UNIVERSITY OF KWAZULU-NATAL

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Exploring the benefits of recycling in low income settlements: A design of a socially inclusive recycling collection centre in Bisasar road informal settlements, Durban

by

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DECLARATION - PLAGIARISM

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I would like to thank God for helping me complete this journey.

To my number one team, my love Thule Mhlongo and our kids for your patience and support throughout difficult and testing times. Without your support, completing this work would not have been possible.

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Abstract

Our dependency on landfills is not sustainable, waste management beyond the Landfill must be considered systematically to achieve a sustainable urban environment. The pursuit of a sustainable urban environment encompasses various issues that are systematically intertwined, these have been adequately captured in the U.N. sustainable development goals. The problem is threefold; it is 'Social, economic, environmental'. The study hypothesizes that the architect or the built environment is central to the complexities of these issues. The study takes on a view that the built environment & the architect cannot be separated from the Social, Economic and Environmental issues, and thus play a pivotal and central role in the convergence of these complex issues that frame the urban setting. The main question of the research is understanding how recycling as part of maintaining a sustainable environment can inform the architectural design and socially benefit low-income households. The research further aims to analyze the role that can be played by the built environment to effect change in waste management and sustainability issues.

Poverty levels are higher than they've ever been in urban areas. Rapid urbanization, lack of employment and opportunities has resulted in a highly unequal society where the poor are somewhat excluded and live under dire circumstances on the periphery of the city. Kennedy road informal settlement as a case study for the research has remained a challenge for the city and encompasses all these issues. However, its unique proximity to the landfill presents many opportunities for waste pickers. As the landfill is fast reaching its end of life, there has been a reduction in its intake. This has led to an uncontrollable problem of illegal dumping and hazardous working environment for waste pickers. Creating a recycling collection center that also acts as a waste transfer depot addressed the issue of illegal dumping caused by the partial closure of the landfill and create opportunities for the poor local community and linking it to other similar informal settlements around the city.

Using secondary sources which comprises of published media such as books, journals, academic research papers, reports and credible online sources, the study sources relevant literature to support the theoretical framework. The study is underpinned firstly by the theory of Social justice, addressing the social aspect and briefly touching on economic and environmental issues as a collective cause of urban decay. Complexity theory places architecture or the built environment at the epicenter of these urban issues. Using one of its primary parameter 'connectivity', complexity is used to formulate an architectural response to current urban issues raised in the problem statement and placing the built environment at the epicenter as a catalyst and a systems generator. Convergence through connectivity as the main phrase that seeks to capture a systems approach to a problem, with architecture and recycling as the main generators of the complex system. Primary sources have been used in a form of case studies, interviews and observations to confirm the hypothesis and achieve the objectives. These sources have concluded that architecture is a catalyst in the processing of waste and community education in addressing environmental, economic and social issues.

Addressing the inequalities in the links between the formal and informal recycling industry is hypothesized in the study as key in reducing levels of exploitation mostly experienced by informal pickers. Constant engagement between waste pickers in this unique location and the and government officials will lead to a review of policies thus improving the working and living conditions of these informal peri-urban communities reducing tensions and developing a level of trust between these informal pickers/communities and the government.

Key Words:

Recycling; Complex systems; Holism; Social Justice; Connectivity; Convergence; Recycling; Informal collectors; Green Economy; Sustainable development Goals (SDG's); Resilience; Inclusion.

Primary question

How can recycling inform architectural design and socially benefit low income households or settlements?

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1.0 Brief Background

The challenges facing Urbanism in the current wake of Global warming are immense. Durban is evolving as a city and with that comes many new challenges. From a Colonial city through to Apartheid until the present Post-Apartheid era, the city has seen many changes. The ushering of a new democratic government brought about the most drastic changes. With big business and the corporate sector moving out of the city, in the biggest exodus in the history of the city, the change that followed in the social and economic structures of the city was inevitable. This saw the city shifting to a more informal micro economy structure as the poor and the previously disadvantaged flocked the city. This led to perhaps the biggest migration the city has seen since Colonial times, people from all walks of life that were mostly escaping poverty and looking to build a better life tried to find solace in the city, either within the city itself or the outskirts of the city (e.g. Bisasar / Kennedy road informal settlement area). Informal traders and waste collectors form part of the informal economy within the city. As the study focuses on waste collection and its benefits, these communities survive on waste collection as means of living. Bisasar road has become a problematic issue as illegal dumping outside of the landfill has also fuelled a growing number of waste collectors that gather daily along this road in search for recyclable materials. The road itself has been reduced to a one lane road due to mounds of waste being dumped along this road. These waste collectors risk their lives daily working under hazardous conditions.

There is also disconnect between the Architecture and waste management. The basic understanding in the design of recycling centers is the common general perception of a steel factory shed type of building that serves one systemic function. This way of thinking is currently changing with these structures becoming more multifaceted and engaging with the communities and their surroundings. The complexity in the design and form of these structures is beginning to emerge in ways that have not been previously explored. This complexity transcends design but also looks into complex relationships that form part of the whole.

The processing of waste requires streamlining in order to maximise the benefits that could come of it. There is a lot of waste that could be recycled but end up in the landfills thus putting pressure on the environment. Focusing on the processing of waste and streamlining that process whilst engaging and including other stakeholders (such as traders) and the community would benefit the environment and sustain the economic well-being of the poor.

The relationship between the macro formal recyclers and the informal recyclers or waste pickers is not a balanced one. Not only are the existing drop off or buy back centres fragmented, but each processes a single material. The issue of unregulated material prices that fluctuate depending on each recycling centre or an individual is a problematic one that causes instability. Consolidating different types of recyclable materials in one buy back canter could streamline the sourcing and distribution of recyclable materials whilst creating more income opportunities for the surrounding poor communities. Creating a platform that could link the two could open much needed economic opportunities in the poorer communities in the urban periphery. Great lack of knowledge and exposure to facilities around recycling and especially up-cycling could lead to an opportunity to create a platform of engagement and learning as well sourcing and sorting of recycled materials which then directs it to relevant macro recyclers. Ralfe notes that the formal and informal are linked but the relationship is unequal (Ralfe, 2007, Pg. 161). The role of waste pickers in the formal marked is not fully explored as the formal sector still receive most of its recyclable materials from the formal market. However, the point of convergence between the two in a form of buy back centres is a very important link, which if streamlined could yield maximum potential in the upliftment of these communities. The current informal sector has no organisational structure and thus remains vulnerable to the formal sector. Creating a platform which engages, promotes and educates about recycling whilst administering by linking the macro and micro recycling industries could prove to be beneficial to these communities. The benefits of recycling can go beyond goals of obtaining ecological sustainability. They can also include Economic and social benefits which could lead to a more sustainable urban built environment. There is currently an unjust balance or

inequalities between the major formal recycling industry and the more informal recyclers (waste pickers) with the major formal recyclers dictating all the terms and the informal waste picker being merely at their mercy. Stitching this gap and connecting macro and micro industry could create opportunities especially in the poorer communities in the urban periphery.

1.1 Motivation / Justification of the study

The city has become more informal and remains socially unequal, limited access to the much-needed resources and education required to manage waste disposal and benefit from it through recycling is a challenge. The failure of the current mainstream economy to accommodate the poor masses flocking the city seeking better opportunities has resulted in the formation of informal settlements that now form part of the current urban fabric but are somewhat excluded from access to basic amenities, opportunities and the economy. The emergence of the informal economy within the city is proof of the city's resilience in the wake of challenges posed by the previous regime and rapid urbanization after the fall of apartheid. Recycling forms a great part of the city's resilience strategies and providing access and streamlining these facilities can address the city's Social, Economic as well as Environmental issues.

1.2 Literature Review

1.2.1 Social justice

Chipkin and Gibert summarize social justice as "*a situation corresponding to economic justice, public participation and social cohesion*" (Chipkin, Gibert, 2013, pg. 03). In the context of this study, social justice will mostly represent inclusivity mainly in the social and economic sectors. Miller defines social justice as *"it is how the good and bad things in life should be distributed among the members of a human society"* (Miller, 1999, pg. 01). The research will initially interpret and analyze the theory of Social Justice in symbiosis with Complex systems theory, briefly mentioning concepts from political

Ecology as supporting literature to social justice, and briefly exploring the concept of 'solidarity economy' as proposed and practiced in countries like Brazil. This type of economy encourages empowerment, participation and is said to promote inclusive solid waste management policies.

1.2.2 Complex Systems Theory

The research will analyze complex systems theory covering two of the four main domains i.e.: social / Economic systems and organizations (of humans) systems. The study will further look at the use or application of pattern language in the architecture field as was initially developed by Christopher Alexander (Alexander, 1977, pg. ix). The theory of complexity is taken much further to a more metaphoric state, looking at how all the theories and concepts are inextricably intertwined in a systemic way with Architecture and recycling as a catalyst generating system that cannot be isolated through a reductionist concept as done in the scientific field.

The study proposes that all of the theories and the concepts be viewed as a complex system that address the issues and the objectives in this study only if viewed from the position of a whole. The study proposes that Architecture be the 'instrument' of convergence for the inclusion and implementation of social, economic and environmental aspects in the built environment.

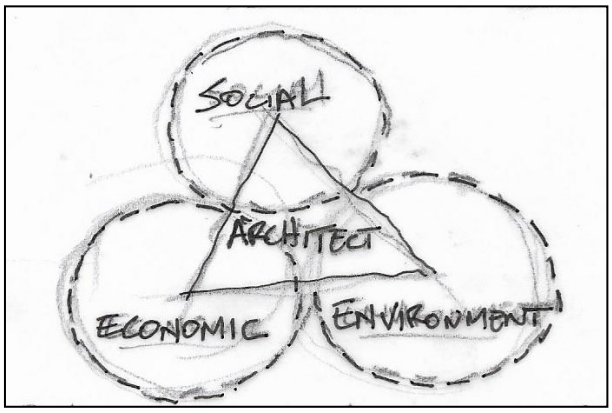


Figure 01 – source: by author

1.2.3 The right to the city

The concept/term "The right to the city" was coined in 1968 by Henri Lefebvre, a radical French Marxist sociologist and philosopher, it is about the rights of all urban dwellers to participate in shaping the city. This theory is to assist the study in engaging the social issues that affect the dwellers in the city including those that travel from the outskirts to be part of the solutions for the issues at hand. The

Theory also addresses the Economic sustainability and empowerment of the disenfranchised and seeks solutions posed by the failings of Capitalism. In this case, Durban with its History of Colonialism and Apartheid thereafter, faces a lot of inequalities and social ills that are relevant to Lefebvre's theory in many senses and this study seeks to explore these. The Theory also address the Social and Political issues.

1.2.4 Resilience

The study will explore Resilience in the international down to the local context. The connection to complex systems theory and their interconnectedness with sustainable development and the U.N. sustainable goals. Resilience is also closely linked with complex systems and has been described by Welsh as "*means of understanding and managing 'complex systems' and the processes and the effects of change upon them."* (Welsh, 2014, pg. 15). The study will cover the two of the three main domains of resilience i.e. Socio-ecological and Psycho social resilience but will exclude the third domain of Political governance. Current literature will be explored, mainly dominated by the Northern geographical sphere. However, the study notes the emerging perspectives from the South, particularly in the local context Durban, South Africa. These will be explored using current Durban's strategy that is part of the 100 resilient cities strategy.

1.2.5 Sustainability

The study will look at sustainability in its broader context, but more specifically the progress on sustainability thus far as addressed by the United Nations and their development policies over the past decade. The research intends to cover sustainable development tracing the United Nations policies over the years to the later sustainable development goals. The recent initiatives by the international community as represented in the United Nations. Sustainability theories can be broken into three categories i.e. Economic, Ecological and Political "*social systems that realize human dignity*" (Jenkins.

W, 2008: 380). The Economic aspect of the study aims at researching more sustainable economic opportunities with regards to waste management whilst addressing the main issue in this study which is recycling.

1.3 Location of the Study

The study will focus on residential areas on the outskirts of the city Bisasar road informal settlements as an integral part of the city. The study area is located in Kennedy Road informal settlement area, opposite Clare Water Estate, in Durban, Kwa-Zulu Natal (29°48'41.37"S 30°58'46.71"E). The settlement is located between the municipal land-fill site and eThekwini college Springfield campus, Umgeni Road.

1.4 Definition of the Problem, Aims & Objectives

1.4.1 Definition of the Problem

The problem is threefold: Social, economic, environmental. The study hypothesizes that the architect or the built environment is central in the complexities of these issues.

Poverty levels are higher than they've ever been in urban areas. Due to rapid urbanisation, current unsustainable economic system and social injustices of the past, the city is faced by challenges like lack of employment and opportunities for the poor, which has resulted in a highly unequal society where the poor are somewhat excluded and live under dire circumstances on the periphery of the city.

The Kennedy road informal settlement is one of those poverty-stricken areas that has remained a challenge for the city. However, its unique location presents much opportunities. The much controversial landfill next to it is fast reaching its end of life, hence the recent reduction in its intake. This has led to an uncontrollable problem of illegal dumping along Bisasar road, reducing the road to a one lane. However, this has presented an opportunity for waste pickers and the surrounding communities, most specifically the Kennedy road informal settlement as it is located adjacent to the landfill.

There has been a growing number of waste pickers occupying the side of the road on a daily basis salvaging recyclable materials. This has resulted in clashes between the city authorities and the waste pickers or community as this dumping activity is illegal and has resulted in a hazardous environment where waste pickers are seen attempting to salvage waste even from moving trucks that are either headed to the landfill or have been turned back by the landfill due to its intake reduction.
Our dependency on landfills is clearly not sustainable, waste management beyond the Landfill has to be considered in a systematic manner as part of a complex broader sustainability spectrum.

1.4.2 Aim of the study

The aim for this study is to explore the role that could be played by the Architecture in the management of waste and how this can benefit low income communities and existing waste collectors that operate next to the Landfill. Using architecture as a catalyst by exploring recycled building materials to create a building that is reflective of its use and one that is systemic in that it engages, receiving and exchanging energy with its surrounding environment.This will therefore require a reviewing the current structure of buy back centers and how they can be diversified and streamlined to accommodate more types of recyclable materials in one center; thereby creating an opportunity for each informal collector to collect more different materials for recycling. The objective is to get the community involved in recycling by creating a hub for knowledge to generate more interest amongst the poor, also raising more awareness about up-cycling as a specialized skill thus diversifying the market even further. The up-liftment and constant transfer of knowledge is necessary in order to create a more sustainable recycling benefits and thus a multi-faceted approach is necessary as opposed to the norm monolithic approaches. This will lead to a more environmentally conscious, sustainable and socially inclusive urban built environment.

1.4.3 Objectives

The main objectives are:

- To explore the role that could be played by the Architecture in the management of waste
- To explore the benefits of recycling in low income communities.
- To explore the need for a streamlined platform which acts as a mediator between the formal recycling industry and the informal recyclers (waste pickers).
- To explore current economic, social and environmental systems and their influence on the informal economy and current social urban ills
- Explore current legislation with regards to recycling, informal waste pickers and protection of the environment.

1.5 Setting out The Scope

1.5.1 Delimitation of the Research Problem

The study will explore benefits of recycling both in the built environment and within the poor communities that are located on the outskirts of the city next to the Landfill and how they could economically and social benefit from their location through recycling. The study will also look at Architecture as a catalyst by exploring recycled building materials to create an iconic structure that is built for recycling, but also created by recycling. Beginning by looking at social issues affecting the city, the study draws critical view from Lefebvre in 'The right to the city' which is quite relevant to current issues faced by the city. The study is not going to cover other specialized form of waste e.g. Medical waste, radioactive, sewerage, industrial etc., however it will concentrate on existing issues that are currently facing waste collectors along Bisasar road and the recent partial intake reduction of the Bisasar road landfill which has led to spiralling illegal dumping. The study will explore how architecture could play a central pivotal role in being a catalyst in social, economic and environmental issues and thus addressing the issues faced by the city. The role of education in the empowerment of the poor is to

be explored and how this can bring about more awareness and understanding of the current issues facing the city and the excluded marginalised communities in the urban periphery.

The research also seeks to explore current Government legislation and possible improvements that could promote a more socially, economically & politically sound urban environment that is inclusive. The study will not cover recycling strategies but will look at more efficient ways collection centres can operate as universal buy back centres that sort and package recyclable materials for further sale and transfer to their rightful recycling centres. This is done to bridge the gap between the formal recyclers and the informal waste collectors, with the Government playing a central role in facilitating the infrastructure and the legislation that will allow constant engagement and community upliftment through sustainable practices.

1.5.2 Definition of Terms

Up-cycling

Up-cycling is the creative re-use of waste without destroying or breaking it down in order to form something new. Practically this would be more energy efficient as opposed to re-cycling which breaks down a material to form a more inferior product.

Recycling / Down-cycling

Also known as cascading, this is the opposite of Up-cycling, it is the breaking down of an item to its material or component and then creating a new material from that, the recycled (or down cycled) material is usually of lower quality. While some items can repeatedly be reproduced, some materials breakdown each time they are recycled hence the term ‘down-cycling’.

Sustainability

Process of maintaining change in a balanced manner. This concept is broad and varies from the Environment to Economic to Social sustainability.

Holism

A theory or idea that individual parts of a system cannot exist independently but should be viewed as part of the whole.

Landfill

A site for the disposal of waste material. This is the oldest form of waste disposal and commonly used all over the world. All modern landfills now bury the waste and have energy systems that produce methane gas as a bi-product of waste.

1.5.3 Stating the Assumptions

Using complex systems theory in understanding and addressing the city's social, economic & political issues will lead to a more sustainable urban environment that is inclusive.

Creating a community driven learning and recycling collection centre can bring awareness and bring about economic opportunities that will benefit informal waste collectors and communities in surrounding informal settlements.

A creation of a new depot for that will collect waste that is not accepted by the DSW landfill site will relieve the illegal dumping currently occurring along Bisasar road and resolve the issues faced by waste collectors along that area.

1.5.4 Hypothesis

Architecture and the built environment are central to the advancement of waste management and its role on economic, social and environmental benefits. Architecture and recycling act as generative systems in a complex urban system surrounded by social, economic and environmental issues. Organised inclusive waste management policies address and improve social, economic and environmental degradation. Waste management and recycling can be used as a tool to addresses economic challenges in poor communities in peri-urban low-income areas, specifically Bisasar road

settlement and waste pickers. The quality of architecture will determine the susses in the use of the space and the level of involvement by the main stakeholders i.e. the waste pickers, the community, the newly formed co-operatives, the formal and informal markets, the city council (government) and unions.

1.5.5 Key Questions

1.5.6.1 Primary question

- How can recycling inform architectural design and socially benefit low income households or settlements?

1.5.6.2 Secondary Questions

- What role can be played by the built environment to effect change in waste management and sustainability?
- What is recycling and up cycling and what role do they have in the management of waste?
- How can recycling and up-cycling be used as a tool to alleviate unemployment and bring about social cohesion and improve the well-being of the people in informal settlements?
- What role can be played by recycling in the built environment and how does it inform Architectural design?

1.6 Research Methods / Approach to Study

1.6.1 Introduction

This section will describe different methods used to conduct this study. Data gathered for the research topic will be collected via techniques that will also be listed under this section. This section will also specify the intended scope of study.

The study will use qualitative and quantitative data collection approach, these will include both Primary and Secondary data gathering.

1.6.2 Approach

The study will adopt a mixed method form of data collection which will involve collecting and analyzing both qualitative and quantitative data supporting them with a theoretical framework. This will assist in creating a more complete understanding of the research problem or questions. As the study intends to also look at the benefits of recycling, which are both economic and environmental, it will be vital to assess the current statistics which are factual when investigating the economic aspect. Qualitative approach will be used to gain an understanding of underlying reasons, opinions, and motivations of the current social, economic and environmental state. This will provide insight to the research question will be addressed using a more qualitative approach as these deals with educating, empowering.

1.6.3 Secondary Sources

The study will use secondary data sources which comprises of published media such as books, journals, academic research papers, reports and credible online sources in order to obtain relevant information. This information will guide the study towards an understanding of the current recycling systems and thus, how the process can be streamlined to be beneficial to the poorer communities and thus being catalysts for a sustainable urban built environment.

- Literature review

The study will source information from books, journals, research papers and the internet as part of the literature review.

- Precedent studies

The study will look at existing facilities within and around the CBD Palmer Street and Warwick recycling centre that deal with recycling focusing on the technical functioning, spatial layout of a recycling plant.

1.6.4 Primary Sources

1.6.4.1 Case studies

A case study will be analysed in order to gain more information on the building or place, case studies will be Palmer Street and Warwick recycling centre. An interview with City Architects will be conducted to gain insight on the design drivers, since they are the City's implementers with regards to the urban built environment. The case study should also give clarity on current recycling procedures and methods in order to understand up-cycling within the context of recycling.

Second Case study: The study will be conducted in Bisasar road and the neighboring informal settlement of Kennedy road.

1.6.4.2 Questionnaires

The study intends to formulate a series of questions to gain more information from the communities living in and around the city, working in the city and Government officials or City authorities who have spearheaded the launch of the new recycling centres in the CBD. This will be done in order to gain an understanding of the technicalities and viability of recycling collection or buy-back centres. It is noted that they have been working in partnership with the private sector in creating and launching these projects and thus further contacts from the private sector will be requested and interviews conducted. The questionnaires will be distributed to the community of Bisasar road informal settlement, existing informal waste collectors in Durban and recycling centre workers and managers in the two chosen case studies

1.6.4.3 Interviews

Interviews will be carried out with all the stakeholders (traders, waste pickers, macro recyclers, Government officials / city authorities). In the case of residents, these interviews are to be carried out with the community leaders and not directly with the residents. Interviews will be carried out with the community leaders of Bisasar, selected waste recycling centre workers and managers using purposive sampling. The professionals to be interviewed will shed light on the design process of a recycling plant,

also using purposive sampling. City authorities responsible for the commissioning and construction of the chosen case studies will also be interviewed.

1.6.4.4 Observations

This data collection method will be used in analysing a case study Bisasar / Kenedy road settlement and the waste collectors that operate in that location. The buyback centres within the CBD i.e.: Palmer street and Warwick recycling centre, assessing a typical structure of waste processing in a recycling collection place. This will include observations of working day of an informal waste collector

Observations will also be conducted in the selected precedent study, to analyse the operations in a fully operational recycling depot in the CBD. The study will observe the operations and logistics of a recycling depot within the CBD i.e.: Palmer street recycling centre, where the dropping off and sorting of recyclable material happens. The purpose is to understand the complete cycle from the sourcing of materials, storage on arrival, separation of materials, and the processing of materials. This will take into account interaction with micro recyclers bringing in recyclable material and payment method & systems in place.

1.6.4.5 Photography

Photography will be used and supporting data and will mainly cover the case studies (Palmer Street and Bisasar road).

1.6.4.6 Sampling Method & size

Both quota sampling and purposive sampling will be adopted as sampling methods for this study. There are multiple samples which are important to the study and within those, certain characteristics that are of interest will be identified and selected in order to best answer the research question. These will include Architects and professionals experienced in designing recycle centres and social spaces, Municipal

authorities responsible for implementing the recently launched recycling centres, waste pickers within the community and in general, community leaders, and macro recyclers.

The study will conduct 5 to 7 interviews and conduct observations as well as distribute questionnaires to 10 no. waste pickers, 2 leaders of community of Kennedy road, and 2 city architects professionals. Interview data will be triangulated with observations and questionnaires thus reaching saturation level early and reducing the sample size to the sizes mentioned above.

Chapter 2

2. Theories and Concepts

2.1 Introduction

The study will constantly approach each section or topic in two ways:

Firstly, from an International down to the local context (Macro to micro context). This is done to obtain a broader perspective.

Secondly, the approach will be from a complex system view. Social systems are made up of vast elements that interact with each other in a random pattern thus forming a complex system. The study proposes that all the theories and the concepts be viewed as part of a complex system with vast relations and connectivity between different elements. The study proposes that to address the issues and the objectives raised in this study, it requires that they are viewed from the position of a whole. The study proposes that Architecture be the 'instrument' of convergence for the inclusion and implementation of social, economic and environmental aspects in the built environment.

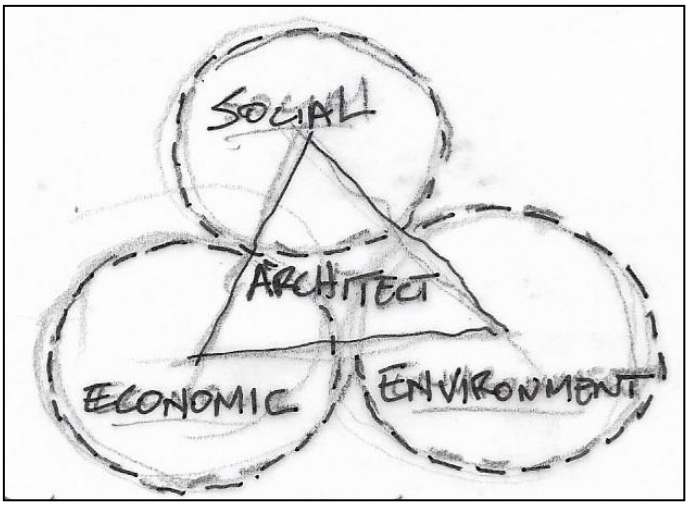


Figure 01a – source: by author

The study takes on a view that the built environment & the architect cannot be separated from the Social, Economic and Environmental issues, and thus play a central role in the convergence of these complex issues that frame the urban setting.

The study will look at the current state of informal recyclers along Basasar road in the context social justice. The study will be raising issues of empowerment, using the built environment to promote community participation. Exploring the relationship between the informal waste pickers and the community and the city authorities promoting dialogue and inclusive solid waste management policies, all underpinned by Social justice and complex systems theory.

