasar landfill in Springfield, Durban. Moreover, it looks at the design motivation and influence to respond to the challenges faced by the municipality, the types of characterization of waste contributors within the landfill thus identifying a response in the type of intervention and community engagement through waste material currently salvaged by informal waste pickers of Bisasar. The product of the spaces on a design point of view is focused on sustainability in response to environmental spatial justice. The questions focused on underpinning the key concept of socio-ecological systems in waste management through sustainability and responding to the needs of the environment, providing solutions or innovative design drivers in an architectural response to underpinning the key concept of environmental spatial justice. The final key questions that the interview schedule focused on, which is crucial in the development of the response architecturally where question pertaining the relationship between waste management practices, informal waste pickers whom the biggest contributors to the formal waste economy and the types of waste material are salvaged as a need for these waste pickers. The identification of how the landfills operations management of the dumping site through sustainability focused on a contested spatial hierarchy between the municipality and the informal waste pickers. Mfundo Nhlengethwa asserted the problems faced by the eThekweni municipality in terms of waste management on an environmental aspect and sustainable methods of rehabilitating the landfill through innovation design.

The second interview schedule conducted, aimed at focusing on waste management expert Antonio blanco- Montero, specifically highlighting the impact that waste pickers have on the waste management sector. The key question identifies waste pickers as the main contributors of the waste economy resulting from failed municipal practices within the built environment. Antonio blanco- Montero asserts that the problems or the driving forces as well as working conditions of informal waste pickers on a community level is hindered by certain thresholds within the environment of waste management. Moreover, these are driving forces as a result of a dis-functional system within the waste cycle. Social stigmatization resulting from the key concept of environmental justice in unregulated environments fosters a debate of responding to an existing community whom are in need of an intervention to celebrate these unacknowledged informal waste pickers within the built form. Therefore, in urban settings individuals and collective waste pickers, residents get exposed to an urban space(landfill) where individuals take ownership of spaces within spatially contested zones as a form of making a living. This is where the theory of empowerment is highlighted within these spatially contested setting where informal waste picking and waste management create a dialogue for change within the built form.

The third interview schedule conducted, informal waste pickers of the Bisasar Landfill whom requested to remain anonymous due to the social and political stigma of the informal activity. A total number of 5 participants were interviewed. In South Africa, waste management systems appear not to be ready to accommodate informal waste pickers. Due to the rapid urbanization within the environment, waste pickers nevertheless contribute significantly to national economies. The field work conducted and the background research reveals that much has been inscribed about waste pickers however, very little dialogue

about street waste pickers. Waste pickers should be considered within the context of formal waste management cycle.

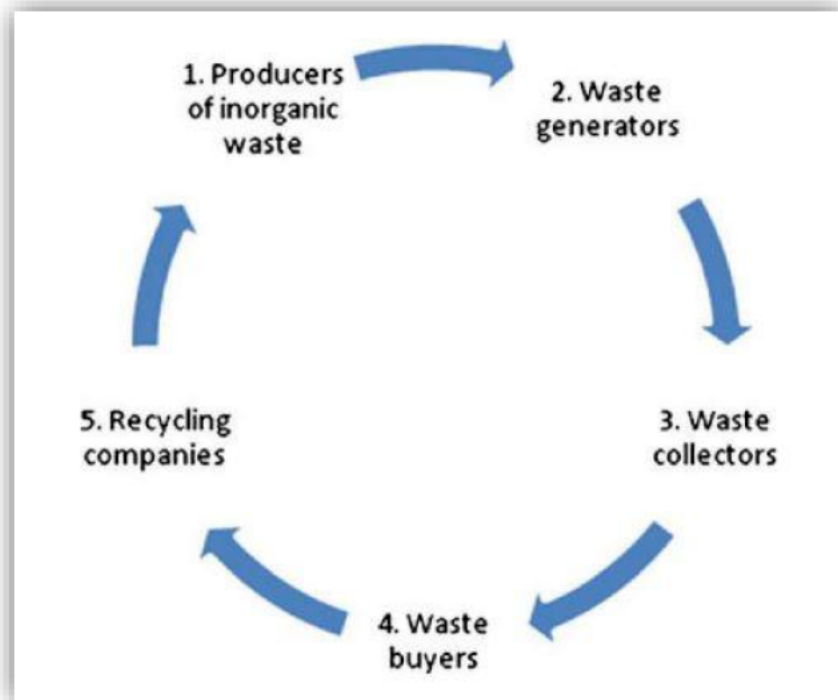


Figure 5.2.1 Illustrating the waste cycle within waste management (Source: Schenck and Blaauw 2010).

The demographic profile of the 5 street waste pickers of the Bisasar landfill in Sprinfield highlighted that the dominant gender was male (80%) and were all black. Furthermore, the demographic profile of the street waste pickers highlighted that the age distribution of the informal waste pickers was between the ages of 31 and 40 (80%). Only one respondent was between ages 21 and 30. The demographic profile of the waste pickers highlighted that the individuals entered waste picking fairly recently, averaging 5 years. In this part of the demographic profile, describes the daily lives of the waste pickers, collection activities,

items collected, driving forces and the challenges of the Bisar landfill. This aids the research in understanding waste management practices and an insight into the lives of waste pickers. In response, helping design an intervention that responds to the social and environmental aspects of this informal activity as well as the contextual issues of the landfill as a whole. Moreover, the demographic profile of the street waste pickers highlighted a complexity within the informal waste recycling economy pertaining to the waste pickers.

Waste picking is seen as a source of income for these individual and collective groups, which is carried out by the poor specially marginalized social groups who resort to reclaiming and scavenging. The activity as a whole is a financial support mechanism for informal waste pickers where relationships are formed as a result of this activity. The relationships formed stem from buy-back centres, the public and the community as well as a collective relationship between the waste pickers which resonates with the theory of empowerment discussed in the literature review. The challenges faced by these groups are issues related to the social stigmatization resulting from social exclusion, inadequate spaces for sorting and storing collected material, access to waste within the landfill being limited resulting in illegal dumping on the periphery of the landfill. It is evident that contested spaces within the built environment create such challenges for the informal waste pickers as a result hybridization through environmental spatial justice is highlighted from the social aspects of waste management, urban space and waste picking.

The items collected by waste pickers are determined by what they can salvage to use or sell within the market. The daily collection patterns of informal waste picking are

influenced by the items collected as a result working conditions within these contexts become harsh and rather challenging. However, economic reasons are the justification of why these individuals and collectives resort to waste picking. Moreover, waste pickers contribute to environmental sustainability through diverging waste from the landfill site. If stakeholders within the waste economy would consider acknowledging waste pickers a valuable link within the waste management cycle, they could contribute to a solution in collaborating within local government, recycling companies as well as NGOs (non-governmental organization). Thus, creating recycling opportunities and enhancing recycling awareness initiatives among the Springfield district public and community.

The fourth interview schedule conducted with project manager Richard Dobson from Asiye Etafuleni, an NPO (non-profit organization) which deals within informal activities within the built environment. The response from the demographic focused on designers whom have a significant influence on the end result of spaces in which inhabitants or communities dwell. The question asked concentration on asserting the designers understanding on the approach to designing form informal waste pickers within the Durban district CBD (central business hub) and incorporating these individuals and collectives within the built form. An understanding of sensitive design in complex environments explores the concepts and theories underpinned in the research as well as understanding community architecture. The key question that the interview schedule focused on, which were crucial in developing the research were questions pertaining to how architecture as a response can foster spaces for community engagement in waste management and urban space. Richard Dobson made reference to informal recycling as an activity can cater for spaces for the community through empowering the informal waste pickers within the waste economy in creating a

dignified activity, introducing communal spaces or platforms to celebrate informal waste pickers. This looked at fostering communal spaces by introducing a park where urbanites, informal waste and the public can integrate thus linking waste management, urban space and architecture. Furthermore, waste recycling schemes are important within the built environment to bring change and social inclusion. Responding to social, environmental and economical constraints within the informal waste economy is crucial in the sustainability of waste management as a whole.