The research will initially interpret and analyse the theory of Social Justice in symbiosis with Complex systems theory, briefly mentioning concepts from political Ecology as supporting literature to social justice. Using some concepts from Political Ecology to support Social justice is important because the issue of the informal economy is a systemic issue that stems from a highly politicized background and transcends through Social, economic and environmental structures. The combination of all these issues is captured through complex systems theory and reinforced by concepts like resilience to capture the broader concept of the study, while specifically dealing with the main question of the study. Gutberlet notes that by using political ecology concepts as supporting literature to social justice would form a systemic approach that would lead to a lasting solution (Gutberlet, 2012, pg. 21). The study will further

analyse or establish whether there is or can be a connection between these theories all in an attempt to create a more coherent theoretical framework which will underpin this study. There are various domains in the theory of Justice and social justice is one of them. Social justice, Economic justice, Environmental justice etc. All are elements of the theory of justice. However, this study will focus on the element of Social justice.

The study will further cover concepts that formulate the conceptual framework i.e. Right to the city; Resilience and Sustainability starting from an international broader perspective, narrowing it down to the local context.

Resilience will be studied in its broader context down to the local context on the current resilience strategies proposed by the city of Durban. Resilience helps cities adapt and transform when facing challenges brought about by issues like climate change, growing migrant population caused mostly by urban-rural migration etc. The study will further analyse resilience in the architectural design context and review current knowledge on a resilient design which supports environmental, social, and economic sustainability. As noted in the introduction, the approach of the study is from a systemic point of view, as embedded in the theoretical framework. The research aims to analyse the city's strategies to weigh them against the research questions and using fieldwork research (interviews, observations, etc.) to gauge its effectiveness. The research will analyse the benefits of recycling for poor communities in peri-urban areas particularly the Kennedy road informal settlers and the current informal waste pickers along Bisasar road as partly a contribution of the city's resilience strategy, and using this to develop a more informed theoretical framework to support the argument of a more inclusive sustainable informal sector.

Issues like sustainable development and climate change as part of the recent initiatives by the international community as represented in the United Nations will be discussed and analysed as supporting concepts under sustainability. It is vital when addressing the research questions and the

problem statement to review them in context with the current world proceedings as these are also inextricably intertwined with the current sustainability issues faced locally. This research is going to review the relationship between Architecture and sustainable development. The researcher aims to obtain current thinking and research by reviewing latest papers published from the *"International conference on passive and low energy architecture"* (Bodart & Evrard – 2011) to obtain current thinking in Issues such as global social, economic and environmental injustice that must be critically addressed from a regional and local perspective.

The study will lastly review waste as a resource, reviewing waste management and landfills, the formal and informal markets in the recycling industry and specifically concentrating on informal waste pickers. The purpose is to review waste picking as one of the contributors to the green economy, more specifically the informal waste picking industry. Through the participatory research process, the participants will comment and review data that is generated during the research process using primary sources. This will create a learning and solution-seeking process, where also the participants gain knowledge from the outcome.

In developing countries, informal recycling is entrenched amongst the poor as a way to earn a basic living. Gutberlet notes that some of these countries like *"India, Mexico and Brazil"*, there is *"approximately 1% of the population that makes a living in this sector"* (Gutberlet, 2012, pg. 22). Locally, the consolidation of collection, pricing, sorting and distribution of recyclable waste into singular buy-back centres that could greatly benefit the informal waste picking industry by introducing consistency, efficiency and regulation, which covers and protects the currently exposed, fragmented and mostly exploited informal waste collectors. This could present new opportunities for the local green economy thus a shift towards new 'green jobs', industries and business opportunities waste pickers as small business enterprises.

2.2 Theory of Social Justice

Social justice is the theoretical foundation framework and thus will support and inform this research. The theory stresses that all that is useful and subscribes to common interest is just. This places much emphasis on the majority, which happens to be the poor in the case of Durban. As rapid urbanization increases the number of poor urban residents through rural-urban migration. There has been a high increase in the number of informal settlements and are usually located in peri-urban areas. These communities have been somewhat excluded, and thus the emergence of the informal city. Although these communities lack basic human needs, such as shelter, water, and sewerage & waste disposal, perhaps just as important is the provision of opportunities for earning a basic income.

2.2.1 Social Justice through the lens of Marxism

Perhaps one of the most important contributors to social justice is the writings of Karl Marx. A quote by Karl himself and inscribed on his grave tombstone proves him to be a pragmatic philosopher, emphasizing on action:

"The philosophers have only interpreted the world…….

The point, however, is to change it". Karl Marx (1818 to 1883) – Source: (Pearce, 2016, pg. 3)

Marx believed that the economic structure is key in ensuring an equal and just society for it is through just economic structures and systems that social justice can really be realised.

It is therefore imperative to note that the current state of South Africa is a result of its colonial past, and a Social segregating system of 'Apartheid', but more so, it is a result of an economic system of capitalism. The concentration of wealth amongst the few and the exclusion of the poor majority to land and benefits this country has to offer. Prof. Richard Wolff in an interview noted that "*the way capitalism has evolved has compromised the ecology and the environment of this planet*" (Wolff, 2016, video file), but more so, has created the most unequal and discriminatory societies, socially and economically, to

"a *level that has no justificatio*n" (Wolff, 2016, video file). Wolf makes note of the recurring problems of capitalism, and how these problems are systemic, and therefore cannot be isolated to each issue to resolve it (Wolff, 2016, video file).

Karl Marx described capitalism as *"a system that seeks to maximize profit whilst improving the technology"* (Max K., Engels F. 1909, 1910). This always results in an extreme imbalance where wealth is always concentrated on a few and the majority languishes in poverty. Marx predicted an uprising whereby the working class will revolt and take over the reins of industry. Marx was ahead of his time, as most of his works were only published much later in the Russian revolution, but still resonate today more than it ever did. The catastrophes caused by capitalism long after his writings have proven him to be a visionary that foresaw the dangers of this system. One of the most important observation which is evident even in the current context economic status quo in South Africa is that of those who have benefited and continue to benefit from such a system, turn resist any fundamental change and would by all means seek to maintain status quo. South Africa is a democratic state, pretty much in a western meaning of the concept. It, however, turns to also subscribe to socialist concepts in a random manner. In an interview with Nelson Mandela when he visited New York in the United States of America for the first time in 1990, not only was he attacked for apparently 'siding' and having 'close relations' with "*vicious communist dictators*", to which he stood his ground and expressed unwavering support for Cuba and Libya (Mandela N. & Kopel - 1990, June).

However, the one comment or question that stood out was when one member of the audience stood up and asked him whether the ANC will run the country as a '*western democracy'* or as a '*socialist or communist state'*, to which he graciously replied that they (the ANC) were not concerned with labels but were rather seeking a pragmatic approach to address a very unique situation (Mandela N. & Kopel - 1990, June). During the transition era, he found himself surrounded by two powerful forces, one that offered him and the ANC friendship and resources, which he was more closely aligned with, and

another that was more powerful because they owned the economic industry and systems, and therefore did not leave him much of a choice (Gleijeses, 2013, pg. 238). Hence much of the economic structures in South Africa mostly remain today as they were before democracy.

According to Sen, *"concepts of social justice can be central to ethical norms for accessing the optimality or acceptability of distributions of income"* (Atkinson A., Bourguignon F., 2000, p60). It is therefore imperative to address issues of social justice along economic justice. Since capitalism is the dominant economic system the world over, the study analysis it's conflicts as described by Karl Max in dialectical historicism and dialectical materialism.

Wolf notes that the problems of capitalism cannot be solved in isolation or individually and thus cannot be resolved within the framework of the current economic system e.g. Homelessness, lack of employment, inequality, etc. are some of the issues facing current urban society. He further notes that these problems are systemic and understanding how capitalism as a system works as a better way of finding a solution. Re-organizing society could be a better way to deal with these issues than dealing with them individually or in isolation.

Many other theories have constituted social justice; however, Ambedkar has resonated amongst many in his conceptual discerption of social justice. According to Jammanna & Sudhakar, D.R. Jatava described Ambedkar's concept of social justice in short term *"as a mode of life, giving every man his right place in society",* and also *" to live honourably, to respect all, to injure no one, and to give every man his due without any artificial discrimination in mind and unnatural classification in society*" (Jammanna, Sudhakar, 2016, pg. 130). Ambedkar's view of social justice is one that is more comprehensive and portrays no ambiguity in its translation. They are more applicable in issues of the second half of the 20th century, e.g. Civil rights movements in the U.S. and here in South Africa. This is a more holistic view of the concept because he takes the concept beyond just sharing the resources equally amongst citizens but more a way of life-based on equality, mutual respect and regard.

The uneven distribution of wealth which widened the gap between the haves and the have nots has been a major issue in the world, but more so in the local context. This has led to a separation of classes where the have nots have been exploited by the haves. In the context of South Africa, it went much further than just class, the system of capitalism took on an identity in a physical distinction. Race or colour became the first and foremost pre-cursor to class and access to benefits the country has to offer, over and above the social ills of classism caused by capitalism. Hence it is still nearly impossible today to attain such social justice for the poor because the problem of exploitation is rooted in the economic structure itself.

2.2.2 Social justice in the Local context

Social justice can be defined as *a "situation where there is a fair distribution of benefits and burdens in society"* (Chipkin, Gibert, 2013, pg. 4).

The main areas or domains of social justice in South Africa where organizations mostly operate are *economic justice, public participation and social cohesion.*

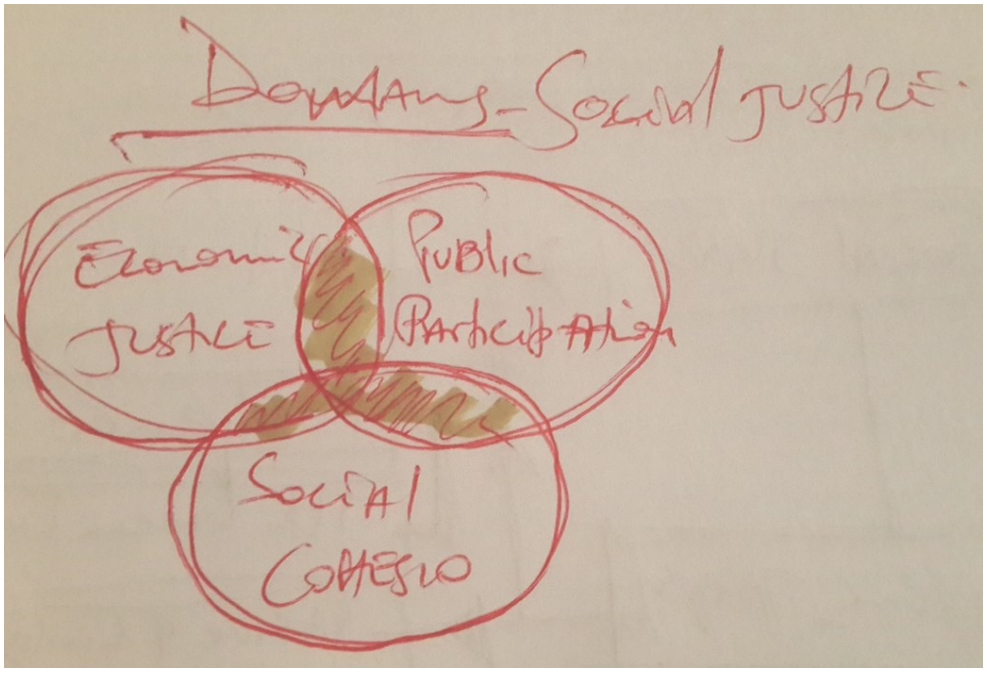


Fig. 02 - Source: By Author (2019)

There is much coherence in the way these organizations define social justice, and mostly share a common concern as far as "*fairness in the way economic, political and social benefits and burdens are distributed in South Africa*" (Chipkin, Gibert, 2013, pg. 5).

In South Africa, the early demonstrations of Social justice are traceable back to the early 1900's after the Anglo-Boer war, this was even before the implementation of the mainly unjust apartheid system. The union state between the English and the Afrikaner after the Anglo Boer war excluded all but those within the union as part and beneficiaries of the state. This meant the distribution of resources, land and basic human rights and dignity was bestowed only to these two fractions that have now formed a union state (The English and the Afrikaner). It was around this time when black organizations like the ANC emerged initially in an attempt to organize and represent the interests of the Africans.

After the legalization and initiation of apartheid as a system in 1949, it became clear and apparent that race was now the driving force behind political agenda of the state. There were however a few advantages that came about as a result, the realization of the need for a united struggle by all the other races i.e.: African, Indian and Colored. This period meant that all the other parties that were based on colour but shared common fate, combined their efforts in pursuit of social justice. Chipkin and Gibert noted that the *"Congress movement (including the African National Congress (ANC), the South African Indian Congress (SAIC), Colored People's Congress (CPC) and the Congress of Democrats (COD)) joined together and integrated the claims of Africans"* (Chipkin and Gibert, 2013). The ANC, South African Communist Party (SACP) and Congress of South African Trade Unions (COSATU) also joined together to form an alliance that was to fight against discrimination but also woman's rights.

The authors, chipkin and Gibert also note in their article the fight was now dual in its nature, the fight for democratic revolution and a fight for Economic revolution. It became a social and economic justice fight that sympathized with all those that were politically disenfranchised. (Chipkin and Gibert, 2013)

Chipkin and Gibert note that a consensus was adopted in 1969 at the Morogoro conference which stated that the fight was now dual, fighting for a democratic state and for economic justice (Chipkin and Gibert, 2013).

The theory of national democratic revolution at the time identified two areas that constitute social injustice, first being as directly quoted *"black South Africans were oppressed by a racist, white regime"* and the second issue was" *black South Africans were exploited by capitalists"* (Chipkin and Gibert, 2013). It was thus agreed that the social agenda needed to advance on these two 'fronts': "*transforming the state and the economy*" (Chipkin and Gibert, 2013).

There was, however, a somewhat deliberate advancement of only the one 'front' than the other, perhaps, due to the forces that were instrumental in the transition of South Africa to a democratic state, forces which had more to lose if this did not occur; if civil war, which was looming was to ravage the country along racial and tribal lines.

Justice issues (social justice, economic justice, spatial justice and environmental justice) are intertwined with the built environment and form part of urban issues which are complex in their nature. A city is a problem of organized complexity (Jencks, 1995). Issues faced by poor communities are more complex and require a systemic approach when attempting to resolve them.

2.3 Complex Systems Theory

Complex Systems theory is a broad interdisciplinary study of systems, spanning from biology, ecology to engineering and other spheres. However, social sciences is where this theory first developed and gained traction much early in the 19th century (Herr M.C. 2002).

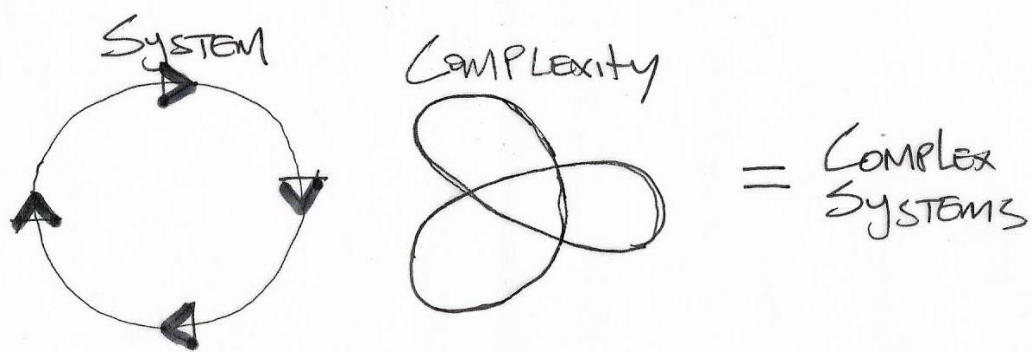


Image 03 – source: by author (2019)

This research will initially look at complex systems theory from a social / Economic view. It will look firstly into systems theory as was initially developed by Christopher Alexander (Alexander 1968, 2011) The theory of complex systems will undertake to define the meaning and background of the theory and its relevance in the field of Social sciences and the built environment.

The whole study also views the theory of complexity metaphorically, looking at how all the theories and concepts in this study are inextricably intertwined in a systemic way with Architecture and recycling as a catalyst generating systems that cannot be isolated in a reductionist way. The study proposes that all of the theories and the concepts be viewed as a complex system that address the issues and the objectives in this study only if viewed from the position of a whole.

This systemic approach leads to a convergence of the theories and concepts that form the theoretical framework of the study into a whole, with all the sub-elements and elements of the system contributing to a holistic view whilst seeking to address the problem statement.

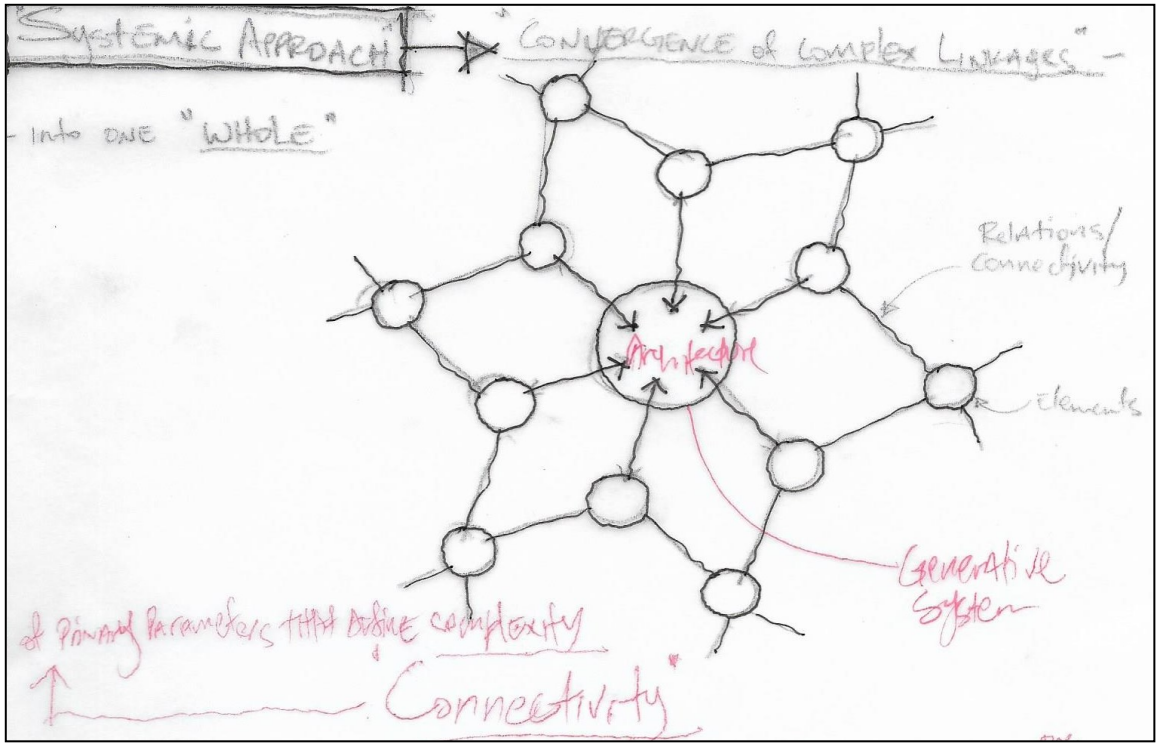


Image 04 – source: by author (2019)

Convergence through connectivity becomes the main concept that leads to the design proposal. Connectivity being one of the main parameters of complexity, for it is through connectivity that the nature of space can be defined.

The study focuses on the two main systems domains, Organizations and social / economic systems. It will also explore complexity in forms relating to architectural design as described by Salingaros and Alexandra.

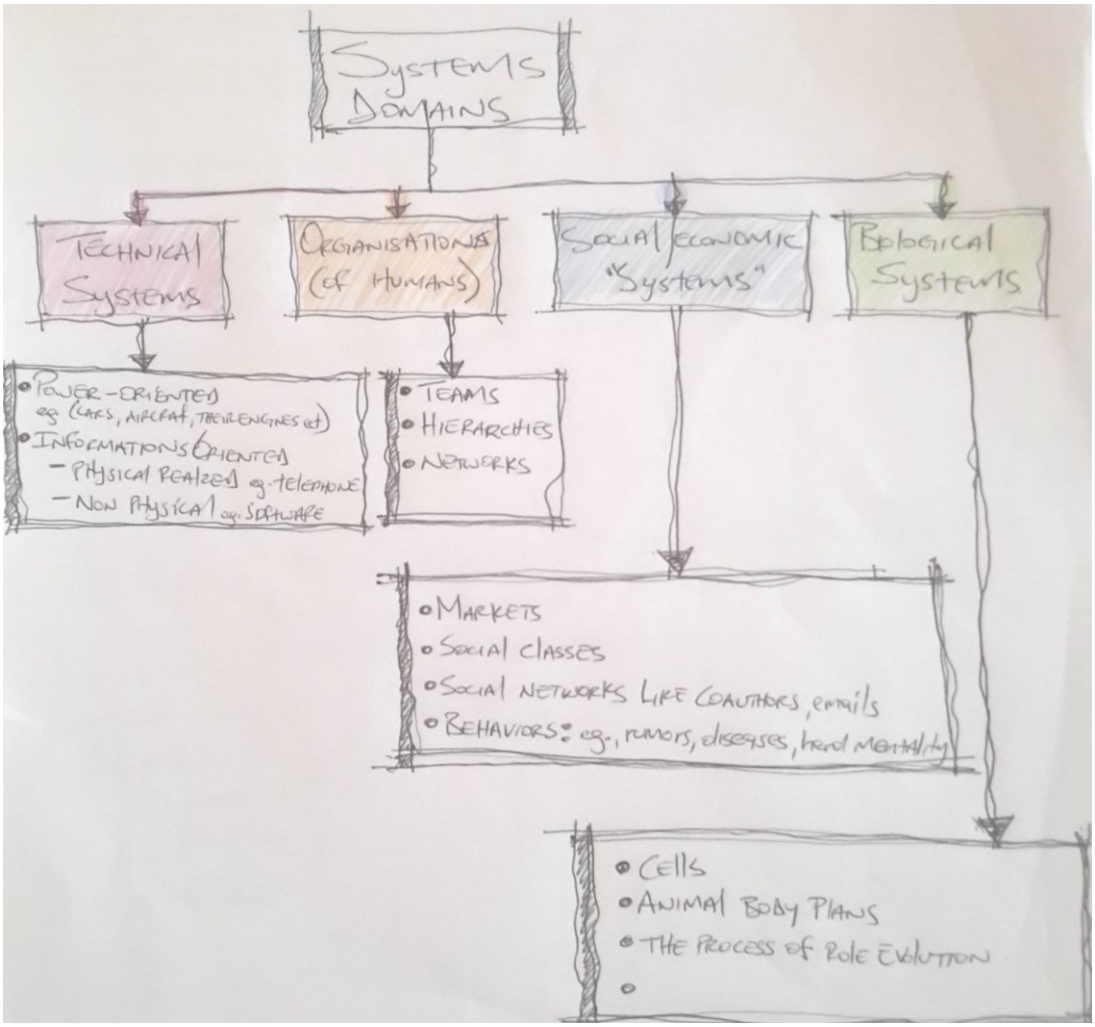


Fig. 05 - Source: By Author (2019)

Shown in the sketch above, as it relates greatly to the social aspect of the study. The study will not cover Technical and Biological systems.

2.3.1 Complex systems theory in Architecture

Architecture and nature are and have always been strongly intertwined. Architecture has always drawn inspiration from the processes of nature and its complexities. Herr defines complexity as a tool that re-connects nature to Architecture *"Complexity seems to re-capture these processes and re-embody*

complexity into Architecture. It is an alternative to the modernist minimalist and simplistic way of thinking" (Herr, 2002, pg. 16.1)

The study explores these in symbiosis with other theories and concepts that form the theoretical framework of this study. As a system can either be defined as 'open or closed', it is important to note that buildings are open system, as these elements receive and exchange energy with their surroundings.

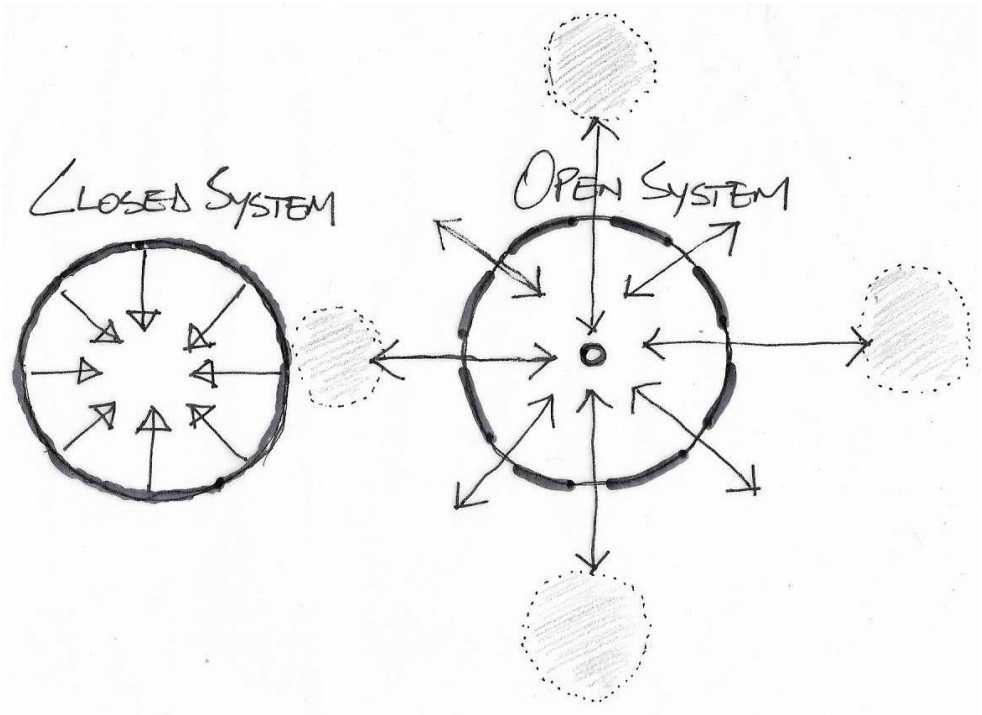


Image 06 – source: by author (2019)

Buildings are open systems, as opposed to closed systems which are predominant in the field of engineering e.g. Bridges & cars, which take a reductionist approach. As systems theory emerged from the field of science, the key method of reductionism employed in these fields make perfect sense. It applies a more linear, top down approach, elements which are predictable, stable and reliable. When it comes to complex systems, it becomes about connecting things together, as opposed to traditional design of components.

Christopher Alexander is one of the main thinkers in the theory of systems, the study reviews his literature along with Salingaros and Venturi.

Venturi initially came up with the first theory about complexity and contradictions in Architecture. His view was that which wanted to move away from modernist approach, which seemed to have an emphasis on the "*linear and grid-like*" and move in the direction of a more practical approach.

(Herr M, 2002, pg. 16.2).

Alexander presented 4 points in his definition of systems and provided reasoning for each. The first being the meaning of the word system, he notes that there are two concepts behind the word, the concept of a system as a "*whole"* and the concept of a "*generating system*". That a system can only be defined or understood on its relations amongst other parts. Thirdly, he makes mention of a 'generating system' as not being a 'single thing but is made up of various parts that have rules on how they can be combined. He further notes that every 'system as a whole' is generated by a 'generating system and that generating systems are to be created in order to get systems to function as 'wholes'. (Alexander 2011, p. 59; Alexander, 1968, p. 605).

The term "whole" is an important concept in Alexander's work. In his definition of the 'whole' in architecture, it is looking at the structure as an element of the whole, and therefore understand the whole, it requires a broader look at other elements that are related to the structure i.e. the end user. He calls it the *"social and human whole"*, as it is this relationship that forms a whole.

"In a properly functioning building, the building and the people in it together form a whole: a social, human whole. The building systems which have so far been created do not in this sense generate wholes at all" (Alexander, 2011, p. 58; Alexander 1968, p. 605).

Alexander's description of the whole however did not include an important part of the whole, the environment. This important missing link is fast becoming more apparent in current global issues and given the urgency and stature it deserves amongst other global issues.

Alexander draws many parallels between Architecture with the fields of languages and genetics when it comes to systems. In languages, he speaks of the 'language of patterns', describing pattern language as 'generative'. He defines how a language works on 'multiple levels' as a 'whole and as a set of rules' and compares this to a system which works in similar form. (Alexander, C. - 1977).

His analogy of building design to the genetic process describes how it is possible to create a generative pattern with a set of rules, which if followed would yield a building or a good design. Alexander speaks of 3 elements of pattern languages that make them generative. The first being how they "*contain inherent rule set which determines their logic"*. The second being how these "*generating systems produce effects that are greater than the sum of their parts*" (Alexander, C. - 1977). This is because they operate on multiple levels, having the obvious surface patterns but also underlying patterns that always equate to more than the individual sum of the parts. This is not the case in modern science and classical physics, where systems or sub-systems can be isolated to resolve an issue, in a reductionist approach and be plugged back into the system. This can be seen in the design of bridges and cars.

In social science, the sum of the individual parts are always more than the individual parts. Alexander's work on pattern language has a strong link to the current generative design and the processes it follows.

As noted above, complex systems are open systems. Thus, the elements turn to have a high degree of autonomy, and therefore the network connections are not linear as in the closed reductionist approach, but rather complex connections that are not so orderly, but yet not random either.

Design in complex systems can be defined as an "*arrangement of elements within a system in order to achieve some optimal global functionality"* (Salingaros N. A. – 2014).

The study reviews Salingaros writings on how architects can use organised complexity, and further mentions Fractals and Alexander's "*fifteen fundamental properties"* which characterise organised

complexity in all systems (Salingaros, 2014, pg. 10). Using Alexander's fiften properties, Salingaros further developed his own Three Laws of Architecture.

Salingaros raises a point that all societies throughout the world, depending on where they are in the world and the conditions on a local context, in the advance creation of human shelter, managed to create unique designs that are complex and unique to that particular society or region. These ways of building formed part of a cultural base and somewhat translated to other parts of that particular society e.g. Art. Salingaros notes that all those traditions and complexity in design was lost in the phase of internationalization in the 20th century. He further questions how complexity can be *re-embodied* into *"architectural form, space, and surface".* According to Salingaros Complexity showcases the detail of structure including insight and the body of work that went in to produce the structure. He further defines complexity as *"stored information on how the system actually works and about its own makeup"* (Salingaros, 2014, pg. 1)

There are two types of complex systems: Disorganized and Organized. According to Salingaros, the human brain can only comprehend organized complex systems "*The human cognitive system is able to comprehend complexity only if it's organized in some way*" (Salingaros, 2014, pg. 3). A complex system has multiple systems interacting with each other on different levels. A system consists of different parts called elements, how these elements are connected is called relations. A disorganized part has no order, and therefore can simply be defined as a set of things. Elements can be isolated, and each described individually. This is common in the field of Science where a reductionist approach is always applied to resolve an issue. However, this is not the case in social studies where the sum of the individual parts is more than the elements. This is a 'reductionist' approach as have been used by science throughout the years. The reductionist approach tends to isolate and focus on one part and excludes the complexity of a system.

Salingaros notes that a human brain can only comprehend organized complexity. This is very important in architecture where order and organization play a vital role. Complexity somehow reinstates the traditional basic elements and concepts in Architecture and the traditional way of designing.

"*Organizing* complexity *reduces the raw amount of information that is needed to specify an object or system. The human cognitive system is able to comprehend complexity only if it's organized in some way"* (Salingaros, 2014, pg. 3)

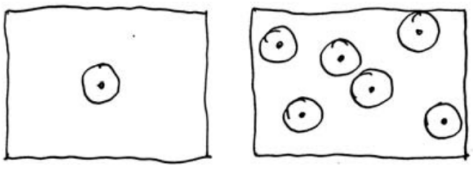


Figure 2. Verbal descriptions of complexity. LEFT: "Circle of radius 1 in center". RIGHT: "Circle of radius 1 centered at point a, circle of radius 1 centered at point b, circle of radius 1 centered at point c, …"

Figure 07 – (Salingaros, 2014, pg. 2)

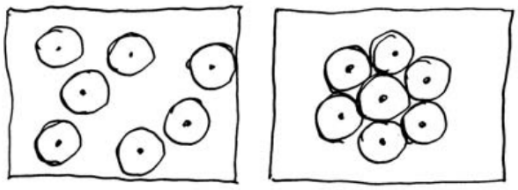


Figure 3. Disorganized versus organized. LEFT: seven circles centered on different points. RIGHT: seven circles arranged in a rotationally-symmetric pattern. The same raw complexity, but different organization.

Figure 07a - (Salingaros, 2014, pg. 3)

Salingaros mentions a few ways of applying this in the actual design or architecture, these involve "*continuity, different types of symmetries, scaling, correlations, harmony, etc."* (Salingaros, 2014, pg. 3)

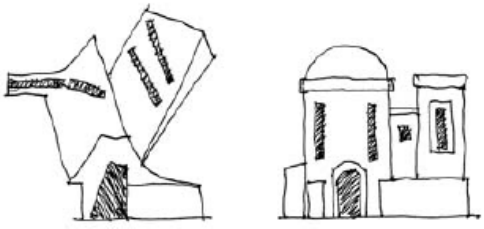


*Figure 10. **LEFT**: disorganized complexity injected into a design for stylistic effect conflicts with the system's forces. **RIGHT**: design that evolves from adapting to the system's forces generates organized complexity.*

Figure 08 - (Salingaros, 2014, pg. 11)

Complexity theory attempts to capture the whole, how each element is directly related to the greater whole. Complex systems are always greater than the sum of their independent parts, therefore cannot be broken down or isolated to their individual parts in a normal top down scientific approach. Inclusion of the urban poor on the outskirts of the city cannot simply be isolated to a singular and resolved as the reductionist approach in science, but rather a bottom up complex process that requires vigorous engagement that seeks answers from the ground up than a top down.

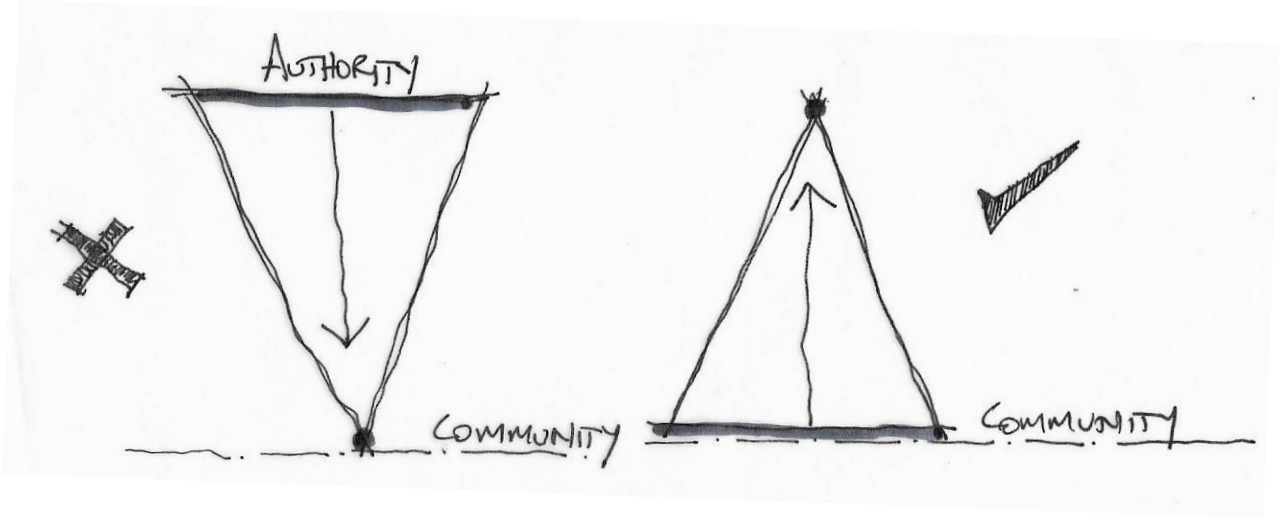


Figure 09 – source: by author (2019)

The bottom up approach adds layers to the complexity of the structure and therefore sees design as a process with various inputs that constitutes to a whole.

In complex systems, networks become platforms through which components can be connected into systems that deliver functionality. Some systems function mainly to support other systems by aiding in the maintenance of the other system to prevent failure, for an example, in the case of this study, recycling functions as a system which in turn supports and is directly related to a bigger system of waste management. Waste management in turn supports the ecological system by preventing it from being overloaded and collapsing due to waste mismanagement. As part of a complex system, ecological system is also inextricably intertwined and connected with other social, economic and political issues and should be viewed as a whole.

In the wake of the world's current issues of global warming, much of current problem-solving methods which subscribe to reductionist approaches, which tended to isolate and focus on one part and isolates the complexity of a system as a whole need to evolve. In order to enable sustainability in urban environments, the approach needs to take a more systemic view in a complex manner. The built environment forms a great part of urban environments and is therefore needs to adopt in order to enable sustainability in urban environments. A sustainable social, economic and environmental systems coupled with technological systems need to be incorporated to the traditional Architectural approach in order to gain a broader impact. The shift has begun in institutions of learning whereby urban design takes precedence and buildings are seen as complex open systems, which interact with surroundings.

Therefore, dealing with urban issues and Architectural problems in an urban setting require a more systemic approach that is highly complex simply because the issues are complex and systemic. The issue of inclusivity remains one of the most challenging in the current urban setting, what the right to the city actually means in the local context also remains questionable. European cities have taken the concept to a much higher level of interpretation as opposed to what it means locally. The 'European Commons Assembly' is a group of nonprofit organizations, activists and civil society organizations that have collaborated to form a bottom up network-based organization to create a democratic self-

managed systems that seeks to create a more sustainable urban environment. They have raised issues like making housing accessible to people with low income using a principle that the ground or urban land be separated from the structure above it. The people or the community then own the ground under a common trust and the structure be privately owned creating a partnership between the public and the private sector, thus removing the commodification of urban land and the neo-liberal development of the city which privatizes almost every part of the city. This concept of 'the right to the city' is a radical but more effective to the local one, which merely advocates for access to basic amenities like: low cost social housing, affordable transport and a mere vague slogan of 'access to what the city has to offer'.

2.4 Right to the city

The concept of the right to the city originate from Henri Lefebvre a French sociologist. According to Harvey, the right to the city is "*a right to change ourselves by changing the city more after our heart's desire"* and also it is *"the freedom to make and remake ourselves and our cities*." (Harvey, 2008, pg. 1-2).

In the context of this study, the right to the city as a concept speaks to the provision of basic amenities to the poor in peri-urban communities that are somewhat excluded from what the city has to offer. The focus is not in moving these communities to the inner city, but rather provide access to qualities and benefits of urban life. Lefebvre mentions in his writings '*socio-economic segregation*' which is what this study intends to focus on.

It estimated that urban population will *"rise to 60% by the year 2030"* (Cohen, 2001, pg. 87). The rate of rural urban migration in pursuit of opportunities is moving at an alarming rate and has put much pressure on urban resources internationally and in the local context. Locally, the slow growing economy has resulted in a slow rate in job creation and thus an increase in poverty levels. This is one of the reasons the city's economy has shifted to a more informal economy. Many people migrating to the city that cannot find work resort to more informal work e.g. Street vending or waste collection etc.

Much of Durban's old capital corporate industry has since pulled out of the city in one of the biggest exodus in the city after democracy, leaving most office buildings either vacant or some most recently converted to residential apartments. The emergence of Umhlanga North of the city as the new home for capital, has raised the question of a somewhat 'economic dualism' taking place. Much of development is taking place in the North and not much in the CBD unless it is a Government driven initiative, which means there is little or no direct investment by the private sector into the city, unless it is foreign direct investment which is the only driver of big developments like the point development in partnership with government. Development is good for the city's economy; however, this kind of development does not address what Lefebvre raises in the right to the city, the process of inclusion and provision of what the city has to offer. A city is a complex large human settlement, its density facilitates interaction between people, government and business. The latter underlines or binds the other two elements because it is the means of production and thus the economy.

The economic dualism mentioned above, the existence of two parallel cities, reflects the apartheid legacy of 'separate development'. The exit was a typical capitalist approach to a problem 'if a system breaks, buy or build a new one'. The system did break, due to the influx of the rural poor and the growing population in the surrounding ghettos now flowing into the city in search for better opportunities was not planned for and therefore the city could not cope. The city was designed for a minority, the haves, at the time the 'haves' were distinguished by race only. A highly strict exclusion of the black population who were restricted to only labor and had curfews in the afternoons. The emergence of slums post democracy in the periphery of the city have been the biggest visible impact of urban poverty due to lack of opportunities and lack of access to basic amenities.

This has resulted in the growth of the informal sector e.g. Street vendors, waste pickers. Even the taxi industry is part of the informal sector, emerging from lack of proper public transport planning by the previous regime, mainly for the black population that were placed in remote ghettos away from the city Centre and as a form of protection to the white neighborhoods or the city, were always flanked by what

was known as ‘buffer zones’ where other races of higher stature to the African (according to the apartheid class system at the time) were placed.

The right to the city as a concept, can only be applied when coupled with social, economic justice. The concept of complex systems must be metaphorically applied when addressing urban issues as to resolve modern urban issues, a more holistic approach needs to be applied. In an attempt to establish the concept of ‘the right to the city’ in the local context, the study analyzed the recent conversions of old office buildings into apartments. The recent attempts by independent developing companies to ‘revive’ the cities’ real estate. Perhaps because the approach is still the same, a neo-liberal approach driven by a capitalist system of market forces and commercial interests which ultimately leads to maximizing profits for the banks and the developer. Disguised as social housing, but in reality, is nothing more than capitalist’s approach of turning common goods to commodities. The bank is mostly always guaranteed a return in their investment with interest, the developer who’s the risk taker may or may not make the profit, and the loser is thus the vulnerable who pay inflated rent just to get closer to work or opportunities. This is not social housing, but rather a continuation of the neo-liberal development of the city which equates to the privatization of everything.

This is evident in the various urban renewal approaches in the city centre, driven by the private sector, as encouraged by government incentives in an attempt to reverse urban decay and revive the city’s real estate. Although the intentions are good, however, the approach is the same, Commodification of urban land where maximization of profit is key. Typical capital top down structure of the Banks funding the developers, developers selling to investors, investors then leasing the properties to those seeking space either to live or operate a business, more often at inflated prices. This equation is always lacking the most important thing, the social aspect where the wellbeing of the people as a whole form a greater part of the process than just profit. The failure of these models in the CBD’s across the country is the precise fact that the capitalist top down approach model applied does not work. Those that can afford,

the wealthy or middle-class part of the population have left the city and are not keen on buying back in the CBD unless it is profit driven. An example is how the hospitality industry is in the center of these urban renewal initiatives, where it is not the actual urban dweller that use, or own these properties, but are more privately owned for rentals thus benefiting the investor or owner.

A bottom up approach that is inclusive and supports sustainable development and empowerment of the urban poor to be part of the economy and take part in decisions that shape the city is a more sustainable approach. This would require a relook at the sustainable development approaches as presented in an international level and in particular Resilience. The political domain of resilience or Governance and sustainable development as presented by the Northern hemisphere would particularly be problematic if applied in the Southern hemisphere, particularly Africa. As Welsh describes the governace of resilience as 'Post lolitical', thus "*sustaining and neutralizing Neo-liberal paradigms of contemporary governance*" (Welsh, 2012).

The concept of Social or solidarity economy can be an alternative to the current unsustainable capitalist system, creating an inclusive society. This concept is seen working in countries like Brazil where most of the poor population makes a living out of waste management or recycling.

The right to the city forms much of complexities that exists in the urban setting. Complexity theory, as mentioned above attempts to capture the 'whole' by taking into account the broader context. As part of the UN International Development policies, the concept of Resilience that has been introduced and adopted attempts to capture complexity and define its parameters in a precise manner. Welsh notes that Resilience attempts to "*capture complexity and creates a means of understanding and managing complex systems and process and effects of change upon them*" (Welsh, 2012).

2.5 Resilience

Resilience is a way for physical or social systems to prevent collapse cause by chronic stress or sudden shock. It is part of a disaster risk management approach to prevent a wide range of disruptive

events. Resilience applies a systems approach and is closely linked to complex systems theory. The rise of complexity has somewhat laid grounds for the emergence and rise of resilience in the academic field, as resilience is used as means for understanding and managing complex systems.

Resilience and Sustainability are closely linked. Sustainability is rather broad and therefore its definition can sometimes be lost.

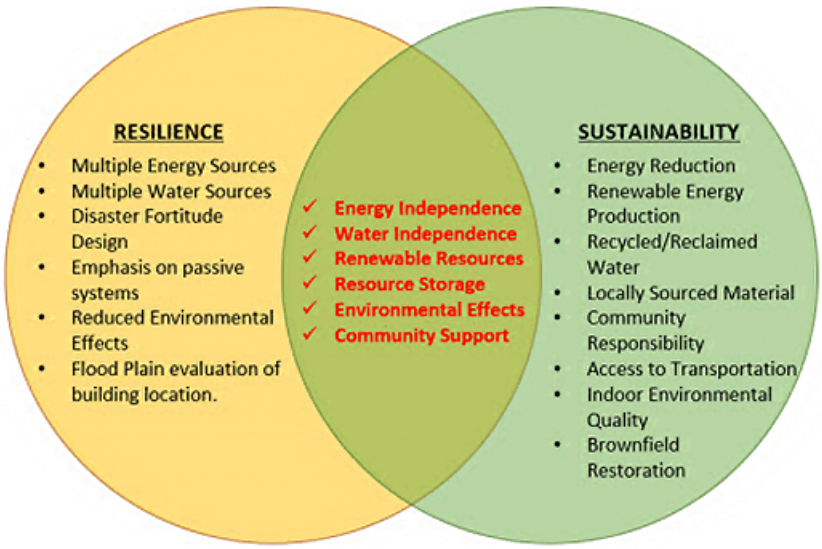


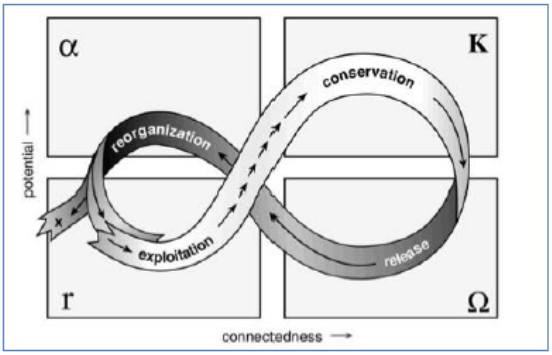
Figure 10 – Resilience combined with sustainability - source: by author (2019)

The emergence of resilience has somewhat focused what sustainability is vague about. There is a clear set of targets and goals that constitute to resilient communities and thus resilient cities. Resilience as an area of study initially emerged from Ecology. Its scientific definition resilience describes *"the capacity of a material or system to return to equilibrium after displacement"* (Norris, F. & Stevens, S. & Pfefferbaum, B. & Wyche, K. & Pfefferbaum, R. - (2008). In social studies, it is used more metaphorically and has had mixed views on its application. In architecture and the built environment, it more "*seeks to solve problems without creating new ones*". Resilience combined with sustainability becomes good means to conceptualize and manage change. However, resilience is not socially, ecologically and politically neutral. Thus, its application in the African context requires a somewhat different perspective that is in line with the current circumstances.

2.5.1 Resilience in its broader context

Resilience as a theory transcends many disciplines, it is thus have contrasting views when it comes to its definition. How it is viewed internationally in academia and governmental structures is somewhat different to how it is viewed or applied in the local context. Resilience emerged in the 1970's and originates from Ecology/Natural science and social science field of studies. Welsh goes on to define the two main forms of resilience theories that exist i.e. Socio Ecological Resilience (Nature-society Disciplines) and Psycho-social Resilience (Mind-body disciplines) and there is a third that overlaps the previously mentioned two, Governance which is the Political Domain (Welsh, 2012).

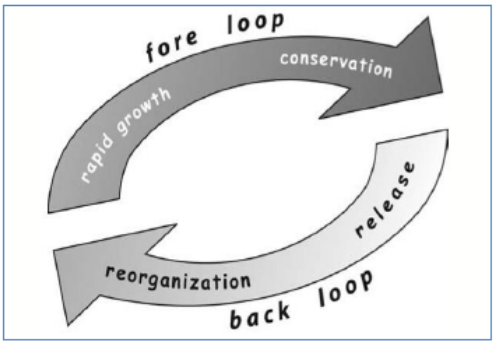
Box 2.7: The adaptive cycle



Source: Walker and Salt (2006)

Figure 11

Box 2.8: The simplified adaptive cycle



Source: Walker and Salt (2006)

Figure 12

Resilience is a way for Physical or social systems to prevent collapse cause by chronic stress or sudden shock. It is part of disaster risk management approach to prevent a wide range of disruptive events. Resilience applies a systems approach and is closely linked to complexity theories. In fact, the rise of complexity has laid fertile grounds for the emergence and rise of resilience, as according to Welsh "*resistance is used as means for understanding and managing complex systems"* (Welsh, 2012). The first two are academic Disciplines and the third is more a political discourse. Governance under the political discourse emphasizes "*Governance Risk and threats to the social body but is closer to political discourse or Resilience as robustness*" (Welsh, 2012). The Political discourse as described by Welsh is seen as a more "*Post political*" with a "*Depoliticizing*" nature. In this way, Welsh describes it as it turns to "*sustain and naturalizes neoliberal paradigms of contemporary Governance*" and further elaborates

on that it simply "*responsibilise risk away from the state and on to individuals and institutions*" (Welsh 2012). Welsh describes possible reasons why resilience is sometimes considered '*problematic*' when deployed: "*a post political ideology of constant adaptation attuned to the uncertainties of Neo-liberal economy* " *(Duffield, 2011) where the resilient subject is conceived as resilient to the extent it adapts to rather than resists, the conditions of its suffering" (Reid, 2012)* cited from (Welsh 2012)

As the study directly relates to the poor in peri-urban areas, and the need for inclusion in the social, economic and political structures of the city, the views mentioned above by Duffield and Reid turn to shift more to adaptation. This is not ideal in terms of the concepts of this study i.e. the right to the city or theories like social justice as its aim would then be simply to neutralize the poor in an effort to get them to accept their current state and not aspire for 'more'; 'more' being what equates to what is fair and just. Resilience, for instance, under the current economic system and structures may turn to promote acceptance of the current unsustainable capitalist system and therefore call for the citizen to be resilient to their shortcomings.

This is evident in the current economic system, whether macro or micro, specifically in the Neo-liberal context of the economy, which is based on a capitalist system, adaptation would not make sense. An economic system that collapses and goes to a recession every several years and is resulting in grave circumstances for the majority poor and middle class whilst the top elite are safe and still receive bailouts from governments is simply not ideal. This would mean the resilient ones should or would then have to be the victims of such economic crashes, which is pretty much the same as asking the poor to accept their fate and be 'resilient' and 'adapt' to their conditions.

"The human here is conceived as resilient in so far as it adapts to rather than resists the conditions of its suffering in the world. To be resilient is to forego the very power of resistance" (Reid 2012, 76) cited from (Welsh, 2012).

Because the human species is resilient and adaptive in its nature, it can adjust to almost any living conditions. It is precisely this ability that could hinder progress in changing the conditions of the poor. However, although there some of the negative views of resilience when it comes to the political domain, there are good qualities with some characteristics of resilience theories seen as shaping change and empowering citizens. However, in politics it has been criticized as shifting the responsibility from government to the citizens.