The fifth and final interview schedule conducted with project Tiago Damasceno from the Sustainable Urban Design Architects/ VPUU (Violence Prevention Through Urban Upgrading) in Gugulethu, Western Cape. The response from the demographic focused on the design approach and the community needs of the Lotus Park Neighbourhood centre and the waste management facility. The question asked focused on how design interventions impact the needs of the community through defining the problem on an urban scale and set fundamental priorities in response to the community needs. The second question of the demographic made reference to the motivation behind the proposal of both facilitates on a community participatory level which identifies needs which cater for public activities in the form of active and justifiable spaces within the built form through identifying the basic needs of the existing community. On the other hand, Tiago Damasceno identifies the waste management facility as one which is focused as a function on waste management even though it caters for the informal activity of waste picking with the exiting community thus fostering a formal activity into a formal role. According to stats South Africa (20102), the waste management sector is moving away from the dumping of organic and recyclable waste which is being dumped illegally on an informal level thus, the waste management

station is a response by providing a clean environment. The third question of the demographic attained focused on a critical question of identifying the vision for the current informal settlements project within the Lotus Park and how these spaces foster community engagement in response to the community needs. The fourth question of the demographic focused on the literature review chapter where environmental spatial injustice responds to spatial reconfiguration of community public spaces within the built environment. Tiago Damasceno asserts, that community public spaces respond to environmental spatial injustice within urban areas. The construction architecturally is not on the physical input however, the community process in terms of participation if linked together tend to prosper on an urban scale. Thus, the imperative activity responding to the needs of the community leads to the activation of the space within the urban fabric. Spaces with specific programs activate or harness the best results through community actively being involved in the process of these current activities thus the process becomes a more collaborative and inclusive through spatial reconfiguration. The fifth and sixth question of the demographic focuses on project schemes such as the Lotus Park Neighbourhood centre through facilitating the empowerment of the local community residents of the informal settlements of Gugulethu. Tiago asserts that such schemes empower the community through the process of designing and building facilities which empower the communities by allowing the inhabitants of the area to take part in the design process as well as construction phasing. He further identifies two types of empowerment which is short term empowerment activities and long-term empowerment activities for the community at large through social cohesion. Lastly, the process of community engagement develops over time through the identification of what are the needs of the community as a whole.

5.3 INTERPRETATION OF DATA

The findings can be concluded from the data above collected in the form of interviews attained is that the relevant information brought forward by the interviewees does not match the literature discussed within the document. Firstly, the first interview schedule which related more the design response and intervention within an existing dumping site which challenges the notion of the challenges faced by the municipal waste management and to further identify filters or drivers which help aid response to the underpinning of the problem statement of waste management, it highlighted that waste management, architecture and urban space are socio-ecological systems within the built environment we inhabit as humans. Furthermore, the interview schedule expressed that within the built form waste management plays a crucial role between the relationship of waste management and informal waste reclaimers in creating a platform which bridges the gap between the two entities on an urban scale. In addition, individuals or collectives within a specific urban setting resulting from social stigmatization fosters an architectural response with the built environment due to the key concept of environmental spatial justice as a consequence of spatially contested urban spaces communities inhabit. From the third interview schedule it was confirmed that an in-depth understanding of the livelihoods of informal waste pickers of the Bisasar landfill was required to gain understanding in how they move within the built environment pertaining to waste management which is seen as their informal activity of trade or skill. It is noted that these waste pickers contribute to the economy of waste management however, unacknowledged nor recognized as the major contributors. The fourth interview schedule concluded that designers within the built environment can have influence in architecture which is responsive to existing communities by identifying the

needs of the community through problem solving design and intervention. Moreover, waste management is a catalyst which drives intervention within existing communities whom are impacted by the problem statement discussed in the previous chapters of the discourse.

5.4 CONCLUSION

The purpose of this chapter of the discourse is to help aid and support the statements in the form of interviews that are presented by the literature above. Moreover, the findings of the research topic and literature concluded that there is the need within the built environment to further explore design typologies of community architecture through identifying the needs of existing communities on an urban scale resulting from the problem waste management and its impact on the environment and its urban dwellers. This is due to the fact that urban dwellers within densified urban environments are hindered by environmental spatial injustices within urban form and fabric. Spaces within the urban fabric of spatially contested settings as a result of displaced urban areas such as landfills foster debates on environmentally challenged and marginalised communities on an urban scale. Therefore, the typology explored in the research topic is appropriate for the scope of work exploring a learning centre for waste management in the Bisasar landfill which is to consider the concepts of environmental spatial justice and urban resilient communities as well as the theory of empowerment in the built form.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 INTRODUCTION

The purpose of this chapter is to outline the conclusions grasped in terms of the mentioned aims of the dissertation, further bringing forward feasible recommendations and suggestions of the design guidelines and findings. Moreover, these are projected to highlight paths of research necessary in the field of this study to further aid and understanding of the research attained. A crucial aspect of the hypothesis is essential to further gain understanding and this is as follows:

The contemporary urban city results from conflicts between waste management, nature, environmental spatial justice and the resistance of informal settlements in urban areas through urban resilience which has led to the need for environmental justice within the communities of Springfield, Durban.

‘The study investigates the underlying social, environmental and spatial principles which define the key concept of urban resilience in addition to how environmental spatial justice in communities plays a crucial role in identifying existing physical and spatial environments within the built form’.

The information attained throughout the research study provided meaningful insight into the influence of recycling on community architecture, utilizing the key concept of urban resilience within resilient communities of informal waste pickers and the impacts of environmental spatial justice within the built environment in understanding the objectives of the research study.

6.2 SUMMARY OF THE STUDY

The study scrutinized the influence of recycling on community architecture through critically investigating the underlying social, environmental and spatial dynamics of contested spaces within the built form fostering learning spaces or processes using waste management, architecture as a driver relevant to the highly contested spatial hierarchy of landfills in urban space and form. The theoretical information attained throughout the discourse supports the preliminary hypothesis posed in the previous chapter of the discourse. Furthermore, by attaining knowledge insight (alternative knowledge systems) through understanding waste management, urban spaces and the lives of resilient communities of informal waste reclaimers living within an active landfill dumping site keeping in mind the existing area of the study categorized as a fragmented urban context influenced by the hierarchy of the Apartheid regime spatial planning (Statistics South Africa, 2012). Therefore, waste management processes are needed to connect the social, environmental and spatial relevance of waste architecture for the community through empowering resilient groups effected by the spatially disconnected urban settings influenced by transformative learning spaces within the built form.

The research study of the discourse comprehends that recycling on an urban scale can influence community architecture within the built form of spatially contested urban spaces through the relationship and interlinkages between architecture, waste management and urban spaces fostering community engagement through integrated learning processes within municipal landfill sites. Moreover, these learning processes within the built environment focuses on waste reclaimers whom play a fundamental role in the waste

economy through identifying urban spaces which can be influenced by transformative learning spaces through different knowledge forms of learning on a technological level informed by culturally diverse contexts in African cities. Environmental spatial justice in urban form identifies the arrangements of contested spatial patterns within densified urban environments(hybridization), defining the existing character of an urban space in response to architecture which caters for the needs of the community and its inhabitants. Urban resilience in urban form and fabric tackles the ideologies of what defines the phenomenon. In a spatially contested space urban resilience identifies three crucial components for design which encompasses the social component, spatial component and the environmental component of the space. Thus, the characteristics of urban resilient communities within the built form are identified as integrated systems which involve both ecosystems we live and its inhabitants on a spatial scale. The following section of the discourse will further elaborate on environments spatially contested within the built form where the focus id shifted towards the relationship between resilient communities (marginalized groups) and environmental issues that hinder the built environment fostering spaces for transformation.

The main question that the research intended to answer in order to respond to the mention declarations is how can waste management, architecture and urban space define or create a new architectural approach of urban resilience for the community of the district of Springfield in Durban, within the context of an African city. To answer the key question of the research study, the enquiry expanded upon the key concepts of environmental spatial justice in Urban contexts and contextualizing urban resilience in African cities. This was intentionally done to comprehend the development of spatially contested spaces within the built form and to identify the underlying influences which underpin the origin of these

concepts related to the built form of African cities. Furthermore, the environmental problem of waste management combined with the literature review of the discourse underpinned the answer to the key question of the research collected.

To answer the first sub question in which the research study aimed to respond to is, how can the concept of urban resilience influence spatial integration of waste management in municipal landfill sites within urban communities. The question was answered through the exploration of data collection in the form of relevant case studies selected in the previous chapters of the discourse. Moreover, from the case studies selected, it was evident in the response of the interview schedules and the data collected that waste management can be integrated into community architecture through identifying the problems within existing spaces of urban dwellers and responding to the needs versus the wants of the community. Moreover, urban resilience in African cities influence inhabitants or dwellers whom step from different situation and environmental problems within existing urban settings.

To answer the second sub question in which the research study aimed to respond to is, how can architecture act as a public interface through integrated learning processes (waste management) within urban areas. The question was answered through the exploration of data collection in the form of relevant case studies selected and literature in the previous chapters of the discourse. Moreover, from the case studies selected and literature, it was evident that the research expanded on the application of the theory of empowerment and contextualized the theory into African context with specific focus on informal waste reclaimers. In addition, the findings suggested that waste reclaiming as an informal activity

is seen as a participatory aspect in the development of individual or group learning and understanding within a natural setting creating social change in urban contexts.

To answer the final sub question in which the research study aimed to respond to is, how can architecture of resilience for waste management empower existing communities within the urban area of Springfield in Durban. The question was answered through the exploration of data collection in the form of relevant case studies selected in the previous chapters of the discourse including literature presented. Moreover, from the case studies selected and the literature, it was evident that resilience stems from the people, place and urban setting which determines or drives a response in architecture to solve critical social, environmental and economic issues facing existing communities in urban contexts.