In the academic disciplines of Socio-ecology and phsyco-social Resilience, the theory turns to take a different perspective. In this context, there is a strong link between resilience and complexity. Welsh explains how resilience is "*used as means for understanding and managing 'complex systems' and the processes and effects of change upon them*" (Welsh 2012). It has also been noted how the rising of complexity in the academic sphere has empowered resilience. Welsh notes that "*the development of complexity to prominence in social sciences has been a catalyst and has provided a fertile bed for resilience to flower*" (Welsh, 2012).

Although present economic development is the cause of environmental and social inequality, however sustainability and sustainable development encompassing the green economy is a good start towards a sustainable and just society.

In a local context, the resilience journey of Durban began in 2013 when the city was selected to be amongst the first 33 cities to join 100 Resilient Cities (100RC). 100 resilient cities were an initiative by the Rockerfeller foundation as part of an innovative strategy to help cities become more resilient to the physical, social and economic challenges facing urban communities in the 21st century. It is an innovative strategy to create future resilient cities that are able to deal with the risks and complexities faced by modern cities.

The current framing of resilience has largely been as result of its conceptualization by northern academic communities and the practices and experiences of cities in the north. Thus, there has been a call for a much deeper and more critical engagement with resilience in the global south, with a focus on

African cities (Ziervogel et al, 2017). This has been largely supported by local academics and has led to the drafting of a more locally inclined version of resilience that speaks to the local context.

In the wake of current global climate issues, Resilience offers a systemic way to deal with these issues. Sustainability is the long term 'repair' system, while resilience offers immediate repair or coping mechanisms caused by unsustainable developments globally in the social, economic and environmental systems. Firesmith notes that "A system is resilient to the degree to which it rapidly and effectively protects its critical capabilities from harm caused by adverse events and conditions" (Firesmith D. 2019).

Beck notes that *"we are living in a 'risk society' where we are managing the dangers"* (Ulrich Beck, 1982, 1995). The theory of resilience is an attempt to manage these shocks, whether natural disasters caused by climate change due to carbon emissions, unsustainable economic systems that crash every several years, which leads to social collapse in society due to social inequality.

2.6 Global perspective on sustainability

There is a convergence of UN International Development policies in supporting a unified global approach to sustainability issues. The Sendai Framework, Sustainable Development Goals, Paris Agreement, and the New Urban Agenda have brought about a more unified comprehensive response in creating a better world for all. It deals with human social issues whilst defending the degradation of the environment, basically creating a harmonious relationship between man and nature. The study aims to look at how these are applied through the local "Integrated Development plan" which outlines that *"by the year 2030, the city of Durban will be Africa's most caring and liveable city"*.

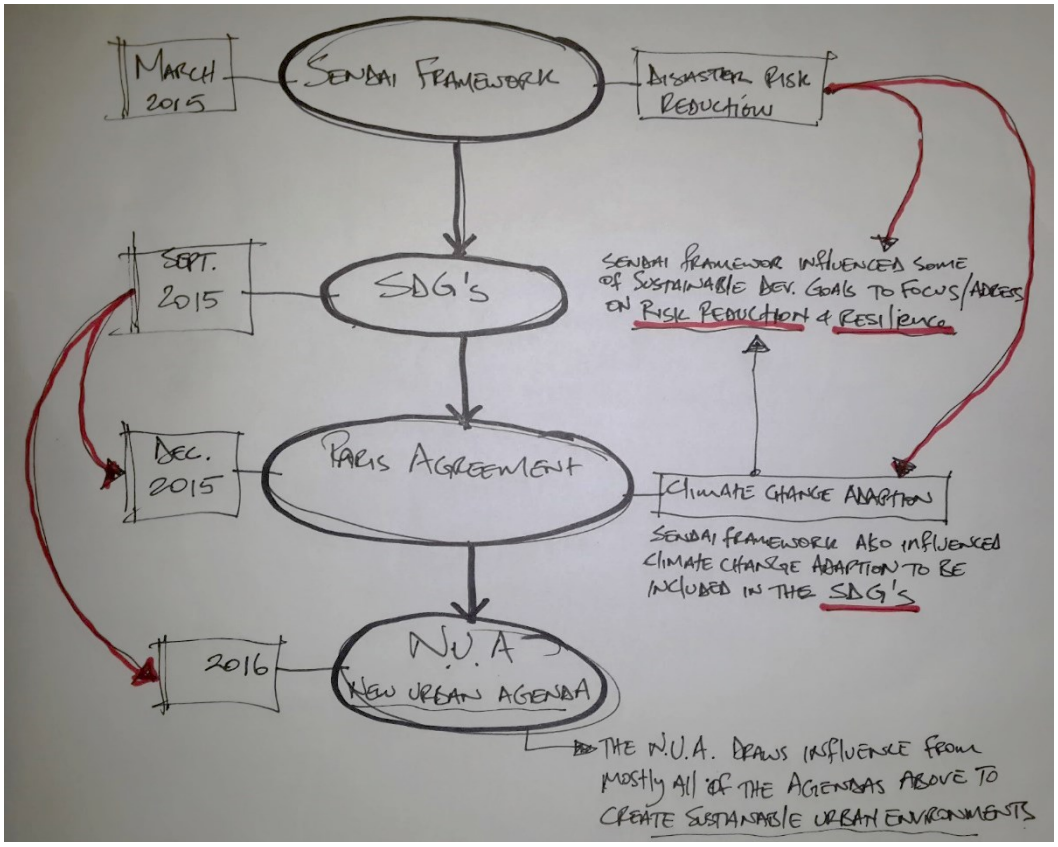


Figure 13: source: by author (2019)

The Sendai Framework mainly discussed disaster risk reduction but also laid ground for the development of the Sustainable Development Goals, which later led to these being included in the 17 Sustainable Development Goals for 2030.

Figure 14: UN Sustainable Development Goals - source: (2019)

Sustainable Development Goals had an impact on the Paris Agreement because the Goals included factors that are directly linked to climate change e.g. Goal no. 7 (Affordable and clean energy) which has a direct link to climate change. It, therefore, set a trajectory for the Paris conference to discuss issues like Carbon Economies that are reliant on coal for energy to begin finding other alternatives that are clean and affordable. The final Paris agreement was a milestone on a scale that has never been seen before as it achieved what the previous conference could not.

Goal no 13 (Climate action) is also directly linked to the Paris Agreement and set the Agenda to act and reach collective agreements.

Goals no. 14 and 15 are also indirectly linked to the Paris Agreement in such a way that they would be a result of Goal no. 13. They called for a sustainable life below water and on land.

Goal no. 11 is perhaps one of the main goals that influenced the New Urban Agenda as it calls for sustainable cities and communities. However, the New Urban Agenda draws from mostly all the Sustainable Development Goals.

Sustainable development clearly defines and embraces the main issues about this study, the main concerns as raised by the study is the redressing of environmental degradation, poverty, and exclusion (Elliott, 2012). There is a great difficulty for developing countries to implement and sustain the concept of sustainable development because they are still developing, they often find it difficult to balance economic growth with maintaining social and environmental sustainability and the distribution of wealth that comes with that growth. (Pacione, 2007).

The interconnectedness of the U.N. agendas has brought about a more unified comprehensive response in creating a better world for all. It deals with human social issues whilst defending the degradation of the environment, basically creating a harmonious relationship between man and nature.

2.6.1 Creating a self-sustaining urban environment

Sustainable development underpins the concept of a 'self-sustaining' urban environment which means the principles of sustainable development would have to be adhered to in order to achieve the latter. According to The Brundtland Report (1987), several conditions would need to be met i.e.:

"A responsive political decision-making process; an economic system that does not generate the same resource demands as the present system; a responsive social system that redistributes the costs and benefits of unequal development; a system of production which is sensitive to the carrying capacity of the ecological system; Innovative developments in technology that enable better uses of resources; A global alliance to support sustainable development initiatives and a responsive, flexible system of governance that enables public participation in decision-making". (The Brundtland Report, 1987)

The core concepts of sustainable development as shown on the image below forms the overall basis for a self-sustaining urban environment.

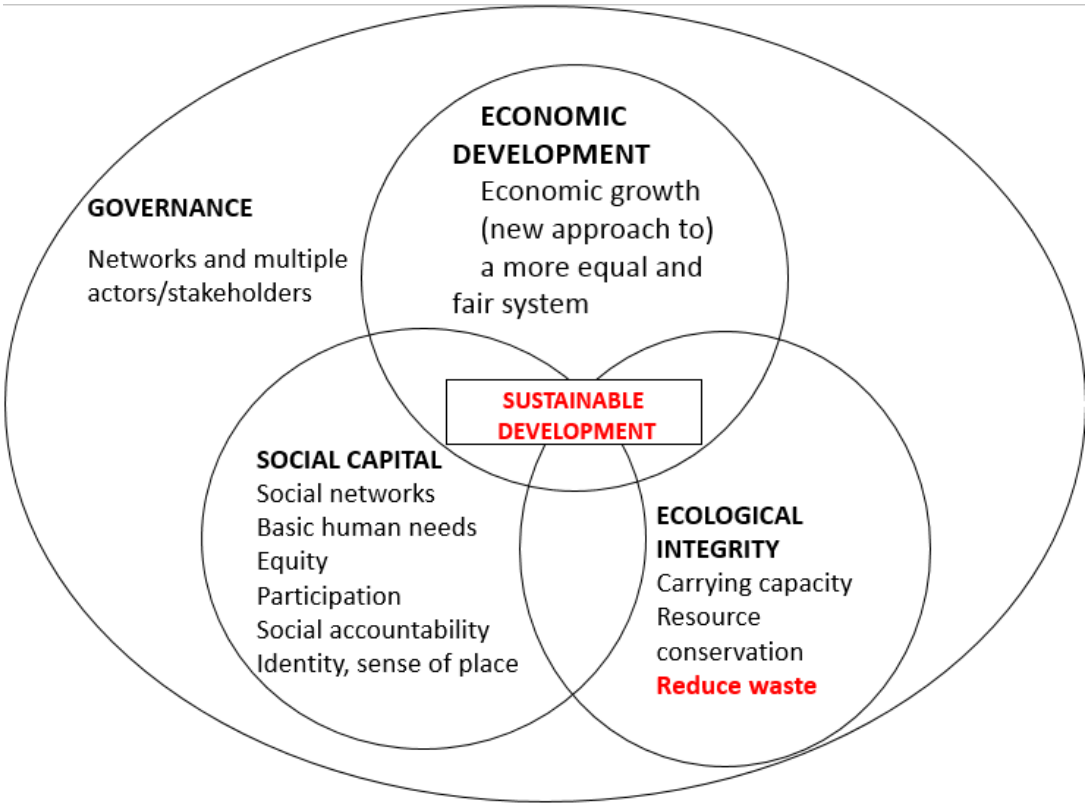


Figure 15 - Source: Sutherland C. 2018

Although sustainable development has received some criticism, progress made over the last decade has been tremendous and the conceptualization of the sustainable development goals is a major step

forward from the previous 'Millennium Development Goals'. There are three pillars of sustainable development: the economic, social and environmental and the millennium development goals were in support of these. There is still a need for review, especially on the Economic approach, which is very much still driven by the Neo-Liberal capitalist approach as mentioned above. However, progress made thus far gives hope that this generation may be headed in the right direction.

The Ecological Integrity part of Sustainable Development highlights waste reduction as part of its core elements. As this directly influences this study, coupled with Social Capital and Economic Development to form complete sustainable development. As this study takes a systems approach, it takes into account all these other systems as part of a more complex system and thus takes a 'holism' approach. Considering that the research topic has the three elements attached to it, the environmental, economic and social aspects, how the built environment can have an influence on these and visa-versa.

2.6.1.1 Sustainability

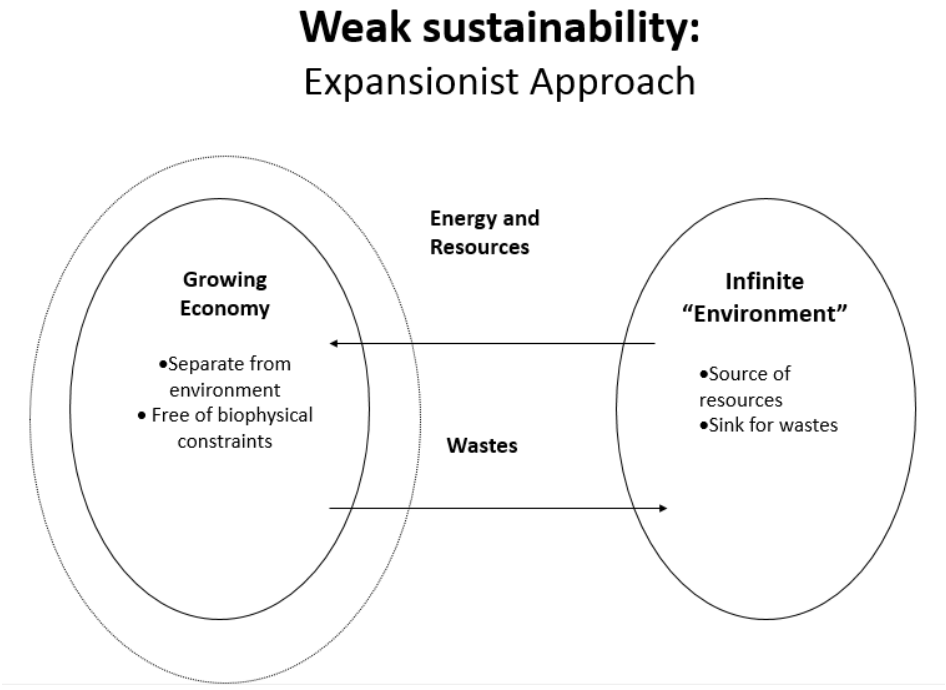


Figure 16 Source: Sutherland C. 2018

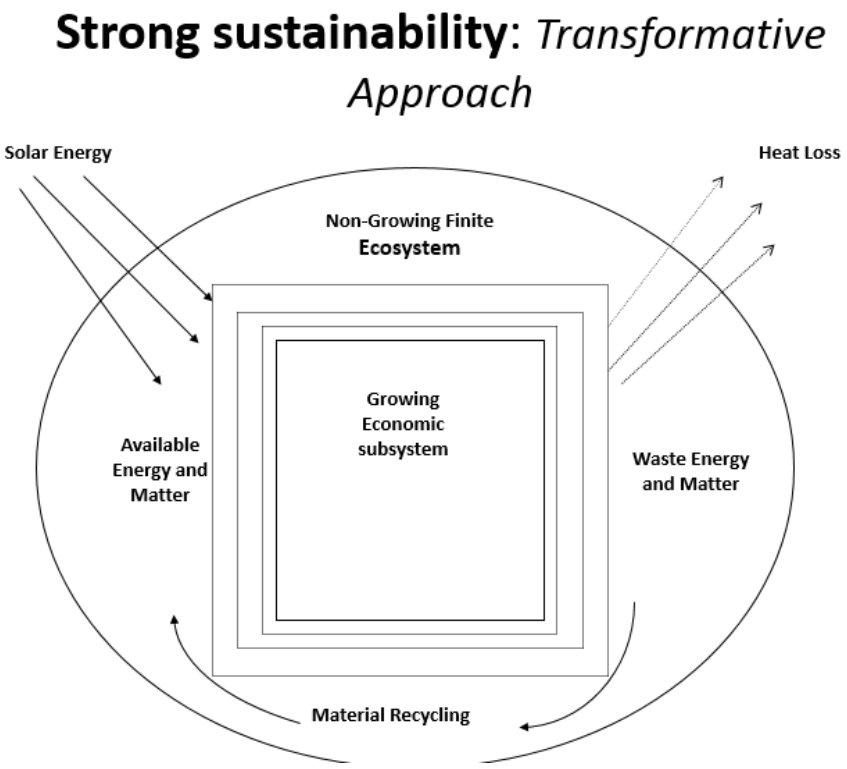


Figure 17 Source: Sutherland C. 2018

2.7 The city of Durban's "Integrated Development plan"

The advancement of the U.N. International development policies as previously mentioned, is systematically being applied and is filtering through on a local context. This in pursuit of a unified global approach on Sustainability issues. As the New Urban Agenda is the most recent U.N. policy adopted in 2016, it has gained its influence from mostly all the previous Agendas adopted by the U.N. in order to create a sustainable urban environment. From the New Urban Agenda, down to the local context, the policies have filtered down in the following structure:

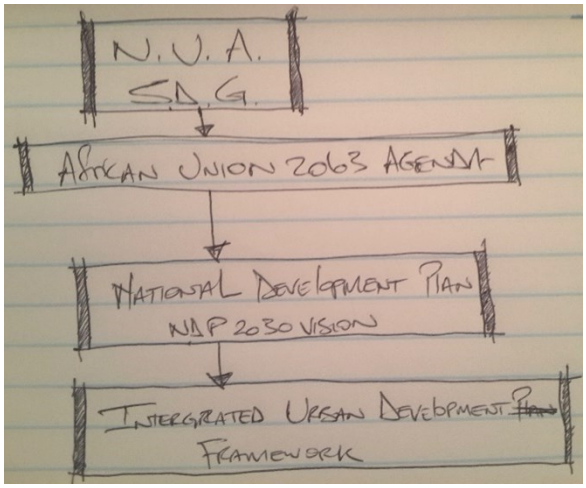


Figure 18: By Author

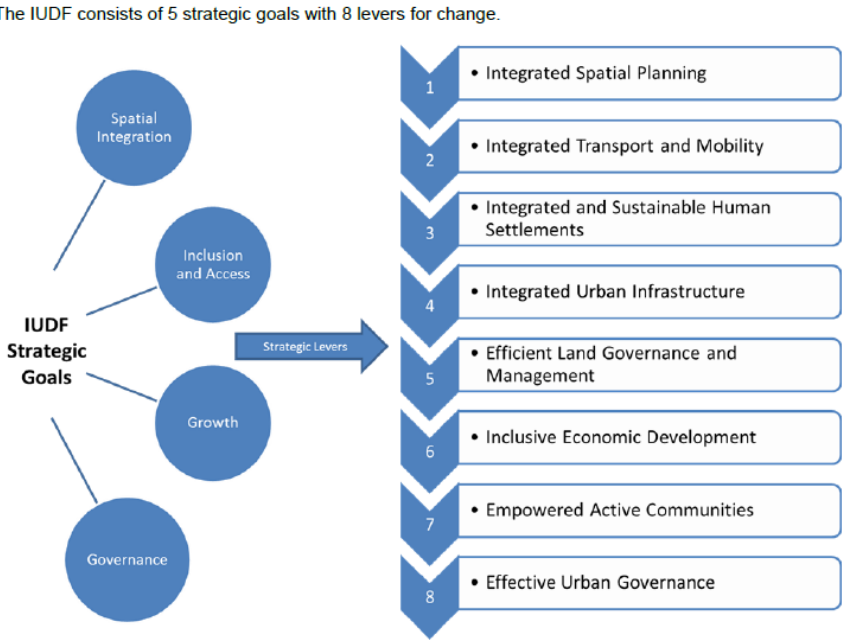


Figure 19: IUDF strategic goals

The 'Integrated Urban Development Framework' is a national policy that was created to boost economic potential of cities and towns in order to boost growth and job creation. As a result, under the National Integrated Urban Development Framework, the city of Durban focused its implementation on a local context by initiating the 'Integrated Development Plan' which is also aligned with the National Development Plan. This is a 5 year plan adopted by Ethekwini Municipality under a vision to: *"By 2030, eThekwini will enjoy the reputation of being Africa's most caring and livable City, where all citizens live in harmony."* (Integrated Development Plan, Draft 2017/2018 IDP.pdf).

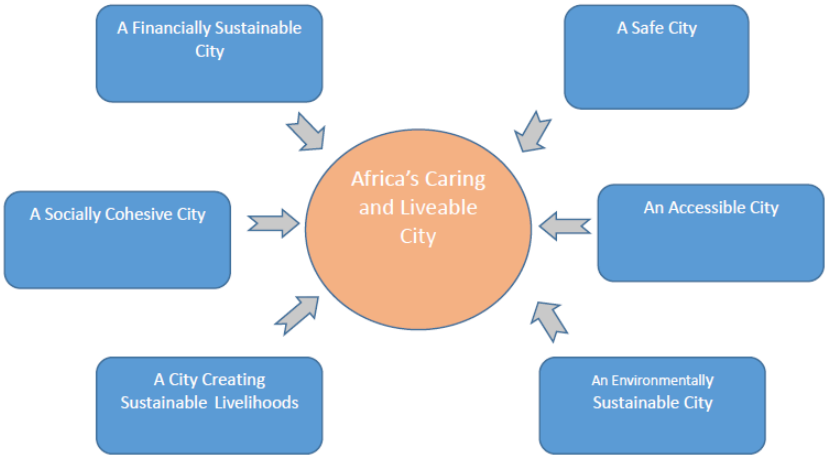


Figure 20: IUDF strategic goals Source: Ethekwini Municipal IDP 2017 / 18

The current framework as laid out with its principles above directly links to issues pertaining to the study. These principles refer to: "*Develop skills for the future economic sectors; Promote small and medium enterprise; Empower and develop skills of the citizens; Promote sustainable development of vulnerable groups; Increase economic and sustainable job opportunities"* (Integrated Development Plan, Draft 2017/2018 IDP.pdf).

As part or continuation of the New Urban Agenda, the city of Durban has adopted a strategic plan, the 'Integrated Development plan' which serves as *"a tool for transforming local governments towards facilitation and management of development within their areas of jurisdiction".* (Integrated Development Plan, Draft 2017/2018 IDP.pdf).

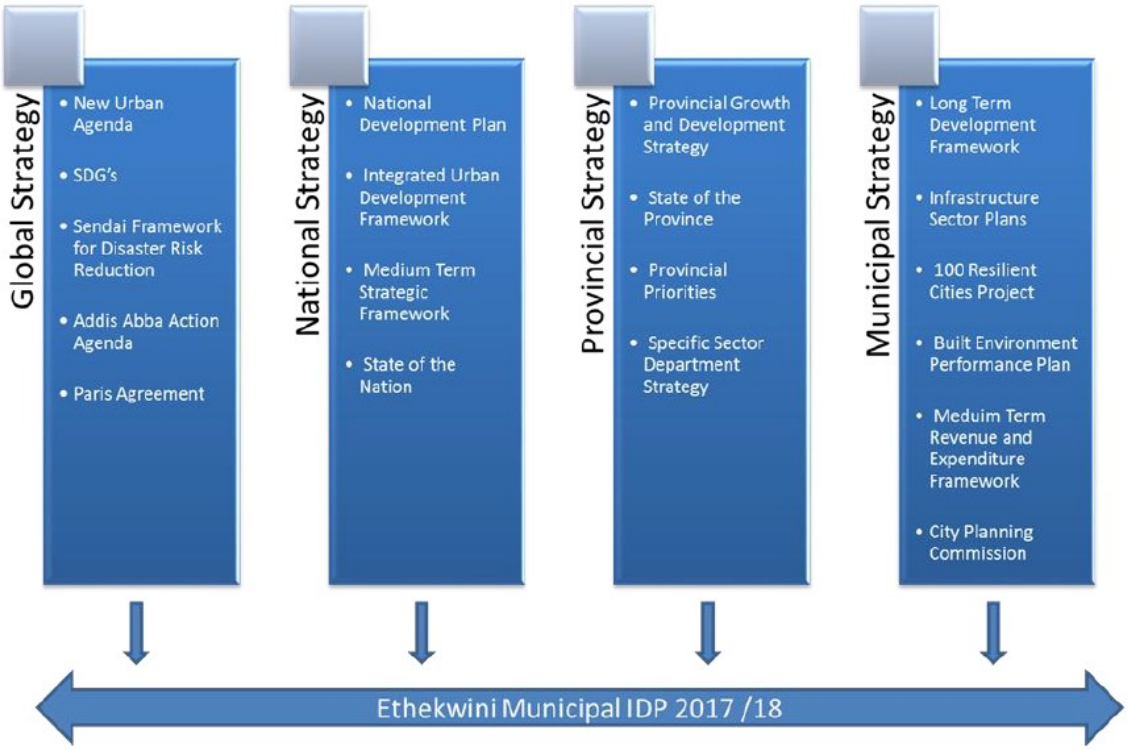


Figure 21: Context - Source: Ethekwini Municipal IDP 2017 / 18 Macro

Image above indicates Ethekwini Municipal 'IDP' from its macro context down to the local Municipal level. As the study focuses on the how recycling can benefit informal waste collectors and poorer

communities in the outskirts of the city whilst exploring its influence on the built environment and the built environment's influence on recycling itself, it would be beneficial to analyze the municipal strategy and the gaps there of in a quest to fulfill the purpose of the study. Amongst these strategies as shown above: Long term development framework, 100 resilient cities project and the Built environment performance plan. In order to create sustainable urban environments, it is vital to create an inclusive economy that is resilient, with a strong emphasis on empowering the informal economy, more specifically, the informal recycling economy in a sustainable way. Benefiting from saving the environment, is the goal behind the Green economy, which forms a great part of the city's resilience. In economic policy, the focus has shifted towards resilience and not just on growth and development. This has led to a policy that is more aware of the environment and preventing it from degradation than simply focusing on profit and growth.

2.6.3 Waste management and Landfills

Legislation in South Africa did not include anything with regards to recycling and sustainability prior 1994. The only law that came close to any form of sustainability or recycling was the Environmental conservation act 73 of 1989 which at the time was the only legislation that mentioned recycling and was the first of its kind. (Ralfe, 2001).

This changed after the dawn of democracy as global trends also started shifting towards a more sustainable environment and sustainable ways to manage waste.

In 1998, a new piece of legislation *"The National Environmental Management Waste Act 59 of 2008 (NEMA)"* was passed which included the concept of sustainable development which addressed development from three spheres i.e.: social, environmental and economic. This legislation was groundbreaking as it directly referred to recycling within the broader framework of sustainable development (Ralfe, 2001). This legislation set a platform for newer legislation that addresses waste

management and recycling. The *'white paper'* published in the year 2000 made direct reference to recycling and waste minimization in South Africa. It also further acknowledged a 'lack of commitment to recycling' (Ralfe, 2001).