In conclusion, the study aimed to respond to all the questions mentioned above in the form of an enquiry, especially the key question of the research study suggesting that urban resilience being a catalyst for spatially contested areas within the built form can influence or foster spaces for community through waste management and its influence on community architecture through identifying critically affected urban spaces in the built form in response to its urban setting.

6.3 SUGGESTED DESIGN FINDINGS AND GUIDELINES

The suggested design findings of the study are theoretically based in application within the design of waste management landfill environments and existing communities impacted by environmental and spatial injustices within the urban fabric. Thus, the theoretical discourse

in the research study discussed are environmental theories including the concept of environmental spatial justice, urban resilience and the theory of empowerment and transformative learning.

The research study interrogated how waste management, architecture and urban space can influence the design of community spaces of engagement through waste. Thus, identifying the types of environments (hybrid spaces) within the built form which resonates with the key concepts and theories mentioned above. The response to these is the concept of environmental spatial justice and urban resilience which is the main concept of the architectural response described as '*connecting spaces with justice*' from environmental inequality in the built form as seen in figure 6.3.1 and figure 6.3.2.

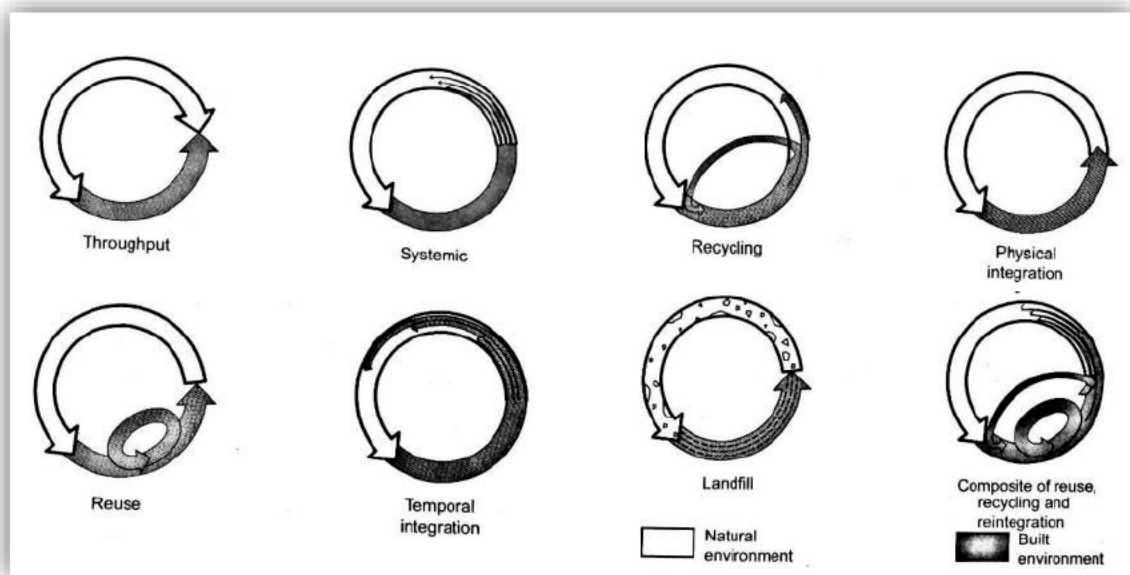


Figure 6.3.1 Identifying a relationship between marginalized groups, environmental issues and integration between the built environment and the natural environment Yeang et al (2008).

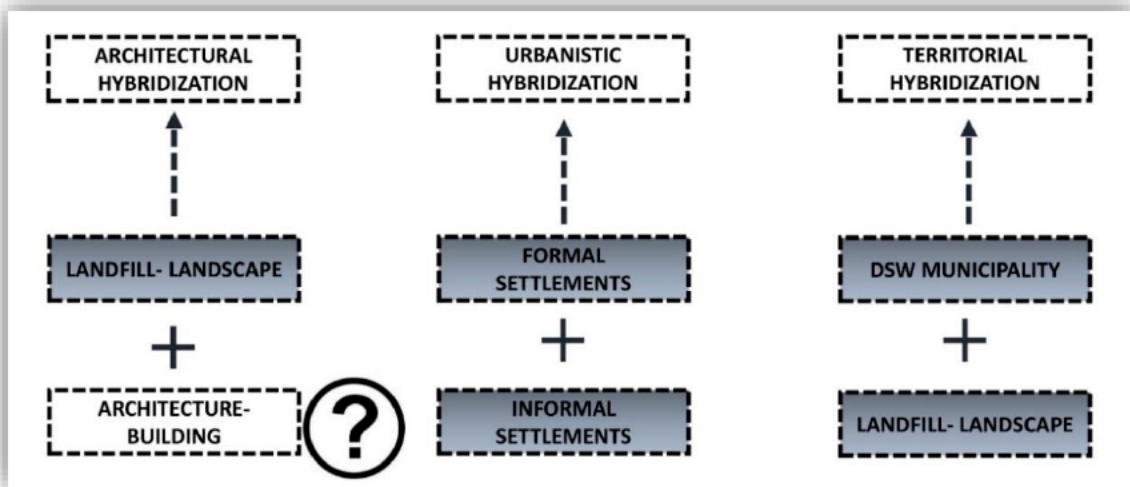


Figure 6.3.2 illustrating the conceptualization of incorporating architectural hybridization as the missing link for built form within the landfill by Author, 2022.

The above-mentioned design guidelines are listed as follows:



Figure 6.3.3 illustrating the five steps for analysing spatial inequality urban environment.

(Source: Soja, 2009).

The concept of spatial critical thinking centres around three principles:

- The ontological spatiality of being (as human or inhabitants on this earth, we are all spatial, social and temporal beings).
- The social production of spatiality (a space is socially produced and as a result can be socially changed).
- The socio-spatial dialectic (the spatial forms the social as much as the social forms the spatial).

In an urban setting, examples of spatial inequality and spatial injustice identify facilities or activities that cause harm to communities where space is unfairly or unjustly controlled through an uneven distribution within the built form. On the other hand, Author David W. Harvey (1973) defines spatial relationships as urban spaces:

- Absolute space: fixed position on an unchanging organized system.
- Relative space: the distance to a common reference point(location) in time and space.
- Relational space: the position within a symbolic system perceived by a particular group or person.

spaces within the built form connect through interactive dialogue and function. Author (PPS, 2015), identifies four qualities of successful public spaces within the built form:

- Accessibility and linkages
- Activities and the user
- Comfort
- Sociality

On an urban scale place making can be identified through a diagram that demonstrates how these four qualities can be implemented to create public spaces of interest (PPS, 2015).



Figure 6.3.4 illustrating a diagrammatic image of placemaking. Source:

<http://www.pps.org>. 2015

According to Bejtullahu, F (2017) of the three components of city and building resilience are broken down into 3 categories and they are as follows:

Social Component

The elements that are related to chronic stress which are condition that affects people who are unemployed, have inadequate access to public transportation, and are suffering from violence and other social issues. The various components of this issue need to be evaluated and treated in order to build a resilient city.

Spatial Component

The spatial and environmental elements that threaten urban and city settings need to be analysed and treated in order to improve their resilience. This includes assessing and treating the different social dimensions of the affected areas.

Environmental Component

The elements that are linked to the threatened environment in a city. These components need to be evaluated and treated in order to build a resilient framework.

- **The multi-functionality of space** - The concept of multi-functionality allows people to use different spaces for their needs. It's because the built environment has dynamic environments which accommodate different needs having multiple functions of transitional spaces.

- **The flexibility of spatial processes** – The ability of space to accommodate changes in the environment is also beneficial to systems' functions. It allows them to maintain their flexibility and adapt to the changes brought about by the environment. The flexibility of the urban fabric helps in identifying the spatial functions of the process. In order to ensure that the process can continue to change, each process has to rely on the support of different spaces.
- **The interactivity of facilities** – On an urban scale, A facility's interactivity helps community members interact with its surroundings. This concept is driven by the need to meet the changing needs of individuals and the complex environments they live in. This concept allows various types of facilities to interact with the natural cycles of the environment, such as water, air, and energy. They can then absorb and digest different types of resources. Through this interactivity, a facility can also change its function depending on its location.
- **The diversity of components** – The facility's diversity of components allows it to function as a multi-functional space, which can switch between different tasks within an urban setting. In addition, this allows for the exact same function to be replicated as a series of prototype units, making the facility adaptable to different environments.
- **The intelligence of public services** – On an urban scale, the ability of public services to respond to the changing needs of communities is a vital part of their

operations. In order to effectively serve the public, they need to develop effective strategies and procedures that are geared toward meeting the varying requirements of their users. The technological advancements that have occurred in the field of public service have also changed the way they operate.