This legislation eventually led to a drafting of the National Waste Management Bill which emphasizes the necessity of including recycling in waste management strategies and focusses on recovery, reuse and recycling of waste.

The National Environmental Management Waste Act 59 of 2008

Objectives:

"*minimizing the consumption of natural resources; avoiding and minimising the generation of waste; reducing, re-using, recycling and recovering waste; treating and safely disposing of waste as a last resort; preventing pollution and ecological degradation; securing ecologically sustainable development and Promoting and ensuring the effective delivery of waste services*" (RSA, 2009).

There have been various updates to the National Environmental Management Waste Act, most recent being in 2014 which included the Air Quality Amendment Act of 2014, Protected Areas Amendment Act 2014 and the National Environmental Management: Waste Amendment Act of 2014 which is more relevant for the purposes of this study.

2.6.4 Recycling industry – The formal and informal markets

Recycling is understood by many to be a concept that is directly linked to efforts by Industries and Governments to reduce pollution and also reduce rapid depletion of resources (Munyai. K, Maina. W & Mugandi M, 2011: 01), however community participation forms a critical missing link that could be beneficial to poorer communities. The informal economy has always been an opportunity for creating employment amongst those excluded in the mainstream formal economy, mostly poorer communities.

In countries like Brazil, the concept of solidarity economy is wildly used and encourages participation of the informal sector in the economy. "*Solidarity economy brings social justice issues and values, such as cooperation, redistribution and reciprocity, into the economy"* (Fisher and Ponniah 2003) (Mundial F.S. 2003). ''*Solidarity economy creates synergies between actors (local authorities, private enterprises, state, citizens) and generates workplaces by offering new services and new forms of production'' (Moulaert and Ailenei 2005, p. 2042)"* (cited from Gutberlet J. – 2012).

Much emphasis has been placed on the formal economy, this can be described as the mainstream economy where workers have formal jobs, paid regular wages/salaries, receive benefits and pay taxes. In the waste management industry, much research has been done as part of its formal economy. However, defining the informal economy is rather complex and the definition will mostly also depend on the particular context. "*The existence of the informal economy is often seen as a reflection of development failures. In short, within both developed and developing countries the informal economy has been simultaneously a solution to and symptom of economic problems*" (Mueller 2005; P7).
In the recycling economy in the local context, the informal does turn to be the poor marginalized on the periphery of the city, that have developed survival skills due to exclusion in the formal economy. This include informal traders, waste pickers etc.
Both Neo-liberal and Marxist shared the same view initially on the description of the informal economy. However, there was a shift as a new Neo-liberal theory emerged in the 70's. This new theory gave a new recognition for the informal economy as showing *"entrepreneurial dynamism suggesting a potential for employment creation and growth"* (Meagher 1995: 262). In some way, this can just be seen as a capitalist driven agenda to exploit and maximize profit. This can be seen in the relationship that exists between the formal and the informal economy in the recycling industry, the formal sector somewhat thrives on the unstructured, unregulated nature of the informal waste collectors, and thus much exploitation is evident.

2.6.4.1 Informal waste pickers in Durban

TYPE OF SECTOR	PERSONS	PERCENTAGE TOTAL
Formal sector	812,920	23.6
Informal sector	87,831	2.6
Private household	87,849	2.6
Do not know	26,000	0.8
Unspecified	0	0
Not applicable	2,427,760	70.5
Total	**3,442,361**	

Table 01 - Source: Ethekwini municipality IWMP

Durban is progressive and has achieved commendable progress with regards to supporting informal economic growth since the dawn of democracy. There has been a lot of progress in the informal cardboard collection sector with various interventions put in place as supporting mechanisms for informal traders and cardboard collectors.

Buy back centres in Durban

BUYBACK CENTRE	***ADDRESS***	***CONTACT DETAILS***
NORTH COAST ROAD	1288 North Coast Rd, Redhill	Ravesh 083 788 8385
WESTMEAD	39 Westmead Rd, Westmead	Sabelo Ngcobo 031 700 6504 Cell: 082 438 3005
LORNE STREET	Warwick Junction, Durban	Richard Buthelezi 031 309 7662 Cell: 082 385 1421
BROOK STREET	Brook Street, Durban	Richard Buthelezi 031 309 7662 Cell: 082 385 1421
ESCOM RD	Escom Rd, New Germany	Logan Moodley 084 603 3761
QUEENSMEAD	Cnr Turquoise & Piet Retief	Harry – 073 211 5409 Roshan – 083 412 1385
Kwa- Mashu Buy Back Centre	From North Coast Road, take KwaMashu Highway off ramp , carry on straight go under bridge then take left into Malendela Road, carry on straight at Robot in front of police station turn right into road 106354 , turn right into circle and second left	

Figure 22 - Source: Ethekwini municipality IWMP

BISASAR ROAD LANDFILL			
WASTE CATEGORIES	WASTE QUANTITIES (tons)		
	2013	2014	2015
DSW	414 803	367 766	323 218
GENERAL SOLID WASTE	96 562	73 617	66 859
GARDEN REFUSE	31 598	22 260	22 428
BUILDERS RUBBLE	83 188	133 246	66 008
MIXED LOADS	13 486	10 925	13 369
SAND & COVER MATERIAL	423 692	278 346	276 918
TYRES	461	322	211
LIGHT TYPE REFUSE	168	111	188
OTHER	19 079	8 176	6 548
PURCHASE COVER MATERIAL	2 228	16 104	0
RECYCLABLES	0	0	0
Grand Total	**1 085 266**	**910 872**	**775 746**

KLOOF DROP OFF	Kloof Civic Offices, Emolweni Rd	Enerst Gugushe 072 514 5157
HILLCREST	Shortlands Avenue, Scout Hall	Keep Hillcrest Beautiful Marge Mitchel 083 419 3807/ 031 765 1046
WESTVILLE CIVIC CENTRE	Westville civic centre, William Lester Drive	Krish Naidoo 031 3116654

Figure 23 - Source: Ethekwini municipality IWMP

The informal economy comprises, "… *all forms of 'informal employment' – that is, employment without labor or social protection – both inside and outside informal enterprises, including both self-employment in small unregistered enterprises and wage employment in unprotected jobs*" (Chen 2005, p. 2).

There are two types of waste pickers, street pickers and landfill pickers. In the context of this study, it is somewhat a combination of both as the location of the study is next to a landfill. However, the location of the study is set in an industrial zone, therefore the exploration of street picking is reviewed as an additional option to maximize opportunities.

Table 02 - Source: Ethekwini municipality IWMP

MONTHLY INCOME RANGE	PERSONS	PERCENTAGE OF TOTAL POPULATION	CATEGORIZED INCOME TYPE
No income	1,422,545	41.3	LOW
R 1 - R 400	430,088	12.5	LOW
R 401 - R 800	107,416	3.1	LOW
R 801 - R 1 600	346,931	10.1	LOW
R 1601 - R 3200	245,726	7.1	MIDDLE
R 3201- R 6 400	179,940	5.2	MIDDLE
R 6401 - R 12 800	152,461	4.4	MIDDLE
R 12801 - R 25 600	105,002	3.1	MIDDLE
R 25 601 - R 51 200	41,673	1.2	HIGH
R 51 201 - R 102 400	10,896	0.3	HIGH
R 102401 - R 204800	4,731	0.1	HIGH
R 204 801 or more	2,887	0.1	HIGH
Unspecified	356,781	10.4	Included proportionally above for the Waste Generation Model
Not applicable	35,285	1.0	
Total	**3,442,361**		

Table 03 - Source: Ethekwini municipality IWMP

2.6.5 The emergence of Buy-back/Collection centers as a contingency plan

To figure the role of Architecture in recycling, it is important to first reflect on the role of Architecture in Urban transformation, in this case peri-urban transformation. The study aims to understand the role of Architecture in recycling collection centers. The basic understanding in the design of recycling centers is the common general perception of a steel factory shed type of building that serves one systemic function. In that sense, it can be said that it is commonly perceived as a more private space that is to a greater extent inaccessible to the greater public. It is thus also common that people that either work in these places or those that work or trade with these places e.g. Waste collectors only know of the workings and function of the building.

For recycling collection centers to become more interactive and a catalyst for social change in the current peri-urban communities, reconfiguration of their role in the urban setting is necessary. In pursuit of a more sustainable urban built environment, recycling centers could play a major role. Recycling collection centres should not only be perceived for their function, whether recycling or just collecting and sorting,

but can rather be utilized as part of public spaces within the urban setting. Having additional functions that promote social interaction which can lead to greater public participation and thus social up-liftment. A study conducted on the Architecture and design of public spaces for waste recycling collection centers in the department of architecture of the University of Federico II in Naples (Italy) notes that the main Idea was "*to conceive waste recycling collection centers not only for their service function but for public space*" (Nobile M.L.: 2018) .

The study further notes that these centers can have new associated functions, such as Laboratories, Markets, exhibition areas and rooms for educational activities (Nobile M.L.: 2018). However, this study will be more focused on exploring social and economic benefits of recycling within poorer peri-urban communities.

2.7 The role and linkages of recycling buy back / collection centers

The relationship between the formal and the informal sectors is dominated by the formal sector, as they dictate the terms of the connection or relationship. Rafle further confirms this view noting that *"The formal and informal are linked but the relationship is unequal"* (Ralfe 2007:161). The role of waste pickers in the formal sector is not fully explored as the formal sector still receive most of its recyclable materials from the formal market. However, the point of convergence between the two in a form of recycling buy back / collection centres is a very important link, which if streamlined could yield maximum potential in the up-liftment of these communities. This point of convergence defines the point of interaction between the informal recycling waste pickers with the formal sector and the general public with an emphasis on the poorer communities. The multi-material buy back centre would consolidate what would somehow be a difficult task for the average waste picker. Collecting different recyclable materials e.g. Cardboard, plastics, cans etc. Would mean travelling to different recycling centres to trade them off. The study will investigate the current recycling centres and the materials they process, thus drawing a clearer picture

or map and understanding of the current fragmentation in the recycling system particularly from the perspective of the informal waste picker.

Image below indicates the structure between the formal and informal market and where the recycling buy back centers could be positioned. This strategic position could end up servicing both the formal and the informal sector and thus becoming the middleman, which would be more convenient for mostly the informal waste pickers. Diagram below indicates structure of the recycling sector and the positioning of a buy back center.

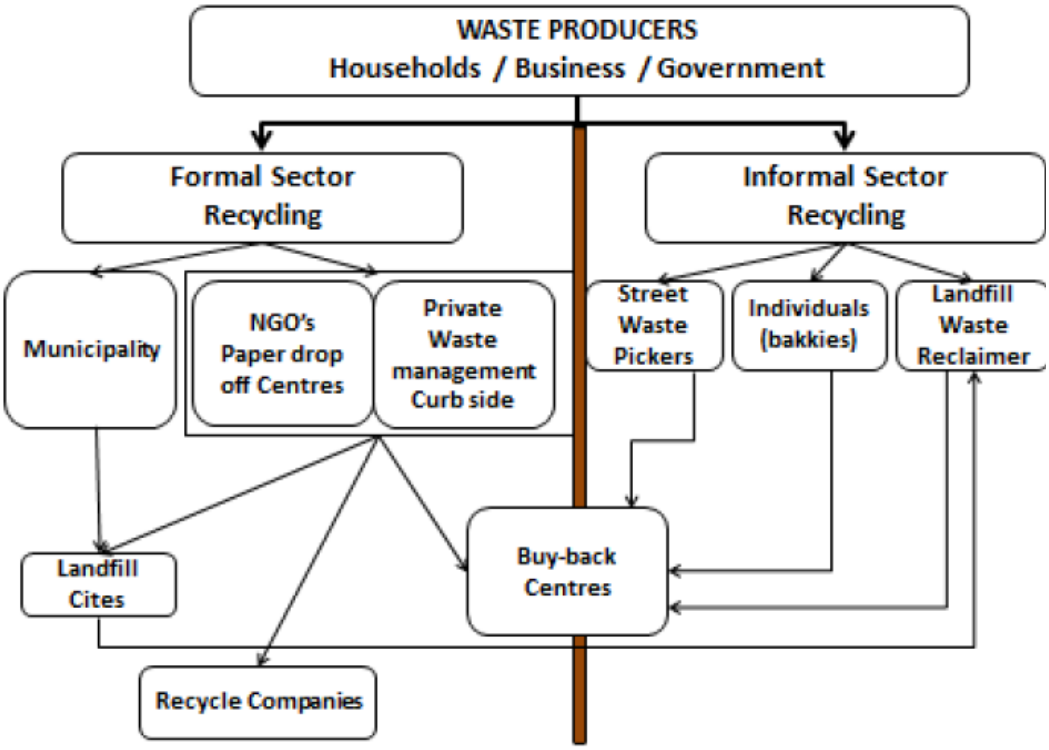


Figure 24 – source: (Viljoen, Schenck & Blaauw, 2012)

Conclusion

The wheels of social justice have come a long way in South Africa, however, the three domains of social justice (economic justice, social cohesion and public participation) have not totally been fulfilled. The Economic justice part of it is greatly lacking, as the evidence of poverty and imbalance is greatly visible. As this section revealed the state of Social justice locally, the shortcomings are clearly defined. It also clear that the most visible of these is the economic imbalance. As the study approaches the main issues from a systemic view, it seeks to analyze these issues in the context of the broader complex systems, sustainability and sustainable development are some of those complex systems and will be discussed in the chapters to follow. As the agreement reached in the *Morogoro Conference* mentioned above, the social agenda needed to advance on the "*two fronts: transforming the state and the economy*" (Chipkin and Gibert, 2013), this has not been the case for the latter. The transformation of the economy would need to happen in modern day context, taking into account modern challenges that have risen e.g. Climate change and changes in world economic setting: a shift towards the green economy and also major technological advances bringing about what is termed the 4th Industrial revolution.

The Green economy is part of that transformation, Segal & Cloete define it as a concept that *"speaks to the notion of an economy that is in tune with its natural environment so that, subject to inevitable long- and short-term influences, it remains ecologically healthy"* (Segal, N. and Cloete, B., 2012*).* This form of economy addresses some of the main issues especially when it comes to the environment. It is definitely a step in the right direction, however, looking into concepts like the social or solidarity economy could prove to be a more sustainable solution especially for the urban poor. *"The concept is held as an alternative path to the failure of neo-liberal, capitalist dominated globalization and its inequality outcomes, as discussed in the wider debates around post-capitalist politics (Fournier 2008; Gibson-Graham 2006)"* cited from (Gurtberlet J. 2012)

3. Chapter 3 - Precedent studies

3.0 Introduction

Precedent studies will draw from the theoretical framework of the study analyzing the connection between the theories and concepts of the study as discussed in the previous chapter. Each precedent has been selected to represent certain elements in the theories and concepts. Social justice theory and its three main domains will be analyzed against the chosen precedent, taking into account all three domains i.e.: public participation, economic justice and social cohesion. Complexity theory will be covered with the selected domains (organizations and social/economic systems) in analyzing the selected precedents. All the principles of the study will apply to all the selected precedents namely "right to the city, resilience and sustainability.

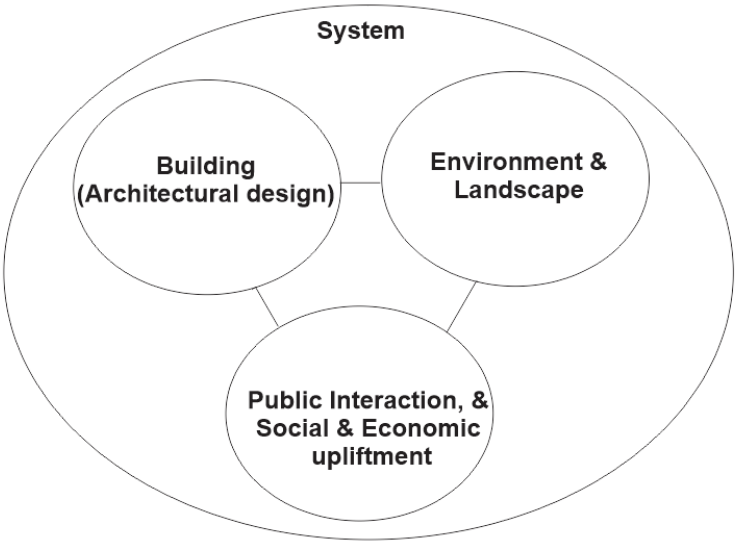


Figure 25 – Source: by Author

The concept of complexity is a metaphoric one, referring to complex urban relations and physical architectural complexity embodied into the structure based on function and basic architectural principles. Recycling plants are always perceived as private introverted structures, limited to public access. Since recycling plants are public spaces, as stated under the purpose of the study, the aim is to explore new ways these structures have morphed to accommodate multiple uses and engage with the public in an effort to bring awareness whilst generating revenue. The study will analyse spatial

interaction between private, semi-private and public spaces, whilst analysing the interaction between building and landscape. Most importantly, the social impact the building has on its users and surrounding communities.

3.1 Naka Waste Incineration Plant of Hiroshima

Architect : Yoshio Taniguchi

Location : Hiroshima, Japan

Year : 2004

Motivation : The precedent study is necessary to investigate design and guidelines of recycling Centres, but also new multifunctional ways that recycling centres are evolving to. The fact that recycling centres are now seen as part of public space that is multifunctional and engages with public in pursuit of educating and increasing public awareness of what was perceived as hidden messy spaces. This precedent also combines the three spheres that this study investigates (as per image above). This connects to the concept of 'the right to the city' and resilience.

3.1.1 Spatial planning and design

This approach is a good example of "using architecture as a tool". A building with dual function, its main function a recycling plant, secondly, as an educational centre that seeks to bring awareness and encourage public engagement.

3.1.2 Public space, Community empowerment and Social interaction

The building engages with the public and acts as a tool for educating and bringing awareness about waste management.

Figure 26 – Source: Nobile, Maria. (2018)

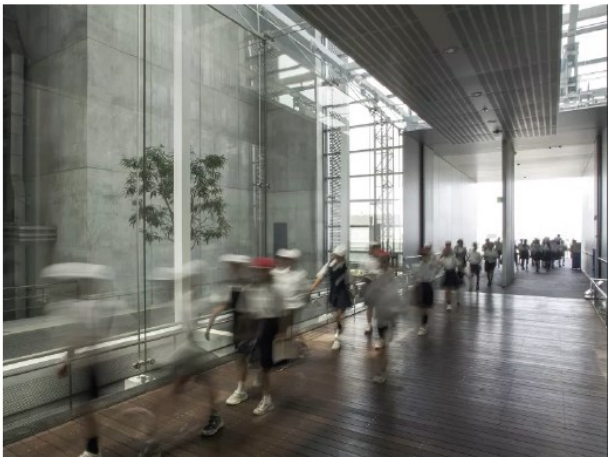


Figure 27 - – Source: Nobile, Maria. (2018)

Figure 28 - – Source: Nobile, Maria. (2018)

Figure 29 – Source: Nobile, Maria. (2018)

Figures 26, 27, 28 & 29 – Naka Waste Incineration Plant - Context, Waste + People Flows, Landscape + Public Activity

3.1.3 Environmental and Landscape impact

Although a solid structure on the ground, the building interacts with its surroundings and opens up to walkways and green landscapes. A bridge protrudes as a visual link to the harbor and connects the visitor to the water's edge.

3.2 Seoul Recycle Plaza, Seoul, South Korea

Architect : Samoo Architects & Engineers

Location : Seoul, Korea

Year : 2015 (Completion)

Motivation : The precedent study is necessary to investigate all three elements of the system as described in the introduction. The complex recycling/upcycling facility combines manufacture, exhibition, education, and resale. The building allows visitors to engage and experience the whole process of recycling and promotes participation. The building was designed as a landmark hub for citizens and is a good example of the role of architecture in recycling and visa-versa. The building is a reflection of its use inside, the interior and exterior were designed so that the visitor can experience recycling/upcycling culture.

3.2.1 Spatial planning and design

The complex recycling/upcycling facility combines manufacture, exhibition, education, and resale**,** and the majority of these facilities face south towards the adjacent park. Natural lighting is maximised with open views facing the park. Voids, double volume spaces and outdoor areas are incorporated in the design for diversity in spatial experiences while providing resting areas (see image below):

Figure 31 – Seoul Metropolitan Government

Figure 32 - – Seoul Metropolitan Government

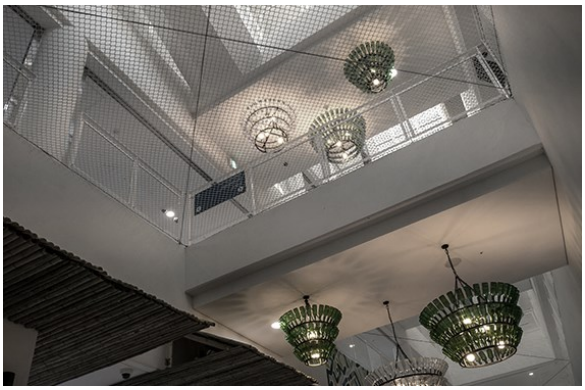


Figure 33 – Seoul Metropolitan Government

Figure 34 – Seoul Metropolitan Government

Similar programs are zoned or grouped into clusters for maximum efficiency instead of functional zoning separated by levels.

3.2.2 Public space, Community empowerment and Social interaction

The linking of the building with the surrounding green spaces and public areas and bringing the green spaces into the structure itself, makes this a unique structure. This invites the public to engage with the building and thus promotes what is happening in the inner contents of the building.

Horizontal transitional spaces between the interior and exterior of the building become spaces for social interaction. These transitional spaces also happen vertically in the form of voids and double volume spaces and links the user/visitor visually to different levels.

The spaces are designed for public empowerment with factory and recycling workshop space as the core function of the building. This main activity is then flanked with supporting functions for entrepreneurs like material bank, workrooms, exhibition rooms and storage spaces. All these activities are then underpinned by the most important of all, educational facilities that have programs on environmental education. This is vital for this research as it supports the core of the study which is to train, educate and empower existing waste pickers, but also recruiting and training the unemployed to see waste as an economic opportunity and to treat it as a business. The study seeks to pursue an investigate a possible active role by Government, community and private sector partnership in creation of a business incubation program as part of the educational space. This would be more ideal than the route of just creating laws and legislation and leaving it to the private sector to abide, which is hardly ever the case.

3.2.3 Environmental and Landscape impact

The building blends with the surrounding landscape with most of the building raised and supported by columns.

The building flows onto adjacent park and as most of the building is raised, the landscape flows into the building and thus visitors can flow through the building on the ground level. The architect used various kinds of reused materials have been applied on the exterior of the building (see image below):

Figure 38 - Source: Seoul Metropolitan Government - 2018

3.3 Eco Ark, Taipei, Taiwan

Architect : Arthur Huang

Location : Taipei, Taiwan

Year : 2010

Motivation : The precedent study is necessary to investigate the use of recycled material in architecture. This is in an attempt to answer the main question of the study i.e.: ‘‘*How can recycling inform architectural design and socially benefit low income households or settlements*?”

The EcoArk Pavilion is the world’s first fully functional public structure made of Recycled materials (plastic bottles). The structure ground-breaking in the use of recycled materials in the built environment, whilst it maintains adequate thermal comfort levels due to the plastic ‘polli’-brick’s high insulation properties. The building has since been converted into a museum.

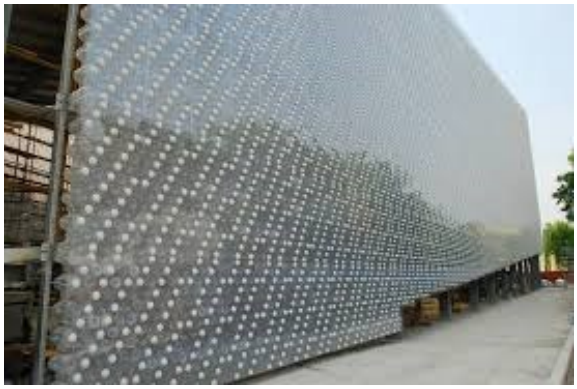


Figure 39 - Source: Wang L. (2017)

Figure 40 - Source: Wang L. (2017)

3.3.1 Spatial planning and design

Taiwan experiences at least 3 to 4 Typhoons a year. Architect Arthur Huang had to design a building that can withstand these strong weather forces, his idea was to build it using recycled plastic bottles as a weatherproof façade. Not only did the façade had to be waterproof but it had to also have acceptable thermal transmittance values. From this Polli-Brick was created, it is honey-cube shaped material that can be adhered with silicone and is made from recycled PET plastic bottles. The PET recycling process involves grinding the bottles into 'flake', separating out contaminants, and then heating and reforming.

The structure was designed as an open plan shed to accommodate public events. The building had to use low carbon building techniques & maintain a zero carbon footprint when it is running. This meant amongst other things that, a lighting system for the building had to power itself, space to be cooled without using air-conditioning, and have minimal impact on the landscape, meaning that the building if need be, could be broken down and reassembled elsewhere. This 9 storey high structure with an area of around 2500 square meters will consist of a movable stage for fashion exhibition shows, art installation (exhibition), huge exhibition hall and a full-length ramp along the one side.

It is a completely adaptable building that goes beyond ‘adaptive re-use’ but is rather designed for deconstruction.

3.3.2 Public space, Community empowerment and Social interaction

Designed for the International Flora Expo in 2010 which is all about environmental awareness. With an estimated 6 million visitors expected, the EcoARK Pavilion as it was named had to meet all the sustainability requirements whilst aesthetically pleasing and strong. The building with its adaptive nature has since hosted various public events i.e.: fashion shows, but eventually, as mentioned above, has been converted to a museum.