- **The humanity of public services** – On an urban scale, the concept of humanity in public services emphasizes the need for resilient urban communities to consider and meet the varying needs of their users in a dynamic environment. This can lead to the development of new services that meet their customers' needs.
- **The prediction is based on management concepts** – This prediction is based on the various management concepts that are used in the field of public services. These concepts help develop effective strategies and procedures designed to address the changing needs of communities.
- **The collaboration of management institutions** – The management process is typically carried out through a collaboration between management institutions. This type of approach involves using responsive tools and methods.

On the other hand, authors Ahern, Qin and liu (2011) argues that there are five planning and design strategies in achieving urban resilience in cities which include:

- multifunctionality
- redundancy and modularization

- social diversity
- multiscale networks
- connectivity
- adaptive planning and design.

To further understand or identify characteristics of urban resilient communities in an urban space, one must recognize that communities within an urban scale exist on a spectrum. Moreover, the lens can be identified or categorized into three types of community networks in an urban space.

Centralized Community Network

- The centralized community network is controlled or owned by the central node (urban space).
- All relationships and power are connected through a central node which can be seen as an organization or individual.

Decentralized Community Network

- A central node where all relationships on an urban scale and environment are organized or collected. The central nodes empower other sub- groups or forms building independent groups which support the central node.

- Scale and diversity broadens the network through enabling the nodes to create other sub- groups. Identity becomes shared among each other in an urban space.

Distributed Community Network

- There is no central node. Every node is connected through a series of webs in the form of spatial relationships.
- No central power and control. All spatial relationships are shared through identity. This results in long- term sustainability and resilience to shocks.

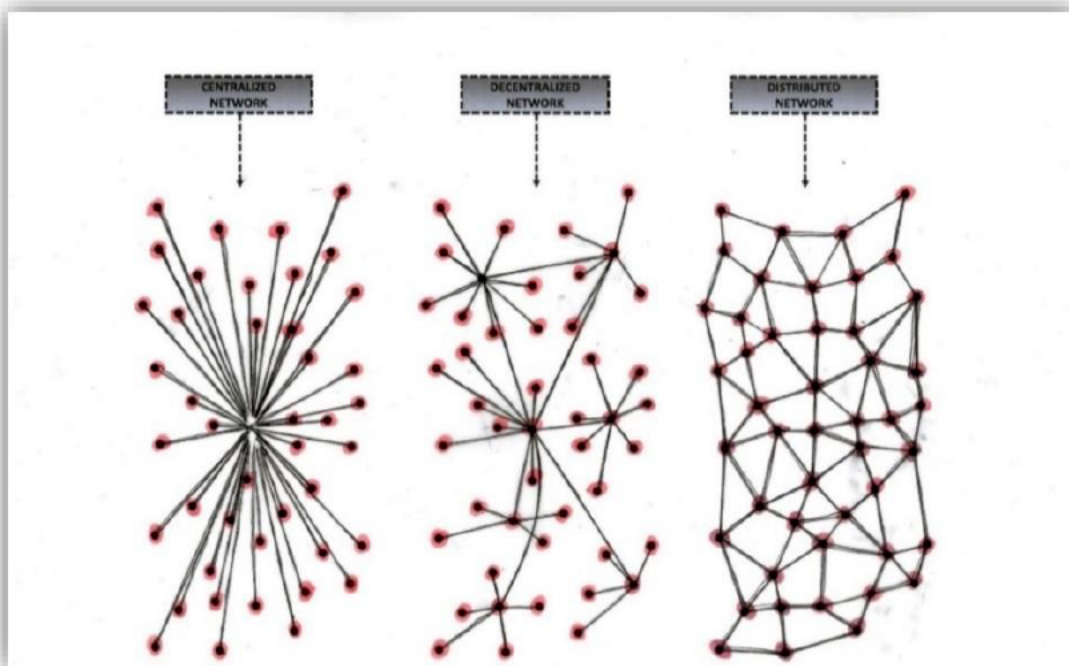


Figure 6.3.5 illustrating Urban Resilience Multiscale Networks- Centralized Network, Decentralized Network and Distributed Network by Author, 2022

Authors, Holling, Ramaswami and Redman et al. all propose examples of these systems which are broken down into three categories: social, environmental and ecological. On an urban scale, these are the drivers that define a socio-ecological system within the built environment (Figure 6.3.6):



Figure 6.3.6 illustrating diagram of the three components of socio-ecological systems by
Author, 2022

Author, Redman et al (2004) asserts that humans are reliant on nature to survive. He further argues, in order for a system to endure sustainability there needs to be an interdependent relationship between society and the environment we inhabit. On the otherhand, author Lindsey (2011) asserts that all systems within the urban environment need to be effective and resilient, implementing much more effective system enhances sustainability (Figure 6.3.7).

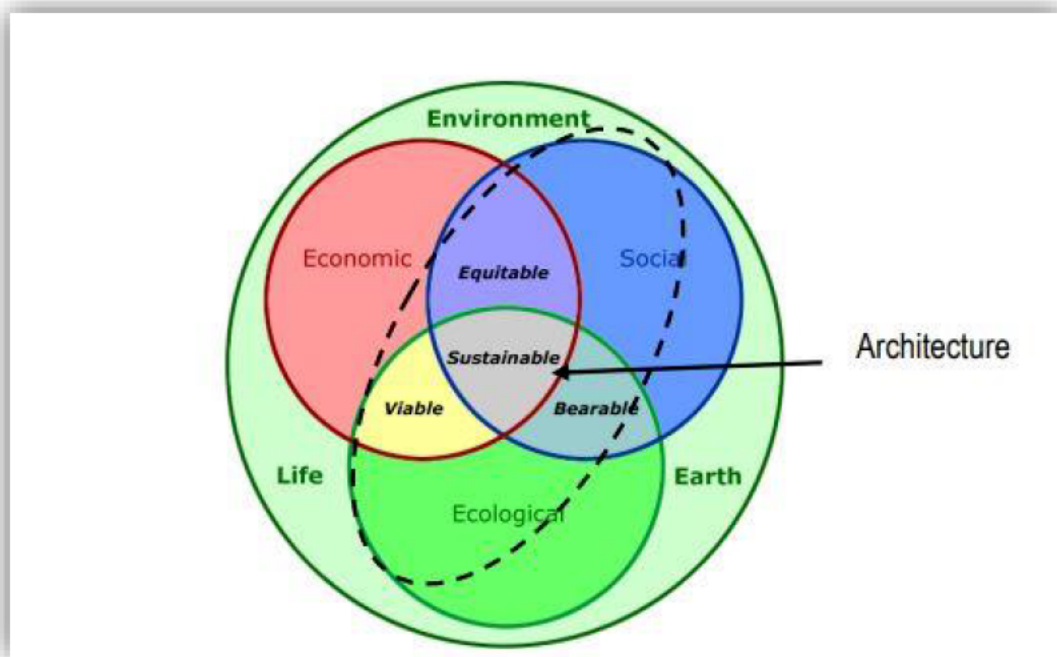


Figure 6.3.7 illustrating diagram of the three components of sustainability Source:

<http://www.thwink.org/>.

The interconnections of the environment, man and nature are crucially important and need to be understood in manner where successful systems within the built form are created. Moreover, sustainability within a system can be sustained through a symbiotic relationship between both the environment and society thus architecture becomes the threshold which brings balance between inhabitants and the ecological environment. Authors Laboy and Fannon (2016) acknowledges Architecture and time play an integral part in the framework for social-ecological resilience in the built environment through multiple physical scales requiring the consistency of adaptation in ever-changing contexts on a technical, organizational, social, and economic realm (Figure 2.2.4.4)

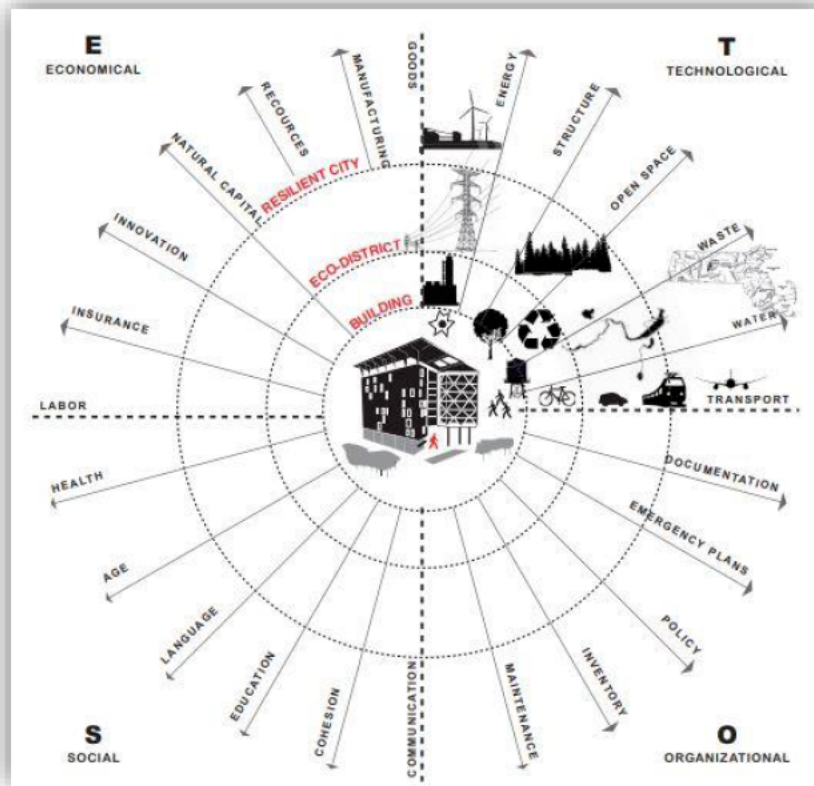


Figure 6.3.8 illustrating diagram of the three components of socio-ecological systems.