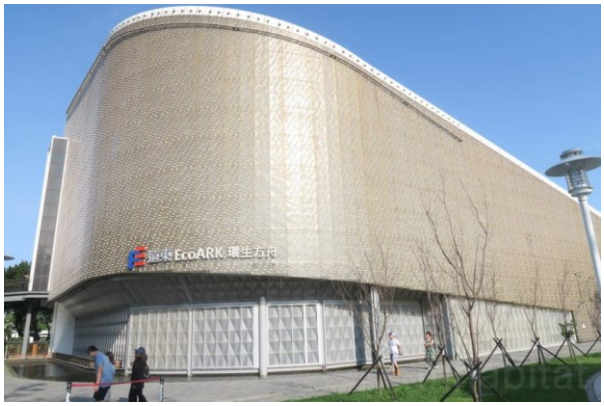


Figure 40 - Source: Wang L. (2017)

Figure 41 - Source: Wang L. (2017)

3.3.3 Environmental and Landscape impact

The structure has minimal impact on the landscape and can be deconstructed and reconstructed in another location.

The use of steel frame makes the building light and leaves no major impact on the landscape. The Polli-bricks covers a standard steel frame that will give the building strength to resist earthquakes. It weighs 50 percent less than a conventional building, yet it is strong enough to withstand the forces of nature, including fire.

3.4 Conclusion

These three precedent studies contribute to theories and concepts that the study looks into order to answer the main question and in addressing the problem statement. The use of space combining waste processing and public engagement is crucial to this study.

Firstly, the architecture, as the designs of waste recycling plants is evolving into multiuse public spaces, these three buildings embody those principles and have been applied in an attempt to engage with the public.

Environment and landscape is the second part and it entails sustainable ways of building that have minimal impact on nature, this includes the actual use of recycled materials that could be disassembled and recycled in future. Promotion of passive cooling strategies, buildings that are less reliant on mechanical systems. Buildings that have minimal impact on the landscape and turn to blend with the landscape as opposed to dominate and destroy.

Public interaction, social and economic upliftment, is perhaps the most important for the purpose of this study. All three buildings engage with the public in a social manner; however, economic upliftment is an exploration that is mostly visible in the second precedent but can be enhanced in the local context to be more rigorous and effective.

5.0 Case studies

5.1 Introduction

The purpose of the case studies conducted is to develop efficient data with regards to the links between phenomena and real-life situations. The chosen precedents were analysed in order to understand the design brief by analysing a project that is related to the building typology in the study. Therefore, the characteristics of the theoretical framework should and will be expressed by these links between the observed phenomenon and the real-life situations. The case study analysis follows the systemic approach of the study, taking a holistic approach and thus aims to capture meaningful characteristics of real-life events while analysing the phenomenon.

The first case study aims to observe a functioning recycling collection center analysing and observing the daily functioning and operations of waste pickers and the collection and recycling centre. The case study will be rigorous and provide a fair presentation of the empirical data, this is done by not allowing biased views that may influence the direction of the findings and conclusions.

The second case study is located in the actual proposed site location along Bisasar road and the surrounding Kennedy Road informal settlement area, opposite Clare Water Estate, in Durban, Kwa-Zulu Natal (29°48'41.37"S 30°58'46.71"E) which are adjacent to each other. The settlement is located between the municipal land-fill site and eThekwini college Springfield campus, Umgeni Road.

5.2 Case study 1 – Palmer Street pick-up centre

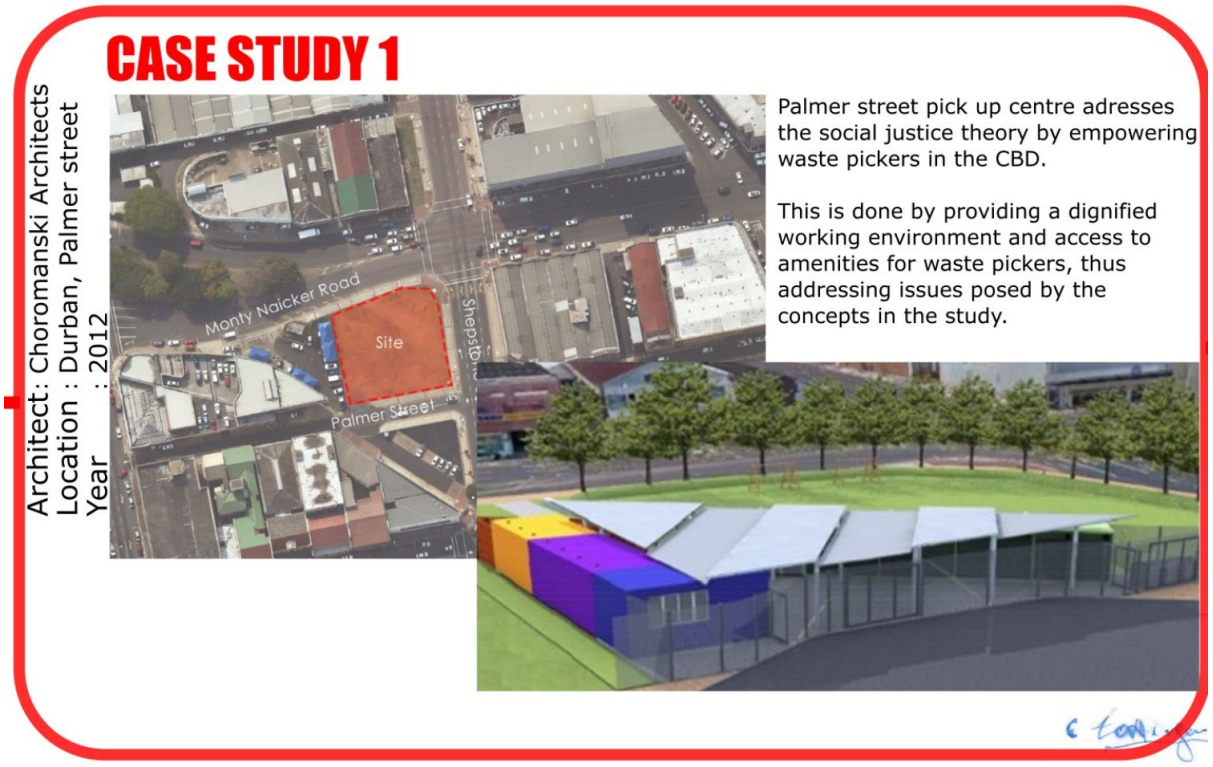


Image: 42 – Site Location & Perspective, Source: www.aet.org.za - Edited by the Author

The palmer street recycling centre has recently been completed but is not in use currently. Although this facility was mainly designed specifically for the cardboard waste pickers, it is however important to the study as it encompasses the main issues in the study as underpinned by the theoretical framework. The practical layout and usage of the space is adequate to direct the study towards a practical design with usable, adaptable and highly social interactive spaces.

The proposed typology is a multi-use structure, and at a much bigger scale that the case study, however, the fundamental use of spaces and the practicality remains as a basis for the study. The usage of space is a bottom up approach, that took complete participation of the waste picker through organisations like Asiye Etafuleni in partnership with the Ethekwini Municipality.

Image: 43 – Site Location - Source: www.aet.org.za

The left image indicates a site plan of the facility with the emphasis being placed on the open green public space. A row of trees screens the building and the green space from the busy roads. The facility was designed around the waste picker in mind, with open green space for pickers to work freely. The pickers have access to storage, ablutions and changerooms.

Image 45a – Source: by Author

Image 45b – Source: by Author

Image 45c – Source: by Author

Image 45d – Source: by Author

The facility has just been completed and serves as a primary example in the city of a bottom up approach design that aims at improving the informal sector. This links to the theories and concepts used by the study i.e. Social justice, right to the city, resilience, sustainable development and the formal/informal sector linkages. Complexity is achieved at a metaphoric level where Architecture is a generative system and a catalyst for urban change.

4.3 Case study 2 – Kennedy road informal settlements (ward 25)

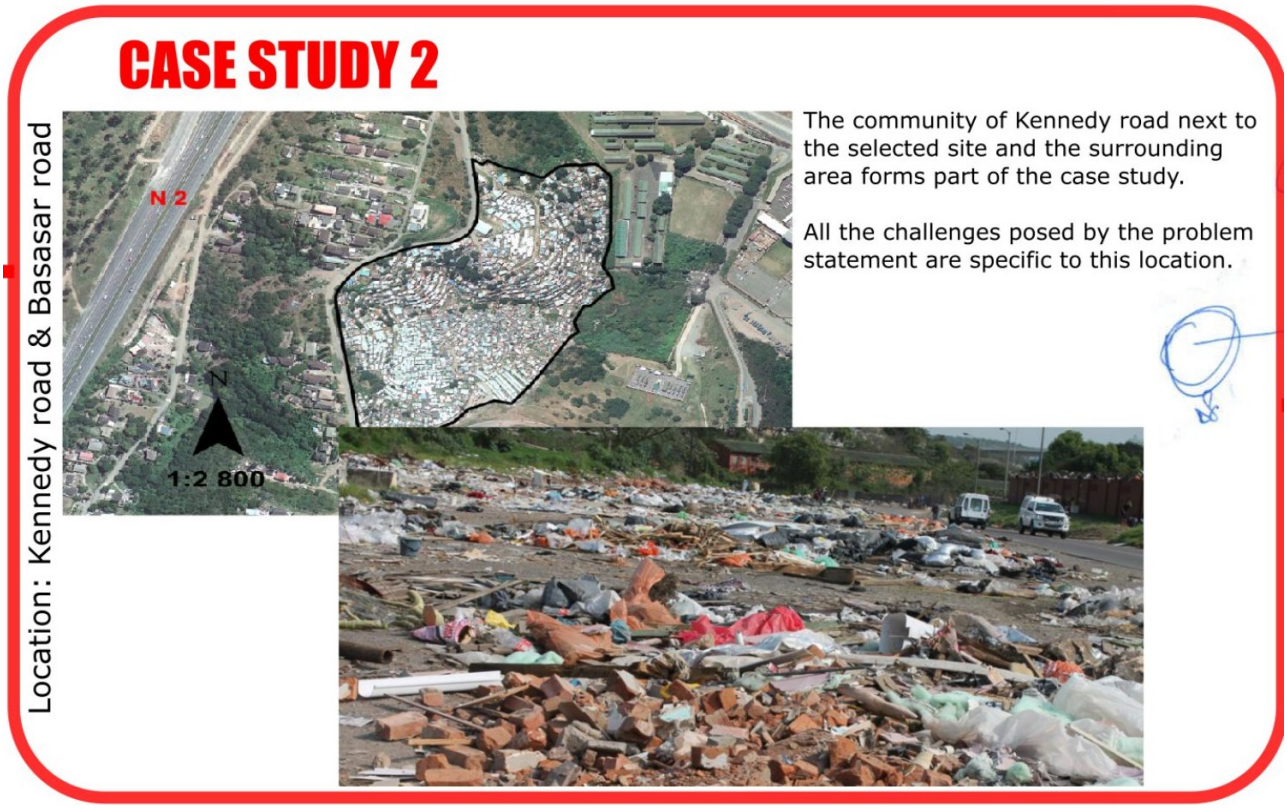


Image: 46 – Site Location & Perspective – Source: Mbonambi, Z. (2016)

The Kennedy road informal settlement is located next to the Bisasar road landfill. Similar to all the peri-urban poor informal communities, it is poverty stricken and lacks basic amenities. A combination of rapid urban migration and poor economic state has resulted in the emergence of these informal settlements mushrooming along the city's' edge. This informal settlement however shares a unique advantage to the other locations in the city, its location next to the landfill is one that is yet to be fully exploited. Although the landfill has been partially closed as it is reaching its end of life, it is precisely this that opens opportunities to look beyond the landfill by processing waste responsibly whilst strengthening the idea of the green economy.

Image: 46a – Source – eThekwini Municipality GIS maps

Image: 47 – Source – eThekwini Municipality GIS maps

The current issue of illegal dumping along Bisasar / Electron road has resulted in an environment that is unsafe and unhealthy, for the waste pickers and the community in general. The current surge in the number of waste pickers mostly emerging from this community, suggests that the people are becoming more aware of waste picking as a form of income. The corner of Bisasar and Electron road is constantly occupied by pickers along the road. This issue has caused conflict between the community and the city authorities as the Municipality seeks to curb the issue of illegal dumping. However, what is a problem for the city, is seen as an opportunity for the community who have turned to waste picking for their livelihood.

5. Chapter – Survey and Data Analysis

5.0 Introduction

Interviews conducted within the case study area of Bisasar road were mainly of waste collectors that occupy the side of the road daily. Due to constant tensions between these waste collectors and the police and city authorities, there is great mistrust towards anyone unfamiliar to them. The long history between the people of Kenedy road and the authorities has been a long and sensitive issue. Although the surveys mainly focused on the waste pickers on Bisasar road, they are mostly part of Kennedy road settlement as most of them reside there.

5.1 Survey Outcomes

The difference between pickers that work in this area and those in the CBD or other low-income settlements in the outskirts of the city e.g. Cato Manor area, is that pickers here are not specific to the type of recyclable materials they collect. This varies each day depending on what is available. They do however have preferences which are based on what is more profitable. When asked which materials they preferred the most, there was a general preference for Steel and copper as the most profitable, then followed by cardboard and glass, then plastics. The interesting comment and observation were that they also collect trash that is re-usable and clean it and repair it if broken, then either sell it to the community or utilize it themselves. An example of this is building materials, either an old door or window frame can be salvaged and sold or utilized by the picker.

The noticeable change recently has been the concrete barriers that on the edge of the road placed by the city council as a preventative mechanism for illegal dumpers and for garbage encroaching onto the road. However, this has had no effect on the illegal dumping or the pickers. There are constant fires burning and thick smoke engulf the area daily as pickers burn some materials to release their contents e.g. tires and electric cables to obtain steel and copper. There is a reasonable presence of female pickers, out of five interviewees two of them were female. When asked if this was a safe environment to

work in, they both agreed it was not. However, they also stressed that there was not much choice as they could not find any formal employment and they were sole breadwinners at their homes.

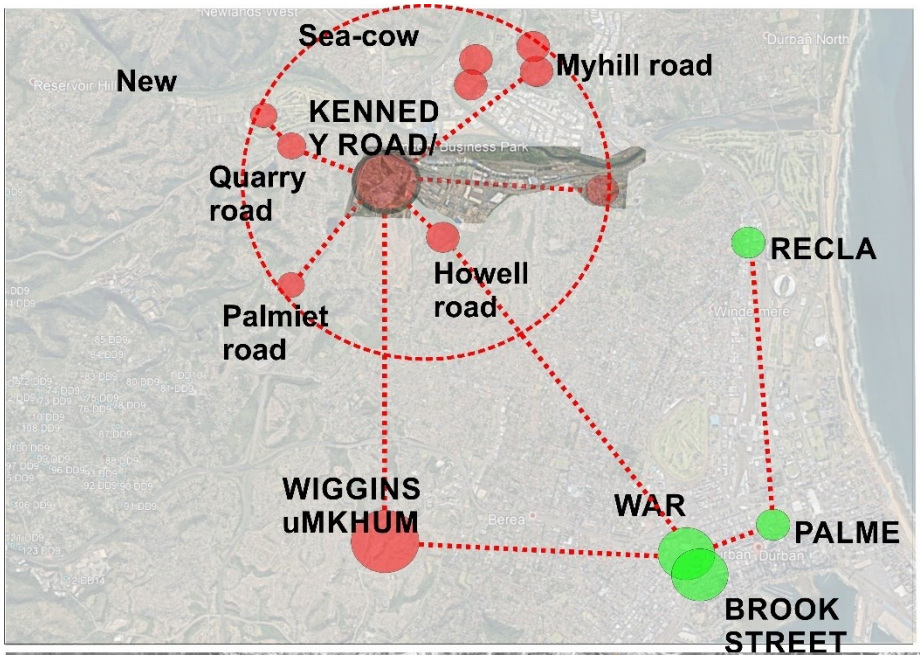
When asked whether they belonged to any form of organization or co-operatives with other pickers, none of them replied yes. The only form of organization mentioned was a community solidarity organization called 'Abahlali baseMjondolo' which means Shack dwellers. There is a long history of conflict between this community of Kennedy road and the authorities and the unsavory relationship between waste pickers and the police and authorities was also a visible one as they spoke of their challenges.

The other main issue was taking the recyclable materials to buy-back centers as they are mostly located in the inner city and far to walk. They end up not picking some materials and only pick what they can sell to the nearest buy-back than to pick multiple recyclables and must travel longer distances to sell them. When asked whether they know of terms like 'global warming' or 'sustainability', none of them had an idea and only knew of recycling for generating income. Although they all complained about what they 'get' from buy-back centers (the selling price), which fluctuates depending on the buy-back center or the person they are dealing with in that center.

The presence of municipal security force presented an unease feeling amongst the pickers, although they don't interfere with their activities, they are however seen as a problem by pickers, as their presence deters dumping, which means little or no income for them.

Chapter 6 – Conclusions and Recommendations

The issue of exclusion of exclusion of the poor within the city has been a constant throughout the study. The mushrooming of informal settlements on the outskirts of the city is clear evidence of the social ills facing the city. The study is proposing locating and connecting these informal settlements, using Architecture and recycling as a generative element.

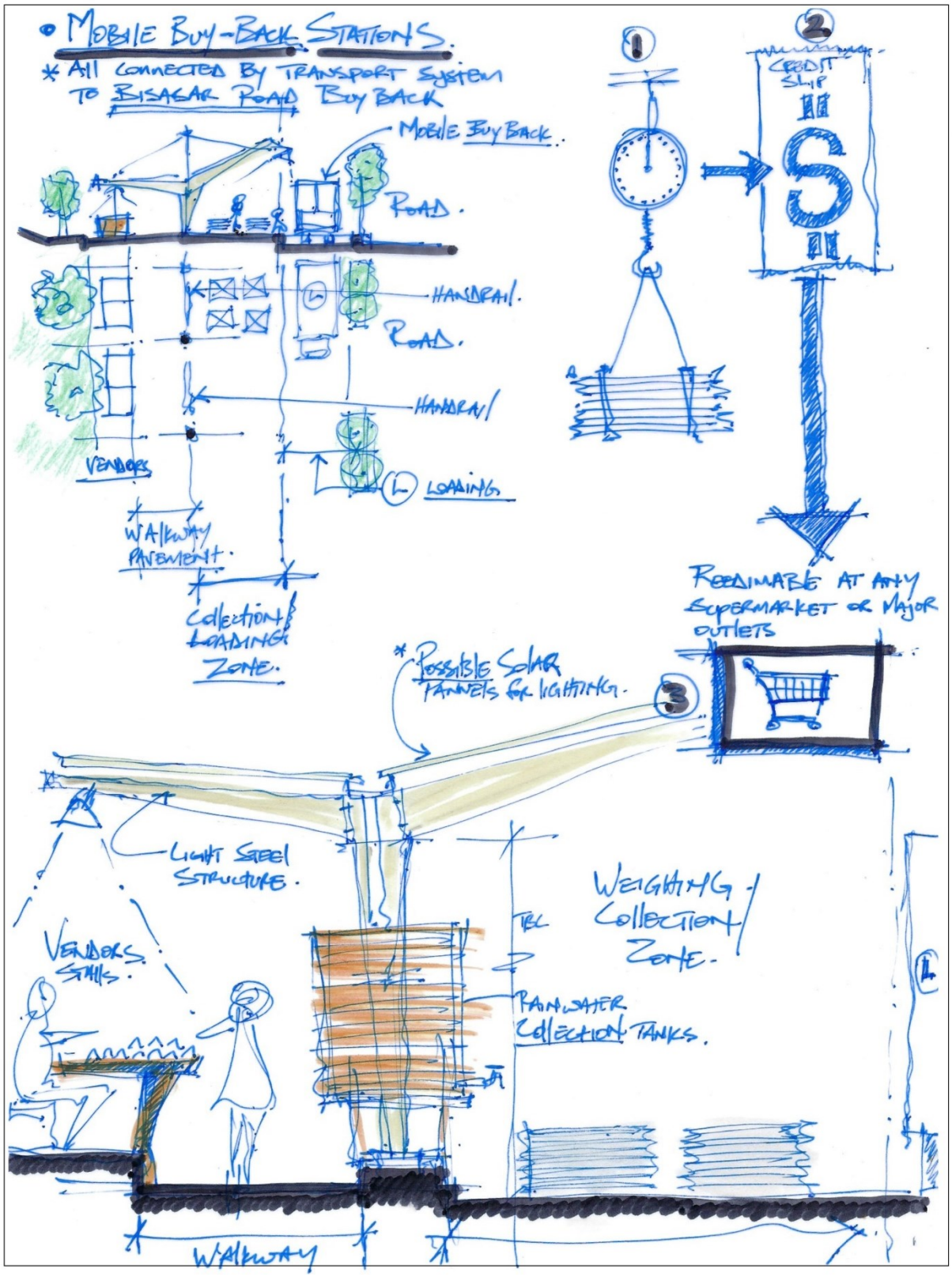


Urban Approach

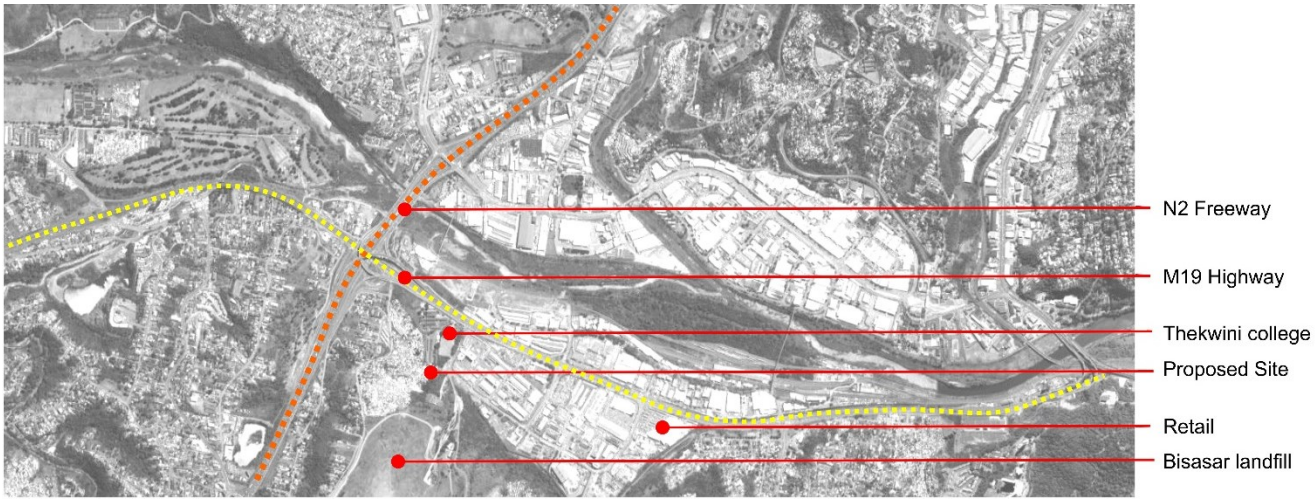
The design concept connectivity and linkages translates at an Urban scale, connecting all the other informal settlements at the periphery of the city and converging into a central universal recycling collection centre.
The study proposes a buy back transportation system that collects recyclable materials from all the informal settlements at a reasonable fee and thus removing the middle man. These points of collection.

Road intervention
The study proposes the changing of roads to accommodate pedestrians and bicycles. This is done to assist waste collectors pulling trolleys and with possible or projected growth, bicycle trailers which will make it easier for waste collectors to collect along the Springfield park area.

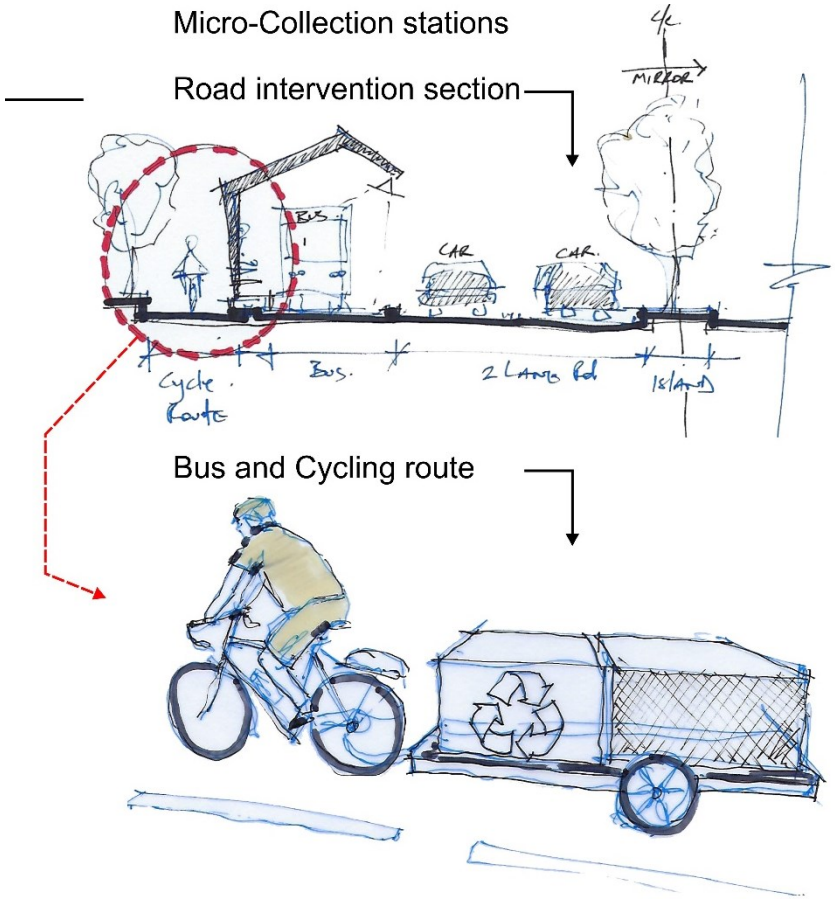
Although the study focuses on Kennedy road, consideration is taken to connect the other informal settlements within the CBD. The study used the nortion of 'convergence' to articulate the purpose and using the theories to support this notion. Transisioning from a macro to a micro scale, the study proposes interventions in all the other informal settlements and linking them to the main Bisasar collection center. A need for micro recycling collection centers where recyclables can be dropped off in exchange for either cash or vouchers became an apparent necessity during the study and surveys. The study proposed to use these as catalysts connecting to the main Bisasar collection center, in an attempt to address the issues raised with regards to social, economic and environmental issues that have been raised.