Source: Laboy, M. and Fannon, D. 2016

Martinez (2022) identifies the theory of empowerment on a social platform which looks at both the individual and collective level.

Individual level

On an individual level, social empowerment expresses the need for gaining resources to make personal choices and other decisions which allow the human individual to control the environment we inhabit.

Collective level

On a collective level, social empowerment associates organizations and institutions which support marginalized groups of individuals through gaining resources to be empowered, such as economic opportunity, social belonging, material assets and educational assistance.

The theory provides a framework for identifying marginalized individuals and communities within the built form to thrive to instil certain skills, such as education, resources and community engagement in these groups Martinez (2022). The theory of empowerment identifies a five-step framework to aid marginalized groups or communities:

- Identify problems
- Define strengths
- Set built environment goals
- Implement interventions
- Evaluate success on a collaborative level

6.4 CONCLUSION

The purpose of the chapter in the discourse is meant to bring influence to the design realm of architecture in addressing environmental issues within the built form and identifying existing communities whom are hindered by environmental spatial injustices in urban form and fabric fostering resilient urban communities. Furthermore, the research findings of the documentation that were consequential to this research will be used in the proposal of a waste management learning centre in the heart of the Bisasar Landfill in Springfield, Durban.

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LIST OF FIGURES

CHAPTER 1

Figure 1.4.2.1.1 The 12 key goals under 4 categories which describe a resilient city. (Source: Jacobs. J, 1958)

Figure 1.4.2.1.2 The Accra's urban resilience challenges within the Accra metropolitan area of Ghana. (Source: Martin. B & A, 2011)

Figure 1.4.2.2.1 Conceptual sketch of the idea of connecting waste and the community in urban areas. (Author)

Figure 1.4.2.2.2 Diagram of The Sydhavyns recycling centre, Copenhagen, Denmark. (Source:)

Figure 1.4.2.2.3 Ariel view of The Sydhavyns recycling centre, Copenhagen, Denmark. (Source:)

Figure 1.4.2.3.1 Diagram for the concept theory of empowerment. (Source: Fulmen. E, 2022)

Figure 1.4.2.4.1 Waste reclaiming material as a form of alternative knowledge systems by Author 2022

Figure 1.4.2.4.2 Waste reclaiming material as a form of alternative knowledge systems by Author

Figure 1.4.3.1.1 Rapid urbanization in the village of Guangzhoo. (Source:)

Figure 1.4.3.1.2 Dense inter-connected system of informal settlements. (Source:)

Figure 1.4.3.1.3 Diagram illustrating informal settlements forming part of the formal urban context. (Source:)

Figure 1.4.3.1.4 Illegal housing on rooftops of apartment buildings. (Source:)

Figure 1.4.3.2.1 The Quinta Monray Housing project. (Source:)

Figure 1.4.3.2.2 Typical informal house in Khayelitsha, South Africa. (Source:)

Figure 1.4.3.3.1 Formal/ informal hybridization of space, Torre David, Caracas (Venezuela), Sri Nivasapuram, Chennai (India) and Shipai village, Guangzhou (China). (Source:)

Figure 1.4.3.3.2 Hybridization of space of the Bisasar Landfill in Springfield, Durban. (Source:)

Figure 1.4.3.3.3 Conceptualization of hybridization of space. (Author)

Table 1.5.7: A summary diagram of sections informing the research study(Matrix). (Author)

CHAPTER 2

2.1 Environmental spatial justice in peri-urban contexts

Figure 2.1.1.1 and Figure 2.1.1.2 The Abahlali Basemjondolo (shack dwellers) and informal waste pickers who reside in such densified urban fabrics. (Author)

Figure 2.1.1.3 and Figure 2.1.1.4 Environmental spatial injustice within the urban area of Springfield which identifies the location of a hazardous landfill and identifying a relationship between marginalized groups, environmental issues and integration between the built environment and the natural environment (Author: Yeang et al (2008).

Figure 2.1.2.1 illustrating social inequality through environmental spatial justice, urban form and fabric as seen from the sky in the context of the Papwa Sewgolum golf course in Durban, South Africa (top left, top right), Nairobi, Quenia in Kenya (bottom left, bottom right) and Mumbai in India by photographer Johnny Miller (2018).

Figure 2.1.2.2 illustrating social inequality through environmental spatial justice, urban form and fabric as seen from the sky in the context of Cidade in Mexico (top left, top right) and Tembisa in South Africa (bottom left, bottom right) by Johnny Miller (2018).

2.2 Contextualising Urban Resilience and African cities

Figure 2.3.1.1 Place making diagram. (Source: PPS, 2015)

Figure 2.3.1.1 Diagrammatic sketch for the concept of the phenomenon of urban resilience. (Source:)

Figure 2.3.1.2 Conceptual framework for city and building resilience. (Source:)

Figure 2.3.2.1 Flow chart diagram of the history of urban resilience. (Source:)

Figure 2.3.2.2 The link between Urban Resilience and the Urban Theory. (Author)

Figure 2.3.2.3 Informal shack dwellers in urban environments by Author 2022

Figure 2.3.2.4 United Nations statistics on urban densification in African cities. (Source: StatsSA (Statistics South Africa), 2012.

Figure 2.3.3.1 Urban Resilient urban communities in African cities. (Source:)

Figure 2.3.3.2 Urban Resilient urban communities in African cities. (Source:)

Figure 2.3.3.3 Urban Resilient urban communities in African cities. (Source:)

Figure 2.3.3.4 Urban Resilient urban communities in African cities. (Source:)

Figure 2.3.3.5 Urban Resilient community model consisting of four performance dimensions of resilience. (Source:)

Figure 2.3.3.6 Urban Resilience Multiscale Networks- Centralized Network, Decentralized Network and Distributed Network by Author 2022.

Figure 2.3.4.1 illustrating diagram of the three components of socio-ecological systems by Author.

Figure 3.1.4.1 Diagram of the resilience of socio-ecological systems. (Source:)

Figure 3.1.4.2 diagram of the three components of socio-ecological systems by Author.

Figure 3.1.4.3 Diagram of the three components of sustainability. (Source: <http://www.thwink.org>).

Figure 3.1.6.1 Urban Resilience, Adaptability and transformability. (Source:)

Figure 3.1.6.2 Location of New Zealand, Christchurch. (Source:)

Figure 3.1.6.3 The Re: Start Mall in Cashel, New Zealand, Christchurch. (Source:)

2.3 Theory of Empowerment and Transformative Learning

Figure 2.3.1.1 Marxist sociological theory known as Critical theory. (Source: Martinez, 2012)

Figure 2.3.2.1 A rational view of the structure of threshold concepts. (Source: Land. F, Meyer J. H. F and Baillie. C (2010).

Figure 2.3.3.1 and 2.3.3.2 The idea of how waste reclaimers and the scavenging of waste material connect as a form of alternative knowledge systems as a means to adapt or survive by Author, 2022

CHAPTER 3

Figure 4.1 Torre- David Tower- informal vertical communities. (Source: Urban-Think Tank, 2012)

Figure 4.1.1.1 Torre- David Tower- informal vertical communities. (Source: Urban-Think Tank, 2012)

Figure 4.1.2.1 Torre- David Tower- informal vertical communities. (Source: Urban-Think Tank, 2012)

Figure 4.1.3.1- 4.1.3.3 Locality map of the Torre- David Tower- informal vertical communities. (Source: Urban-Think Tank, 2012)

Figure 4.1.3.4 Torre- David Tower- informal vertical communities site plan. (Source: Urban-Think Tank, 2012)

Figure 4.1.3.5 Torre- David Tower- informal vertical communities aerial view. (Source: Urban-Think Tank, 2012)

Figure 4.1.4.1 Torre- David Tower- informal vertical communities spatial configuration. (Source: Urban-Think Tank, 2012)

Figure 4.1.5.1 Torre- David Tower- informal vertical communities section. (Source: Urban-Think Tank, 2012)

Figure 4.1.5.2 Torre- David Tower- informal vertical communities section. (Source: Urban-Think Tank, 2012)

Figure 4.1.5.3 Torre- David Tower- informal vertical communities zoning. (Source: Urban-Think Tank, 2012)

Figure 4.1.5.4 Torre- David Tower- informal vertical communities building sections. (Source: Urban-Think Tank, 2012)

Figure 4.1.5.5 Torre- David Tower- informal vertical communities spatial configuration of adapted spaces. (Source: Urban-Think Tank, 2012)

Figure 4.1.5.6 Torre- David Tower- informal vertical communities typical living space layout. (Source: Urban-Think Tank, 2012)

Figure 4.1.5.7 Torre- David Tower- informal vertical communities living space converted to an entrepreneurial store. (Source: Urban-Think Tank, 2012)

Figure 4.2 North Transfer Station entrance to building. (Source:)

Figure 4.2.1.1 North Transfer Station disposal waste truck entrance. (Source:)

Figure 4.2.1.2 North Transfer Station public open space. (Source:)

Figure 4.2.1.3 North Transfer Station public open space and play area. (Source:)

Figure 4.2.1.4 North Transfer Station community spaces. (Source:)

Figure 4.2.3.1- 4.2.3.3 Locality map of the North Transfer Station. (Source:)

Figure 4.2.3.4 North Transfer Station site plan. (Source:)

Figure 4.2.5.1 North Transfer Station public and community engagement spaces. (Source:)

Figure 4.2.5.2 North Transfer Station public and community sections. (Source:)

Figure 4.2.5.3 North Transfer Station truck entrance to waste processing area. (Source:)

Figure 4.2.5.4 North Transfer Station design plans. (Source:)

Figure 4.2.5.5 North Transfer Station building roof design. (Source:)

Figure 4.2.5.6 North Transfer Station visual image. (Source:)

CHAPTER 4

Figure 4.1 Waste Pick-Up Facility conceptual sketch design. (Source: [http:// aet.org.za](http://aet.org.za))

Figure 4.1.1.1 Waste Pick-Up Facility before and after design intervention. (Source: [http:// aet.org.za](http://aet.org.za))

Figure 4.1.3.1- 4.1.3.3 Locality map of the Waste Pick-Up Facility. (Source: [http:// aet.org.za](http://aet.org.za))

Figure 4.1.3.4 Waste Pick-Up Facility site plan. (Source: [http:// aet.org.za](http://aet.org.za))

Figure 4.1.4.1 Waste Pick-Up construction of the design. (Source: [http:// aet.org.za](http://aet.org.za))

Figure 4.1.5.1 Waste Pick-Up Facility diagram of informal cardboard collectors in the inner Durban CBD. (Source: [http:// aet.org.za](http://aet.org.za))

Figure 4.1.5.2 Waste Pick-Up Facility process diagram of cardboard collecting waste material. (Source: [http:// aet.org.za](http://aet.org.za))

Figure 4.1.5.3 Waste Pick-Up Facility Palmer Street waste picker prototype trolley. (Source: [http:// aet.org.za](http://aet.org.za))

Figure 4.1.5.4 Waste Pick-Up Facility conceptual site plan design. (Source: [http:// aet.org.za](http://aet.org.za))

Figure 4.1.5.5 Waste Pick-Up Facility conceptual sketch design utilizing shipping containers. (Source: [http:// aet.org.za](http://aet.org.za))

Figure 4.1.5.6 Waste Pick-Up Facility construction phase. (Source: [http:// aet.org.za](http://aet.org.za))

Figure 4.1.5.7 Waste Pick-Up Facility completed construction of the design. (Source: [http:// aet.org.za](http://aet.org.za))

Figure 4.1.5.8 Waste Pick-Up Facility interior spatial construction of the design.
(Source: [http:// aet.org.za](http://aet.org.za))

Figure 4.2 Lotus Park Neighbourhood Centre and Waste Management Station site photo of building intervention. (Source: Digest of South African Architecture, 2015)

Figure 4.2.1.1 Lotus Park Neighbourhood Centre and Waste Management Station design intervention of community participation. (Source: Digest of South African Architecture, 2015)

Figure 4.2.3.1- 4.2.3.3 Locality map of the 1 Lotus Park Neighbourhood Centre and Waste Management Station. (Source: Digest of South African Architecture, 2015)

Figure 4.2.3.4 Lotus Park Neighbourhood Centre and Waste Management Station Apartheid regime spatial planning, housing, informal settlements and industrial zones. (Source: Digest of South African Architecture, 2015)

Figure 4.2.4.1 Lotus Park Neighbourhood Centre and Waste Management Station conceptual sketch phasing of spatial configuration of densified urban communities within urban settlements. (Source: Digest of South African Architecture, 2015)

Figure 4.2.4.2 Lotus Park Neighbourhood Centre and Waste Management Station existing dumping site before intervention. (Source: Digest of South African Architecture, 2015)

Figure 4.2.4.3 Lotus Park Neighbourhood Centre and Waste Management Station design. (Source: Digest of South African Architecture, 2015)

Figure 4.2.5.1 Lotus Park Neighbourhood Centre and Waste Management Station spatial elements through design. (Source: Digest of South African Architecture, 2015)

Figure 4.2.5.2 Lotus Park Neighbourhood Centre and Waste Management Station sports court and re-used shipping container. (Source: Digest of South African Architecture, 2015)

Figure 4.2.5.3 Lotus Park Neighbourhood Centre and Waste Management Station conceptual site plan. (Source: Digest of South African Architecture, 2015)

Figure 4.2.5.4 Lotus Park Neighbourhood Centre and Waste Management Station spatial implementation diagram sketch phase 1. (Source: Digest of South African Architecture, 2015)

Figure 4.2.5.5 Lotus Park Neighbourhood Centre and Waste Management Station spatial reconfiguration plan. (Source: Digest of South African Architecture, 2015)

Figure 4.2.5.6 Lotus Park Neighbourhood Centre and Waste Management Station site plan. (Source: Digest of South African Architecture, 2015)

Figure 4.2.5.7 Lotus Park Neighbourhood Centre and Waste Management Station types of waste management systems. (Source: Digest of South African Architecture, 2015)

Figure 4.2.5.8 Lotus Park Neighbourhood Centre and Waste Management construction material utilizing shipping containers. (Source: Digest of South African Architecture, 2015)

Figure 4.2.5.9 Lotus Park Neighbourhood Centre and Waste Management Station 3D conceptual design program of spaces. (Source: Digest of South African Architecture, 2015)

Figure 4.2.5.10 Lotus Park Neighbourhood Centre and Waste Management Station design plan. (Source: Digest of South African Architecture, 2015)

Figure 4.2.5.11 Lotus Park Neighbourhood Centre and Waste Management Station 3D conceptual design program of spaces. (Source: Digest of South African Architecture, 2015)

Figure 4.2.5.12 Lotus Park Neighbourhood Centre and Waste Management Station diagram. (Source: Digest of South African Architecture, 2015)

Figure 4.2.5.13 Lotus Park Neighbourhood Centre and Waste Management Station diagram. (Source: Digest of South African Architecture, 2015)

Figure 4.2.5.14 Lotus Park Neighbourhood Centre and Waste Management Station food composting system. (Source: Digest of South African Architecture, 2015)

Figure 4.2.5.15 Lotus Park Neighbourhood Centre and Waste Management Station waste consumption and illegal dumping zone. (Source: Digest of South African Architecture, 2015)

Figure 4.2.5.16 Lotus Park Neighbourhood Centre and Waste Management Station overload of waste consumption. (Source: Digest of South African Architecture, 2015)

Figure 4.3 Durban Harbour Tunnel North and South Entrance Structures & Mahatma Gandhi Road Sewer Pump Station site photo of building intervention. (Source: <http://choromanski.com>)

Figure 4.3.1.1 Durban Harbour Tunnel North and South Entrance Structures & Mahatma Gandhi Road Sewer Pump Station site photo of building intervention. (Source: <http://choromanski.com>)

Figure 4.3.1.2 Durban Harbour Tunnel North and South Entrance Structures & Mahatma Gandhi Road Sewer Pump Station site photo of building intervention. (Source: <http://choromanski.com>)

Figure 4.3.3.1- 4.3.3.3 Locality map of the Durban Harbour Tunnel North and South Entrance Structures & Mahatma Gandhi Road Sewer Pump Station. (Source: <http://choromanski.com>)

Figure 4.3.3.4 Durban Harbour Tunnel North and South Entrance Structures & Mahatma Gandhi Road Sewer Pump Station aerial view. (Source: <http://choromanski.com>)

Figure 4.3.3.5 Durban Harbour Tunnel North and South Entrance Structures & Mahatma Gandhi Road Sewer Pump Station birds eye view. (Source: <http://choromanski.com>)

Figure 4.3.4.1 Durban Harbour Tunnel North and South Entrance Structures & Mahatma Gandhi Road Sewer Pump Station Durban harbour mouth. (Source: <http://choromanski.com>)

Figure 4.3.4.2 Durban Harbour Tunnel North and South Entrance Structures & Mahatma Gandhi Road Sewer Pump Station Durban harbour tunnel. (Source: <http://choromanski.com>)