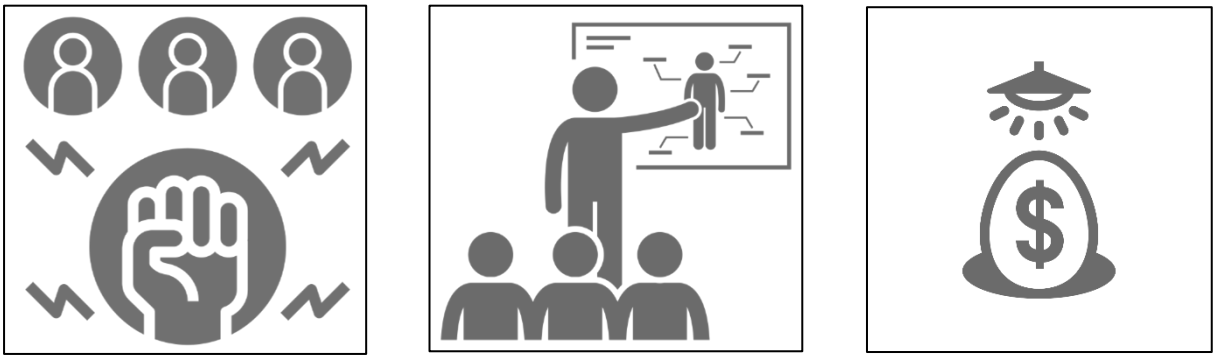
Sketch – By Author



Upon analyzing the case study and the surrounding precinct, various interventions were proposed. The proposal of amending the layout of the main highway to accommodate better public transport, but mostly, an introduction of bicycle lanes which can be used by wastepickers currently using trolleys as a form of transporting their recyclable materials. The study projects future growth through government whereby waste pickers are developed into micro businesses and use better forms of transportation e.g. bicycles etc.



The surveillance approach applied by the municipality does curb illegal dumping, however, a more permanent sustainable intervention as proposed by the study is a real necessity to create future sustainable urban environment.



1. Empower the waste-pickers
2. Educate the community
3. Business incubation

5. Policy to accommodate Waste-pickers in landfills
6. Implement the Green Economy
7. Promote sustainable urban living

Figure 48 - Icons Above – Source: thenounproject.com

A change in waste management policies to accommodate operation of waste pickers inside landfills is necessary. In this case, since the landfill is nearing its end of life, it is necessary to introduce and alternative that acts as a waste transfer point thus still allowing waste to pass through but reducing the amount of waste that proceeds to other landfills. Achieving this environmental milestone assists in the other milestones as mentioned in the beginning of the study i.e. Economic and social challenges. Education plays a vital role in the emancipation of these poor, currently excluded communities empowering them with the necessary knowledge and skills to make a living whilst protecting the environment.

A central waste processing / collection plant that accommodates all waste types and acts as a community education hub that connects with all the other informal settlements in an urban design scale.

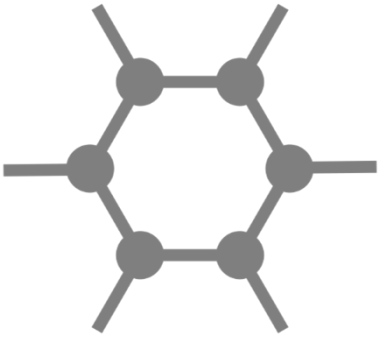


Figure 49 - Connect informal settlements – Source: thenounproject.com

A building that accommodates the community by including facilities vitally needed as a support system.

Urban farming on Roof gardens

Day care facilities

Public ablutions facilities

Feeding schemes soup kitchen

Figure 50 - Icons Above – Source: thenounproject.com

The primary purpose of the structure is recycling collection, office and education facility. It is therefore vital that the structure represents its core function. A sustainable building i.e. a self-sustaining building with the use of solar power, rainwater collection, sustainable or recycled building materials and passive cooling strategies.

7 Chapter – Design Report

7.1 Theoretical framework

The study takes on a view that the built environment & the architect cannot be separated from the Social, Economic and Environmental issues, and thus play a pivotal and central role in the convergence of these complex issues that frame the urban setting.

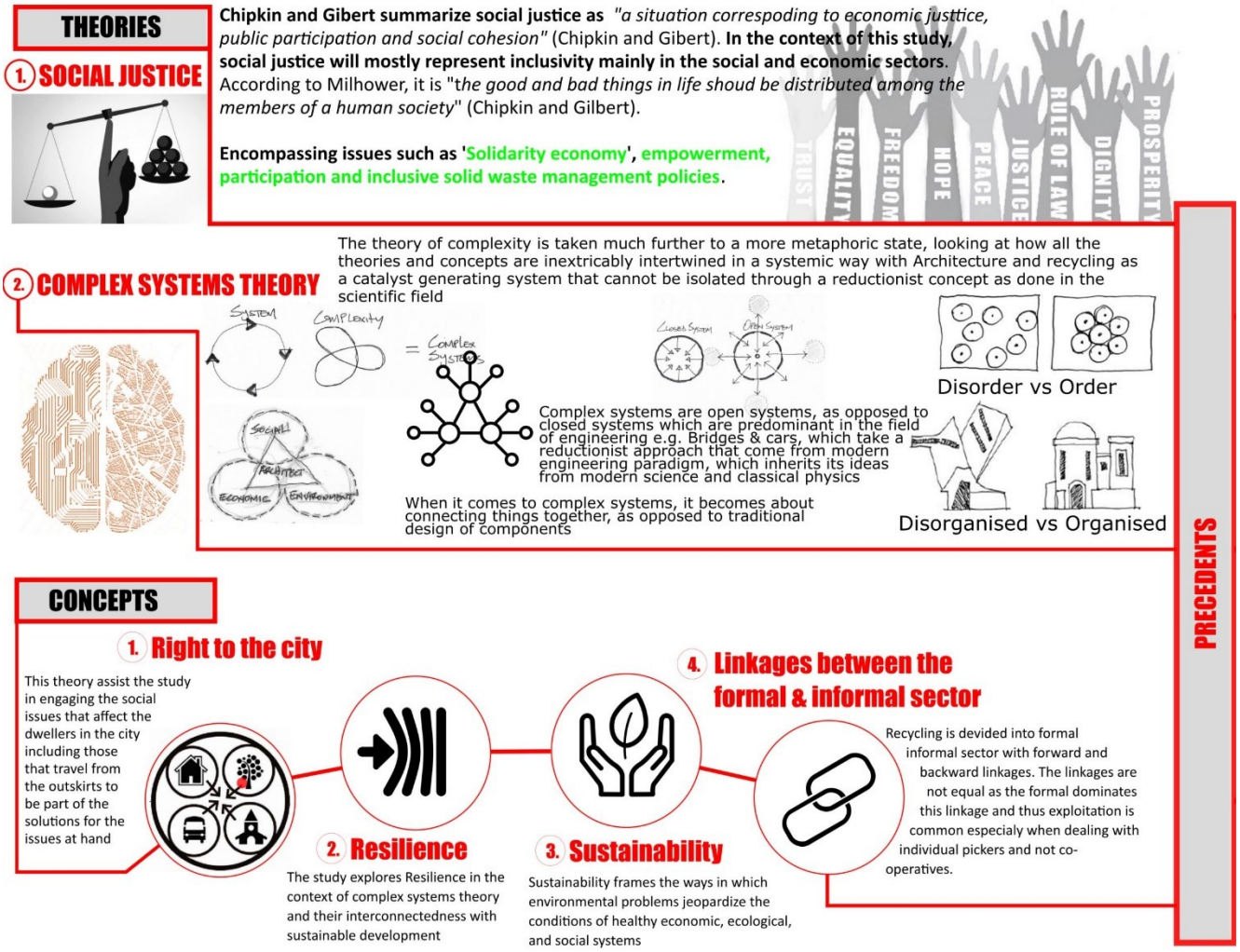


Image 48 (Mock jury) – source: by Author (2019)

7.1.1 Social Justice

The social challenges facing the current waste pickers in Bisasar road and the neighboring community in the informal settlements raise the question of social and economic justice for the urban poor. The selection of the theory of social justice was aimed to encompass both these issues currently facing the city.

7.1.2 Complexity theory

The nature of the problem is multifaceted and complex; the metaphoric use of Complexity theory seeks to address the problem in a systemic manner. The idea that urban issues are complex and thus each element cannot be isolated as done in scientific reductionist approach. However, complexity theory is mainly approached from an architectural perspective, with the works of Alexander and Salingaros reviewed as a design approach. The idea to re-embody complexity into design instead of simplistic, minimalist design celebrated by the modernist and post-modernist era is discussed.

The conceptual framework is framed by 'the right to the city, resilience, sustainable development and linkages between the formal and informal sectors.

7.1.3 The right to the city

A term coined by Henri Lefebvre, this theory explores issues of access and inclusion in urban settlements and the study draws from different perspectives and views in the understanding and meaning of the term and theory at an international scale and focusing on the local context.

Resilience – in the context of the study, this concept plays a major role as it frames the main theory of complexity and sustainable developments as it assists in risk assessment in the current volatile state of environmental collapse, unstable weather and economic conditions.

7.2 Problem:

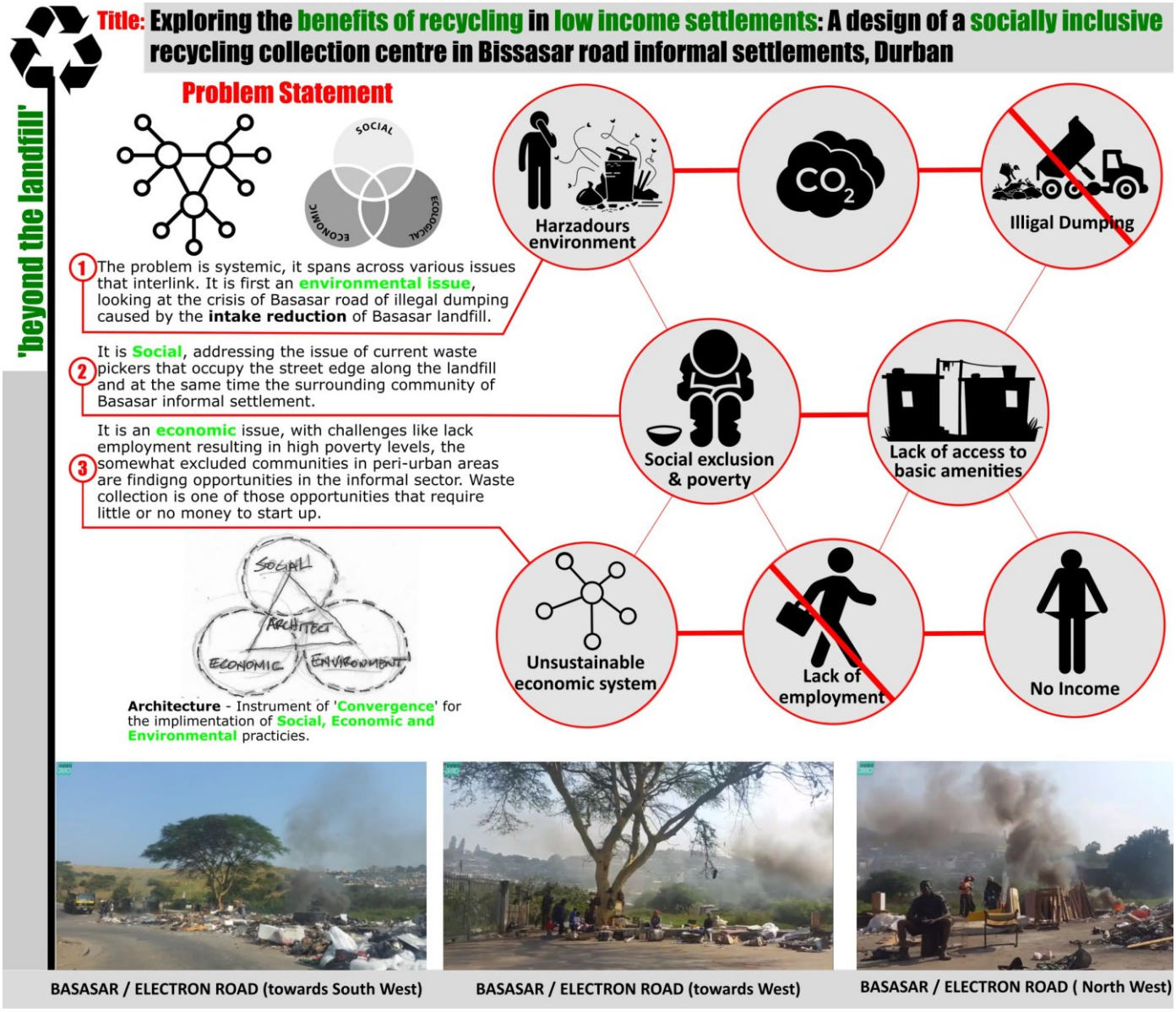


Image 49 – by Author (Mock jury)

What & where? - The intake reduction of Bisasar landfill has resulted in chaotic unmanageable situation along Bisasar and Electron Road. This has prompted the need to think of waste management beyond the landfill and the role Architecture can play in recycling, economic development and environmental management. Bisasar road has become a problematic issue as illegal dumping outside of the landfill has also fuelled a growing number of waste collectors that gather daily along this road in search for recyclable materials. The road itself has been reduced to one lane road due to mounds of

waste being dumped along this road. The poorer communities along this area survive on waste collection as means of living,

these waste collectors risk their lives daily working under hazardous conditions. The need for a more controlled environment that can deal with the issue through recycling whilst addressing the economic shortfalls of these communities is a necessary intervention. The built environment plays a central role in the integration of the social, economic and environmental challenges that are facing these communities on the outskirts of the city that are somewhat excluded.

Why? – A combination of issues that are systematic that also require a systematic approach (see fig. 00). Social Injustice for the urban poor in peri-urban areas, the economic challenges that they face, the challenging environmental issues that have resulted in the closure or reduction intake of the landfill and the consideration of 'life beyond the landfill' in general.

Who? – As mentioned above, the focus in on the waste pickers currently operating along Bisasar road and excluded poor communities in peri-urban areas, more specifically informal settlements around the Bisasar road Landfill.

7.3 Site Selection and analysis

The study focused on residential area Bisasar road informal settlements and the Bisasar road landfill. The process on selection of the site is very specific to the problem area or location of the study. The study area is located in Kennedy Road informal settlement area, opposite Clare Water Estate, in Durban, Kwa-Zulu Natal (29°48'41.37"S 30°58'46.71"E). The Bisasar road settlement and the location of where the illegal dumping is occurring is located between the municipal land-fill site and Thekwini college Springfield campus, Umgeni Road.

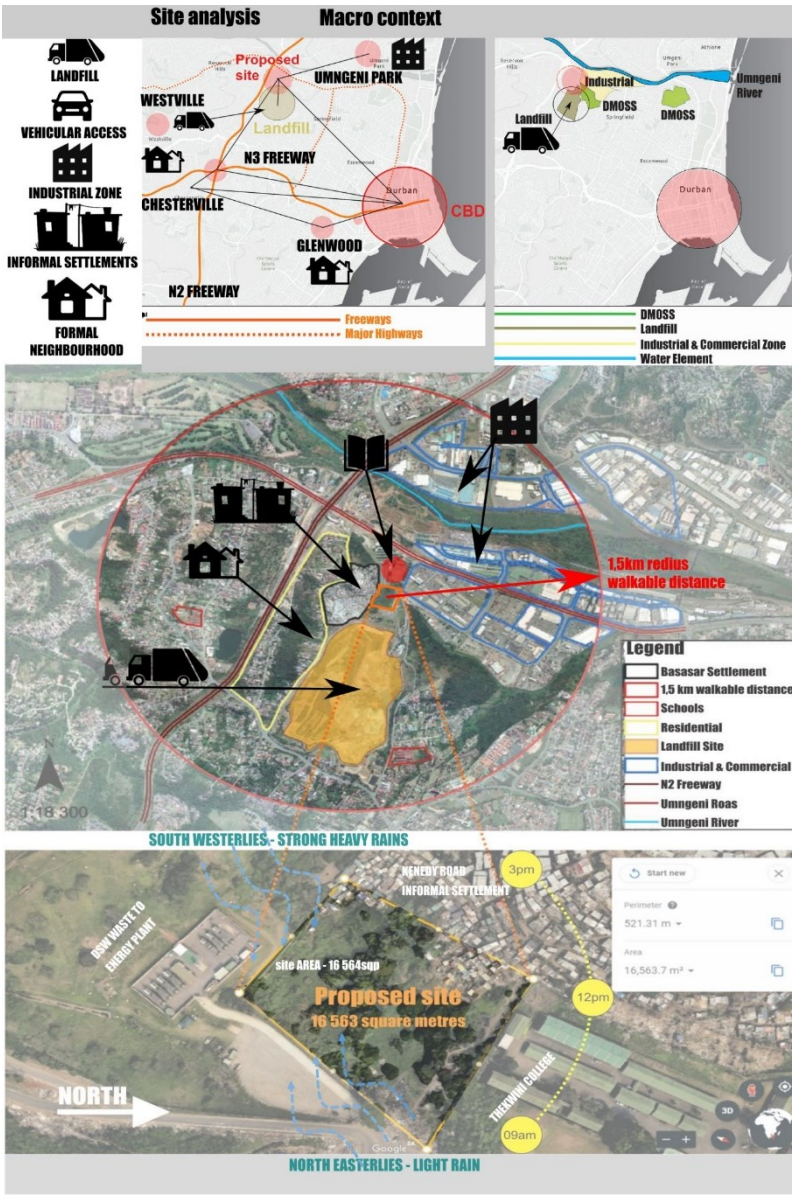


Image 50 (Mock jury) – Source: Mbonambi, Z. (2016)

The selection of the site was based on the following:

7.3.1 Urban / context Relationships

The selected site is located on the perimeter of the city, within an industrial zone. The 1,5km walkable radius covers most of the Springfield industrial zone. This creates an opportunity for the rest of Springfield park which is not fully explored by informal waste pickers. The site is located between three different zones i.e. Landfill, protected DMOSS, residential and industrial zone (Springfield park). Its proximity to the current landfill is most ideal as it seeks to promote 'life beyond landfills' in a form of a more sustainable alternative.

7.3.2 Site Location and site information

Proximity to the study area which is the problem area made the site ideal to achieve the objectives of the study. The open space between the landfill and the community serves as a link that can address all the issues raised (social, economic and environmental issues).

7.3.3 Pedestrian access

The site is ideally close to main transport highway and is linked to the existing informal settlements through informal pathways. Bus and taxi stops are within 200 meters and link to the site via Bisasar road cul-de-sac. A train station is within 2 km from the site providing a cheaper form of transportation that links to the proposed site.

7.3.4 Vehicular access

The site is close to the main highway (Umngeni road) and freeways (N2) and is connected via Supply road from Umngeni road which then leads to Electron.

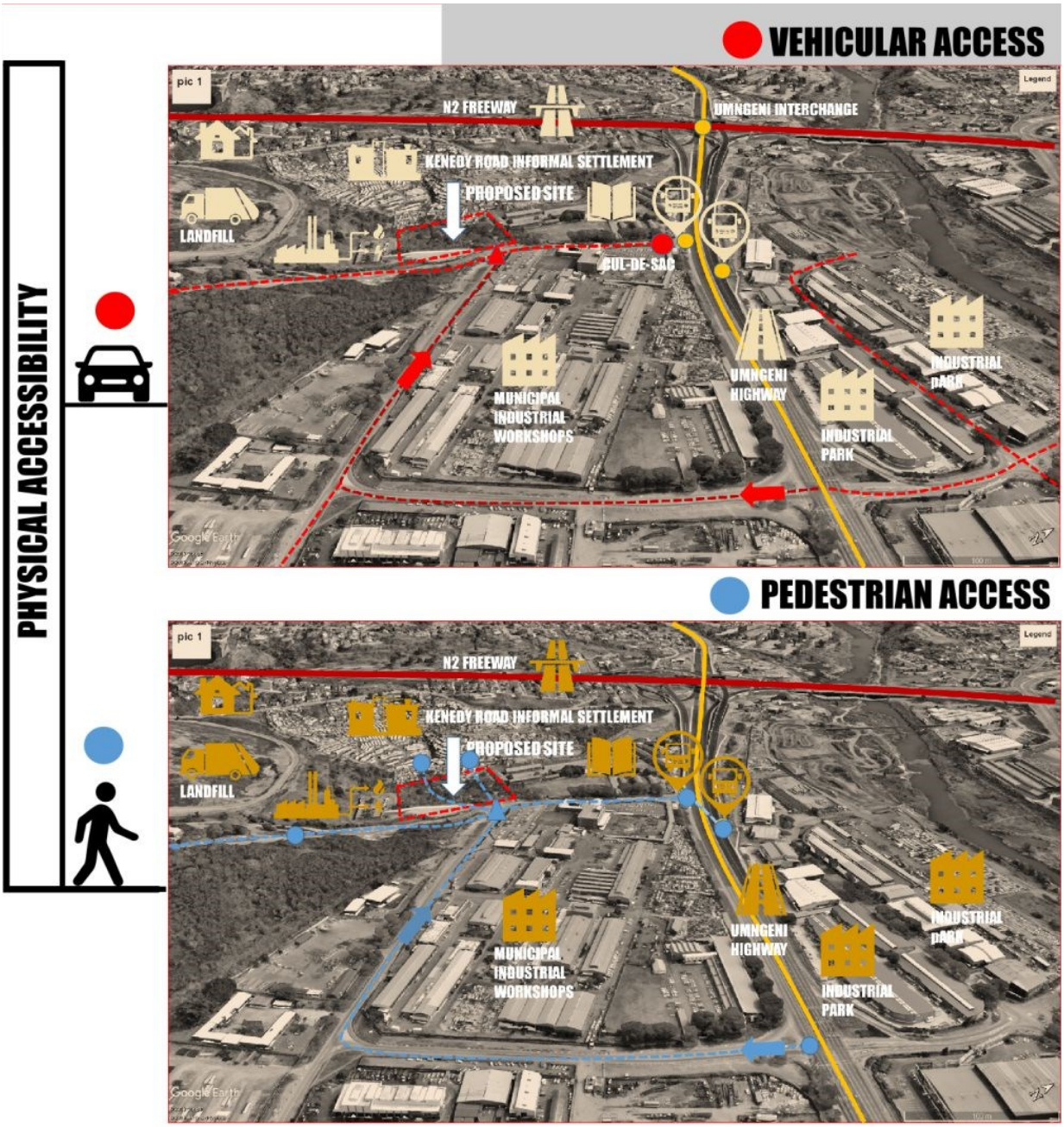


Image 51 (Mock jury) – source: by Author - (2019)

7.4 Design brief & project requirements

A partnership between the DSW, Department of Environmental affairs and the private sector (formal recyclers), funded by the world bank as part of their finance programs that support the sustainable development goals. The World bank SDG fund supports innovative initiatives in an attempt to achieve the 2030 agenda thus equipping countries with tools and best practices to achieve their sustainable development objectives ahead of 2030.

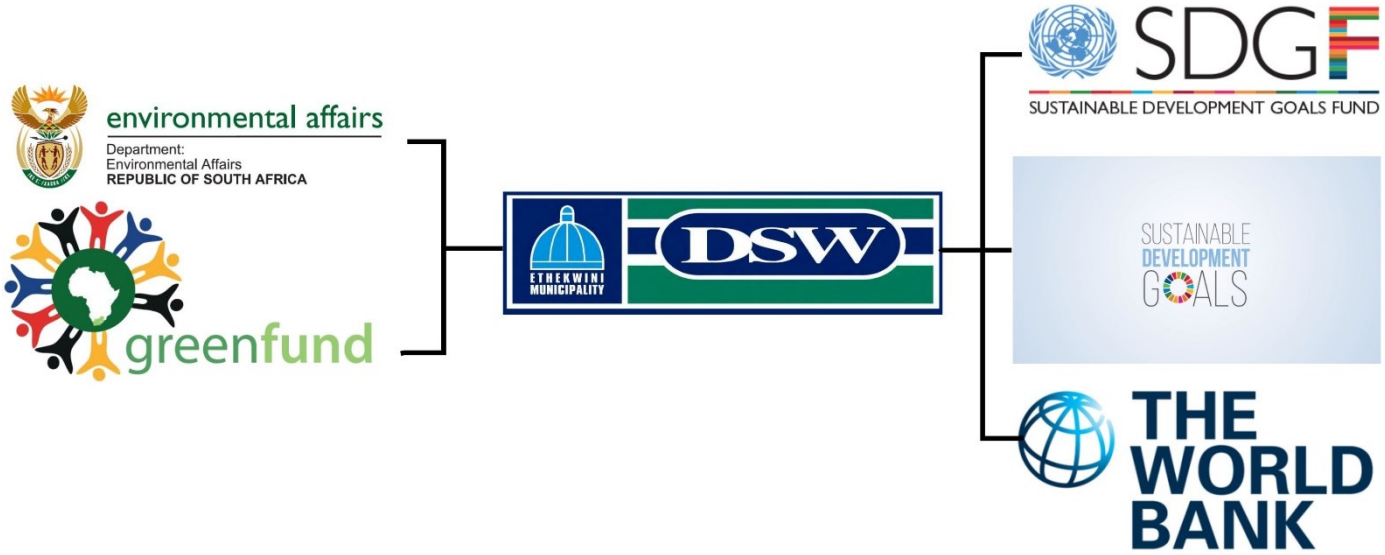


Image 52 - Source: by Author (2019)

DSW in association with waste pickers co-operatives and community associations are to administer the daily running of the center. Possible funders as listed above set to be the main investors in the project in line with promoting the sustainable development goals with the Green Economy as the focus.