Figure 4.3.5.1 Durban Harbour Tunnel North and South Entrance Structures & Mahatma Gandhi Road Sewer Pump Station design intervention. (Source: <http://choromanski.com>)

Figure 4.3.5.2 Durban Harbour Tunnel North and South Entrance Structures & Mahatma Gandhi Road Sewer Pump Station design intervention. (Source: <http://choromanski.com>)

Figure 4.3.5.3 Durban Harbour Tunnel North and South Entrance Structures & Mahatma Gandhi Road Sewer Pump Station design intervention. (Source: <http://choromanski.com>)

Figure 4.3.5.4 Durban Harbour Tunnel North and South Entrance Structures & Mahatma Gandhi Road Sewer Pump Station design intervention. (Source: <http://choromanski.com>)

Figure 4.3.5.5 Durban Harbour Tunnel North and South Entrance Structures & Mahatma Gandhi Road Sewer Pump Station conceptual design intervention. (Source: <http://choromanski.com>)

Figure 4.3.5.6 Durban Harbour Tunnel North and South Entrance Structures & Mahatma Gandhi Road Sewer Pump Station design intervention. (Source: <http://choromanski.com>)

Figure 4.3.5.7 Durban Harbour Tunnel North and South Entrance Structures & Mahatma Gandhi Road Sewer Pump Station design plans. (Source: <http://choromanski.com>)

Figure 4.3.5.1 Durban Harbour Tunnel North and South Entrance Structures & Mahatma Gandhi Road Sewer Pump Station construction design intervention. (Source: <http://choromanski.com>)

Figure 4.4 Durban Bisasar Landfill- Methane Gas- to- Electricity Facility site photo of building intervention. (Source:)

Figure 4.4.1.1 Durban Bisasar Landfill- Methane Gas- to- Electricity Facility landfill dumping site. (Source: www.google.com)

Figure 4.4.3.1- 4.4.3.3 Locality map of the Durban Bisasar Landfill- Methane Gas- to- Electricity Facility. (Source: www.google.com)

Figure 4.4.3.4 Durban Bisasar Landfill- Methane Gas- to- Electricity Facility birds eye view. (Source: www.google.com)

Figure 4.4.5.1 Durban Bisasar Landfill- Methane Gas- to- Electricity Facility retro-fitted shipping containers. (Source: www.google.com)

Figure 4.4.5.2 Durban Bisasar Landfill- Methane Gas- to- Electricity Facility gas flare design. (Source: www.google.com)

Figure 4.4.5.3 Durban Bisasar Landfill- Methane Gas- to- Electricity Facility design intervention. (Source: www.google.com)

Figure 4.4.5.4 Durban Bisasar Landfill- Methane Gas- to- Electricity Facility diagrammatic process and programming of the facility. (Source: www.google.com)

CHAPTER 5

Figure 5.2.1 Illustrating the waste cycle within waste management (Source: Schenck and Blaauw 2010).

CHAPTER 6

Figure 6.3.1 Identifying a relationship between marginalized groups, environmental issues and integration between the built environment and the natural environment Yeang et al (2008).

Figure 6.3.2 illustrating the conceptualization of incorporating architectural hybridization as the missing link for built form within the landfill by Author, 2022.

Figure 6.3.3 illustrating the five steps for analysing spatial inequality urban environment. (Source: Soja, 2009).

Figure 6.3.4 illustrating a diagrammatic image of placemaking. Source: <http://www.pps.org>. 2015

Figure 6.3.5 illustrating Urban Resilience Multiscale Networks- Centralized Network, Decentralized Network and Distributed Network by Author, 2022

Figure 6.3.6 illustrating diagram of the three components of socio-ecological systems by Author, 2022

Figure 6.3.7 illustrating diagram of the three components of sustainability Source: <http://www.thwink.org/>.

Figure 6.3.8 illustrating diagram of the three components of socio-ecological systems. Source: Laboy, M. and Fannon, D. 2016

INTERVIEW QUESTIONNAIRE

Appendix A

Section A

Built Environment Professionals: DSW (Durban Solid Waste) eThekweni Municipality

Please answer all relevant questions honestly in full to the best of your ability and knowledge insight. The data collected will help aid the reviewer and base the analysis and conclusions on the information provided on the questionnaire form.

PLEASE SELECT THE MOST CORRECT ANSWER BY INDICATING (WILL AUTOMATICALLY MARK “X”)
WHERE NECESSARY.

PART 1	
Participants Name	Mfundo Nhlengethwa
Position in Organization	Operations Manager
Organization Name/ Place	eThekweni Municipality(DSW), Durban Solid Waste
Date of Interview Schedule	
Interview Conducted by	Siphesihle Jonas Sphephelo Mdluli

PART 2

1. Question: Provide a brief background on the project location?

2. Question: Have there been any sustainable solutions implemented in the rehabilitation of municipal landfills?

3. Question: Have there been any innovative design drivers or solutions used which allowed for the re-use and rehabilitation of municipal waste landfill sites?

4. Question: Which methane gas to electricity project have you worked on or been a part of in the rehabilitation process of municipal landfill sites near Durban?

☐ A: DSW Bisasar Road Landfill site.

☐ B: DSW Marion hill Landfill site.

☐ C: DSW La Mercy Landfill site.

☐ D: All of the above.

5. Question: Which one of these do you think is the biggest contributor towards environmental waste pollution within peri-urban areas of South Africa?

☐ A: Household hazardous municipal solid waste disposal.

☐ B: Industrial Waste disposal.

☐ C: Extraction and mining waste.

☐ D: Construction and demolition debris.

☐ E: Oil and gas production waste.

☐ F: Agricultural and animal waste.

☐ G: Fossil fuel combustion waste.

☐ H: Sewage sludge waste.

6. What are the perceptions and challenges that the municipal authorities are facing within the peri-urban areas of municipal landfill dumping sites?

- ☐ A: Illegal dumping of waste prohibited on landfill.
- ☐ B: Spewed fires due to toxic fumes in the form of methane gas.
- ☐ C: Toxic substances such as leachate and greenhouse gases.
- ☐ D: Control and monitoring of land filling and fly-tipping activities.
- ☐ E: Illegal scavenging of waste from landfill (waste pickers and collectors).
- ☐ F: Violent protests against the dumping of waste near local residential households (shack dwellers).
- ☐ G: All of the above.

7. What are the reasons behind the burning of solid waste in peri-urban areas?

- ☐ A: Lack of systematic waste collection which leads to open waste burning.
- ☐ B: Inadequate waste management systems.
- ☐ C: Deliberately burned to free up space at dumpsites (landfills) due to the overload of waste brought in.

- ☐ D: To facilitate the scavenging (waste- pickers and collectors) of non-combustible materials (such as metals) for profit.
- ☐ E: Uncontrolled waste combustion within landfills and dumping sites, including the emissions of flammable methane gas from biodegrading waste in the producing of electricity.
- ☐ F: Alternative life support or source of income for informal waste pickers whom are dependent on the landfill.
- ☐ G: All of the above.

8. Question: Which one do you think is the biggest contributor towards the characterization of the different types of waste brought in by DSW (Durban Solid Waste) within the municipal Bisasar landfill site?

- ☐ A: Recyclable Waste.
- ☐ B: Putrescible (organic) Waste.
- ☐ C: Greens and Garden Waste.
- ☐ D: Builders Rubble Waste.
- ☐ E: Other.

9. Question: Which of the following municipal waste dumping sites situated within the area of Durban generates the most electricity from captured methane gas extracted from waste?

- ☐ A: DSW (Durban Solid Waste) Bisasar Road Landfill site.
- ☐ B: DSW (Durban Solid Waste) Marion hill Landfill site.
- ☐ C: DSW (Durban Solid Waste) La Mercy Landfill site.

10. Question: Do you think the municipal landfill caters for the needs of the informal waste pickers within the Bisasar landfill? If yes or no, please explain.

INTERVIEW QUESTIONNAIRE

Appendix A

Section B

Built Environment Research Expert

Please answer all relevant questions honestly in full to the best of your ability and knowledge insight. The data collected will help aid the reviewer and base the analysis and conclusions on the information provided on the questionnaire form.

PLEASE SELECT THE MOST CORRECT ANSWER BY INDICATING (WILL AUTOMATICALLY MARK "X")
WHERE NECESSARY.

PART 1	
Participants Name	Antonio Blanco- Montero
Profession	Professional Architect and Researcher
Qualifications	M.Arch and PhD Candidate
Date of Interview	
Schedule	
Interview Conducted by	Siphesihle Jonas Sphephelo Mdluli

PART 2

1. Question: Do you think waste pickers should further be considered within the context of the formal waste management cycle? If yes, state reasons.

2. Question: Which one of these is the biggest contributor to the waste cycle within the waste management cycle?

- ☐ A: Producers of inorganic waste.
- ☐ B: Waste generators.
- ☐ C: Waste collectors.
- ☐ D: Waste buyers.
- ☐ E: Recycling companies.

3. Question: Who are often the biggest contributors of the waste management system which form the basis of waste collection services at no cost to local authorities, central government and residents?

- ☐ A: Formal waste recycling companies.

- ☐ B: Buy-back centres.
- ☐ C: Informal waste pickers.

4. Question: What are the driving forces & Working conditions that are faced by waste pickers within the informal economy?

5. Question: What are the reasons for people to resort to the collecting of waste on the streets to survive?

- ☐ A: Poverty and hardship caused by unemployment.
- ☐ B: Venturing into the urban informal economy in order to survive.
- ☐ C: Waste collecting and selling as an alternative activity that saves people from starvation.
- ☐ D: Provides a source of livelihood to extremely poor people with few employment opportunities.
- ☐ E: All of the above.



INTERVIEW QUESTIONNAIRE

Appendix A

Section D

Informal Waste Pickers: Bisasar Road landfill

Please answer all relevant questions honestly in full to the best of your ability and knowledge insight. The data collected will help aid the reviewer and base the analysis and conclusions on the information provided on the questionnaire form.

PLEASE SELECT THE MOST CORRECT ANSWER BY INDICATING (WILL AUTOMATICALLY MARK "X")
WHERE NECESSARY.

PART 1			
Participants Name	Waste Picker A (Anonymous)		
Gender you identified as?	<input type="checkbox"/> Female	<input type="checkbox"/> Male	<input type="checkbox"/> Other
Date of Interview Schedule			
Interview Conducted by	Siphesihle Jonas Sphephelo Mdluli		

PART 2				
Question	Yes	No	Sometimes	Other
1. Is waste picking a source of income generation and for everyday survival?				
2. Is informal waste recycling within the periphery of the landfill carried out by poor and marginalized social groups who resort to the reclaiming and scavenging of waste material?				
3. Financial support to families at home (waste picking)?				
4. How often do waste pickers send money home?				
5. Relationship with buy-back centres?				
6. Relationship with the public or community?				

7. Relationships with other waste pickers/ Co-workers?				
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8. Question: Age distribution of street waste pickers?
<input type="checkbox"/> A: 20-30
<input type="checkbox"/> B: 31-40
<input type="checkbox"/> C: 41-50
<input type="checkbox"/> D: 51-60

9. Question: Length of time spent as a waste picker?

10. Question: What are the driving forces resulting in waste picking?
<input type="checkbox"/> A: Macroeconomic Forces (i.e. demand, supply, and competition).
<input type="checkbox"/> B: City/ Government Policies and practices (i.e. lack of basic infrastructure).
<input type="checkbox"/> <u>C: Value chain dynamics (i.e. sources of support from waste material).</u>

- ☐ D: Earning capacity and a sense of independence that is offered by the informal economy of waste picking as an alternative life support system.
- ☐ E: Influenced by the demand for income generation, job creation and economic empowerment.
- ☐ D: All of the above.

11. Question: What are the challenges or working conditions as a waste picker?

- ☐ A: Access to waste from landfill sites and privatization of waste within the municipal landfill dumping site due to permit access being limited (lack of access to waste).
- ☐ B: Inadequate space for sorting and storing collected materials.
- ☐ C: Macroeconomic realities such as inflation and recession impact due to the rising costs of living and the increasing number of waste pickers within a zoned dumping site (landfill).
- ☐ D: Hazardous chemicals emitted resulting from the illegal burning from the process of salvaging waste materials.
- ☐ E: Social stigmatization resulting from social exclusion.
- ☐ F: The exploitation and intimidation by middlemen due to corruption or unethical behaviour by the buy-back centres.

- ☐ G: Harassment by authorities which may lead to arrests or physical assault (police).
- ☐ H: Gender and waste inequality within the waste picker informal sector.
- ☐ I: Most landfills lack proper on- site waste management systems.
- ☐ J: All of the above.

12. Question: Daily Collection Pattern of waste material within or on the periphery of the landfill?

- ☐ A: Collecting of materials on the periphery of the landfill begins between 06:00 hours and 08:00 hours.
- ☐ B: Materials are then delivered at any time between 10:00 hours and 15:00 hours to buy-back centres.
- ☐ C: Continued collecting waste material up until 18:00 hours for use until the next day.
- ☐ D: Waste pickers then rest, eat, drink and socialize after delivering of materials collected on site (landfill).
- ☐ E: All of the above

13. Question: Items Collected within or on the periphery of the landfill?

- ☐ A: Paper for recycling (buy- back centres).

- ☐ B: Cardboard boxes for recycling (buy- back centres).
- ☐ C: Plastic bottles for recycling (buy- back centres).
- ☐ D: Glass bottles for recycling (buy- back centres).
- ☐ E: Scrap metal for recycling (buy- back centres).
- ☐ F: Garage waste.
- ☐ G: Electronic e-waste (buy- back centres).
- ☐ H: Planks and wood (upgrading of informal settlements near municipal landfill).
- ☐ I: Rubble demolition (upgrading of informal settlements near municipal landfill).
- ☐ I: Collect valuables for own use such as clothing, food, and electronic devices.
- ☐ F: All of the above.

14. Question: Daily waste pickers' activities?

- ☐ A: Reclaiming and scavenging of raw material within the periphery of landfill.

- ☐ B: Bailing and sorting of waste material to be transported to buy-back centres.
- ☐ C: Travel longer distances within their daily rounds collecting waste material.
- ☐ D: Pushing and pulling waste material to be transported to buy-back centres using transportable trollies.
- ☐ E: All of the above.

INTERVIEW QUESTIONNAIRE

Appendix A

Section C

Asiye Etafuleni eThekweni Municipality & Rodney Choromanski Architects

Please answer all relevant questions honestly in full to the best of your ability and knowledge insight. The data collected will help aid the reviewer and base the analysis and conclusions on the information provided on the questionnaire form.

PLEASE SELECT THE MOST CORRECT ANSWER BY INDICATING (WILL AUTOMATICALLY MARK "X")
WHERE NECESSARY.

PART 1	
Participants Name	Richard Dobson
Profession	Project Manager at Asiye Etafuleni
Organization	NPO (Non-Profit Organization)
Date of Interview	
Schedule	
Interview Conducted by	Siphesihle Jonas Sphephelo Mdluli

PART 2

1. Question: What was your design approach to incorporating the previously disadvantaged informal waste pickers within the Durban district CBD (Central Business Hub)?

2. Question: What was the motivation behind the proposal of the waste pick-up and collector recycling station and the incorporation of the park landscaping concept?

3. Question: Do you think that the waste pick-up and collector recycling station foster spaces for community engagement through integrated learning process in waste management, architecture and urban space? If yes, please explain.

4. Question: Do you agree that in order to solve the waste management collection services crisis waste pickers within the informal economy should be incorporated within the municipal waste management system, who form the basis of waste collection services? If yes, please explain.

5. Question: Do you think that waste recycling schemes such as the pick-up and collector recycling station in Durban CBD, facilitate in empowering waste pickers who stem from informal settlements or urban areas? If yes, please explain.

INTERVIEW QUESTIONNAIRE

Appendix A

Section D

Sustainable Urban Design Architects/ VPUU (Violence Prevention Through Urban Upgrading)

Please answer all relevant questions honestly in full to the best of your ability and knowledge insight. The data collected will help aid the reviewer and base the analysis and conclusions on the information provided on the questionnaire form.

PLEASE SELECT THE MOST CORRECT ANSWER BY INDICATING (WILL AUTOMATICALLY MARK “X”)
WHERE NECESSARY.

PART 1	
Participants Name	Tiago Damasceno
Profession	Architect / Project Manager
Qualifications	M.ARCH
Date of Interview	
Schedule	
Interview Conducted by	Siphesihle Jonas Sphephelo Mdluli

PART 2

1. Question: What was your design approach in terms of the design intervention based on context and the community needs for the Lotus Park Neighborhood Centre and the Waste Management facility?

2. Question: What was the motivation behind the proposal of the Lotus Park Neighborhood Centre/ Waste Management facility and the conceptualization of the building as an “active box” within the peri-urban area of Gugulethu Precinct?

3. Question: Do you think that the vision for the informal settlements project in Lotus Park fosters spaces for community engagement in the response to the desperate need for community facilities within Lotus Park? If yes, please explain.

4. Question: In your own opinion, do you think community public spaces in peri-urban areas such as Gugulethu Precinct respond to environmental spatial injustice through Architectural spatial reconfiguration? If yes, please explain.

5. Question: Do you think that community project schemes such as the Lotus Park Neighborhood Centre facilitate in empowering the local community residents who stem from informal settlements within peri urban areas? If yes, please explain.

6. Question: In your own opinion, do you think that the site before intervention on an urban scale influenced the site selection of the design intervention since it was an existing waste dumping area? If yes, please explain.