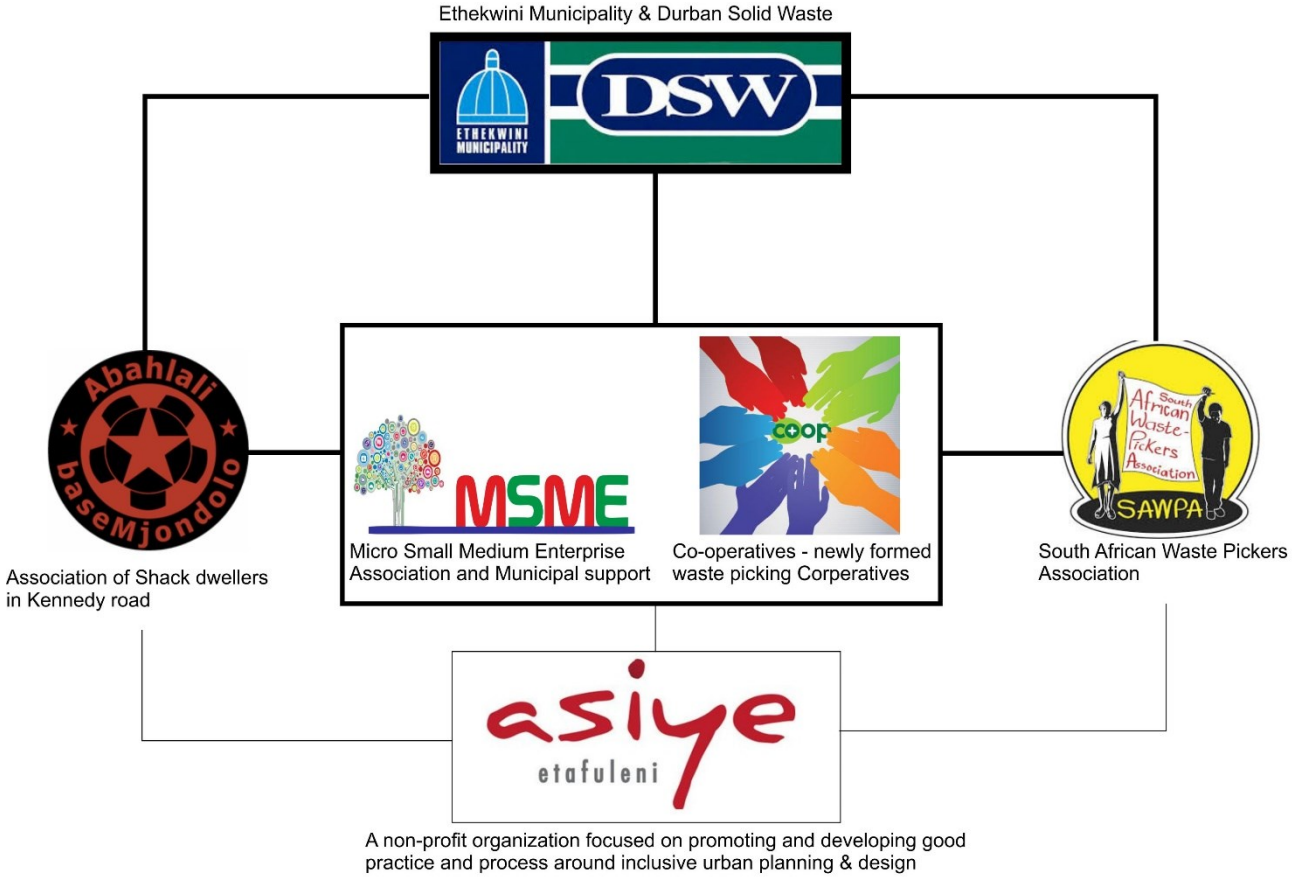


Image 53 - Source: by Author (2019)

The stakeholders are as shown above, project initiation by Ethekwini municipality and administration of the collection center by DSW in partnership with MSME's and co-operatives. Organizations like 'Abahlali basemjondolo', SAWPA and Asiye Etafuleni in partnership to constantly ensure inclusivity and participation of the community.

7.5 The brief

The design on an inclusive recycling collection centre in Basasar road addressing various issues that plague this location. The structure is to accommodate existing informal collectors that currently occupy the side of the road thus formalizing their work environment ultimately providing employment and a safe & healthy work environment. The proposal seeks to address the current challenge of illegal dumping due to partial closure of the Bisasar landfill. The idea is to minimize the amount of waste that will eventually be transferred to landfills that are still operational. The involvement of the community is of main priority and thus an educational centre is to form a substantial part of the structure. This will accommodate public learning centres on recycling, business training and incubation, workshops, weekly markets, urban roof farming and social feeding schemes. The educational part of the building in partnership with the neighboring Ethekwini college are to embark on a joint initiative to advance education within the poor communities in the area. The structure seeks to be a catalyst for change in social, economic and environmental aspects, thus promoting sustainable development of the currently excluded urban poor communities.

The Architecture plays a central generative role, the purpose being to create responsive architectural design and dynamic spaces that are accessible and linked to promote awareness, learning and income opportunities thus creating smart communities.

The emphasis is on the users, as Bodart notes *"users are central to determination of qualities in sustainable buildings of the future"* (Bodart, Evrard – 2011).

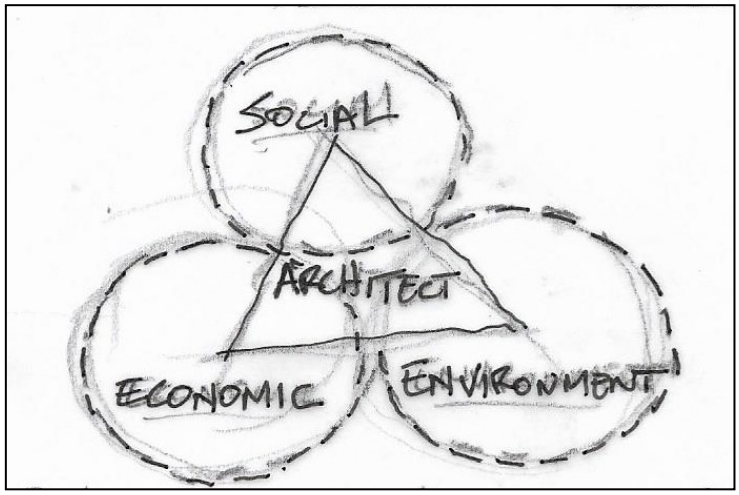
Materials used in the design are to reflect the primary purpose of the building (recycling) utilizing mostly recycled or recyclable materials and greening of urban structures portrayed in a form of green roofs and green walls. Standard sustainable green building elements are to be incorporated i.e. rainwater collection tanks, solar panels and passive cooling strategies that promote less use of mechanical equipment.

The use of materials, space, light, transition between functions and landscape as the main architectural qualities that promote spatial and social interaction in order to create responsive quality architecture.

7.6 Proposed Design (Mock jury)

7.6.1 Design concept and principles

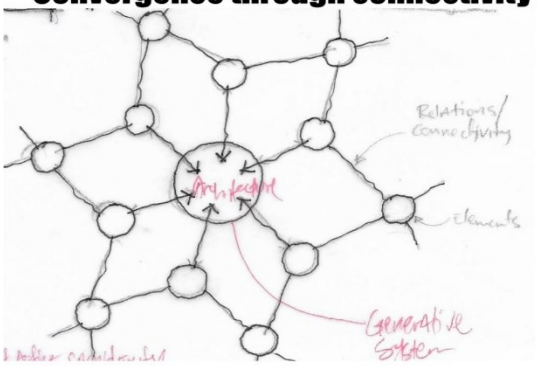
Convergence through connectivity and linkages, metaphorically describing convergence of the main three elements in the study i.e. social, economic and environmental aspects with architecture as the generative element in a system.

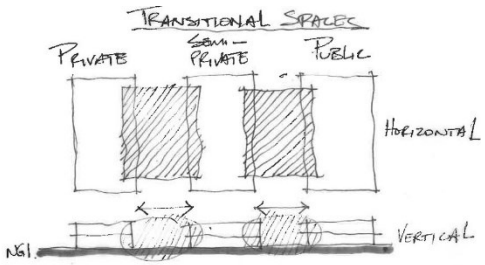


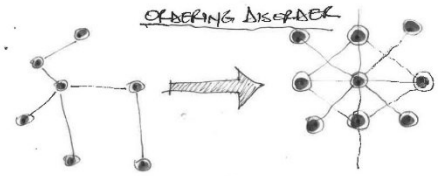
Connectivity is one of the primary parameters that define complexity, it is what and how these elements are connected that define the nature of space.

This is firstly achieved from an accessibility level, the relationship between private, semi-private and public spaces. These spaces

"Convergence through connectivity and linkages"







- **"connectivity - one of the main parametres that define complexity "**
- **It is how and what elements are connected that define the nature of 'space'**

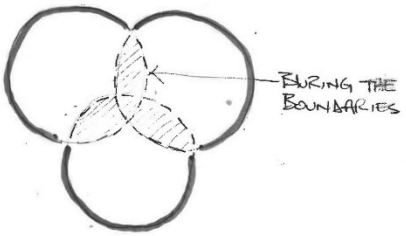
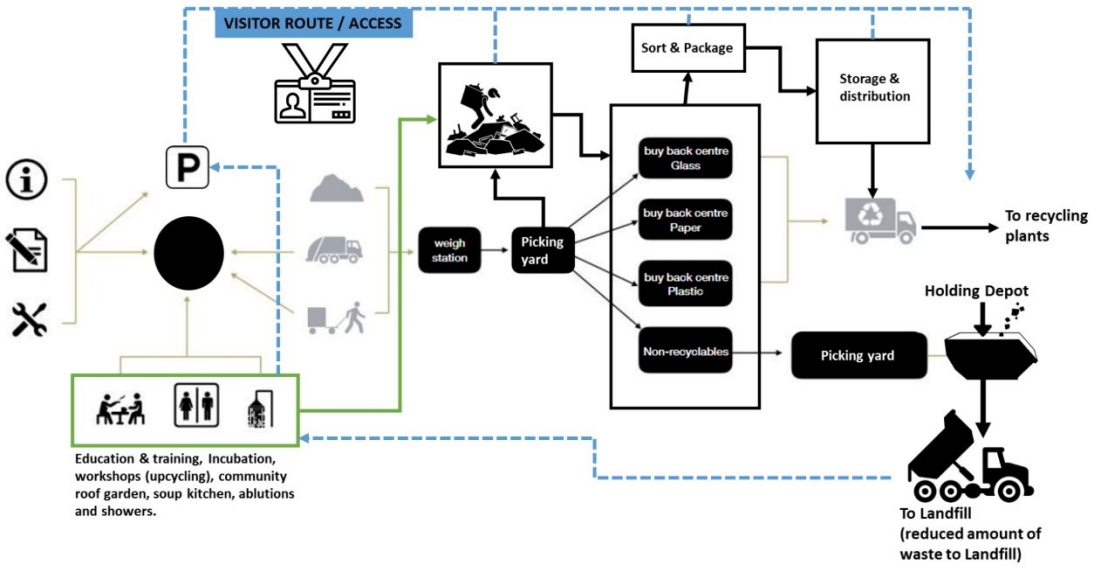
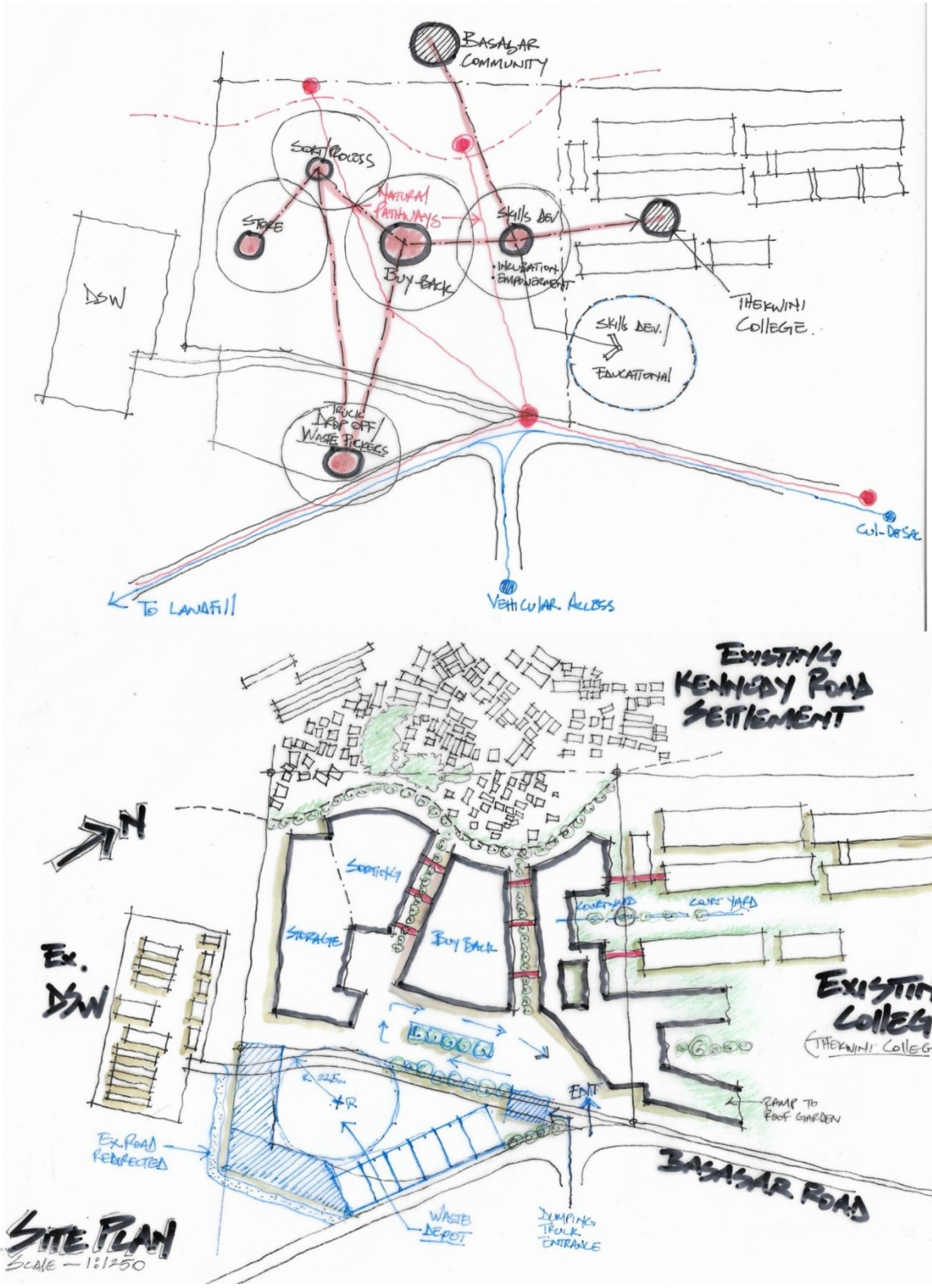


Diagram layout

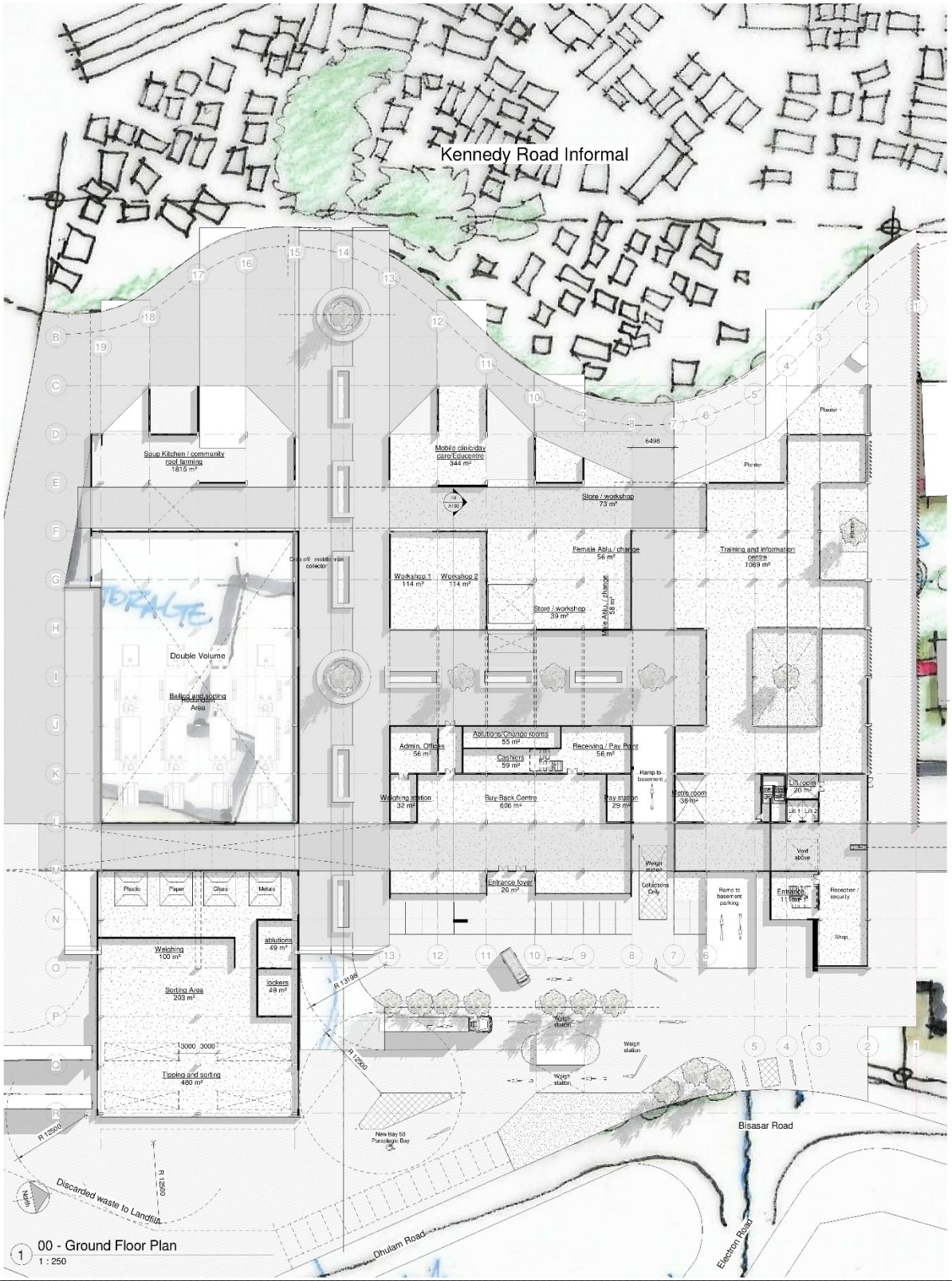
A partnership between government (DSW) and the private Investor, in a bid to improbe the current conditions face by informal waste pickers around Basasar Landfill and the surrounding settlements where they reside.



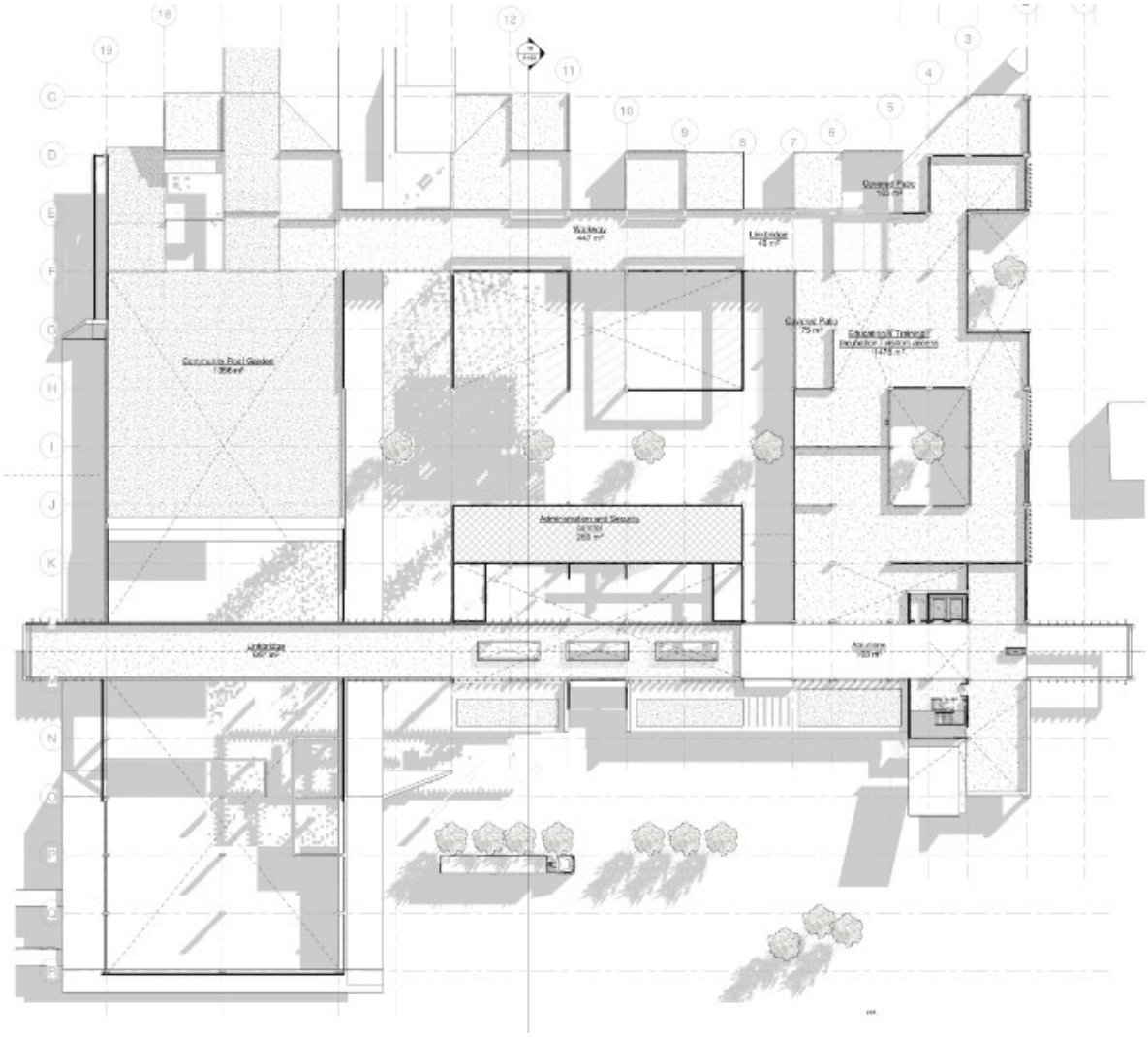
7.6.2 Design development Sketches



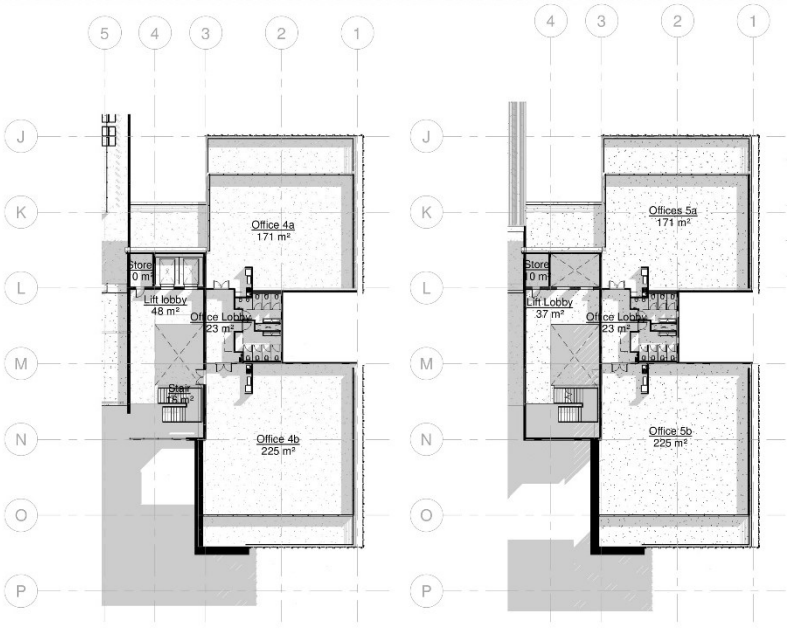
7.6.3 Proposed Design



Ground Floor Level



First Floor Level



3 04 - Fourth Floor Plan
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2 05 - Fifth Floor Plan
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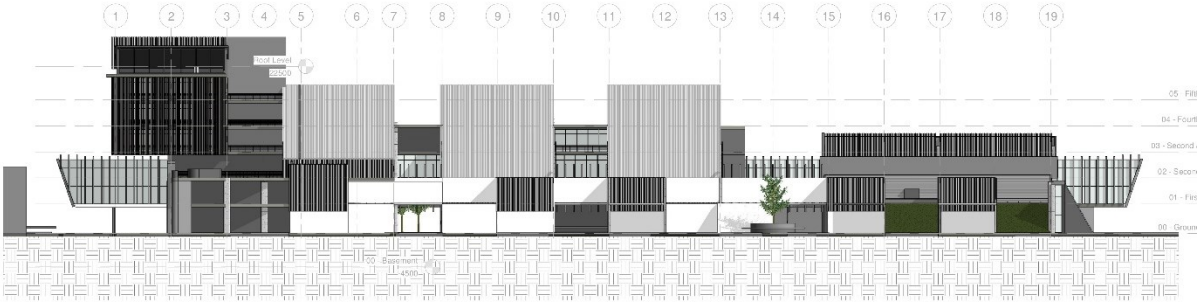
2
1
R Q P O N M L K J I H G F E D C B A
A B C D E F G H I J K L M N O P Q R
oor Plan


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

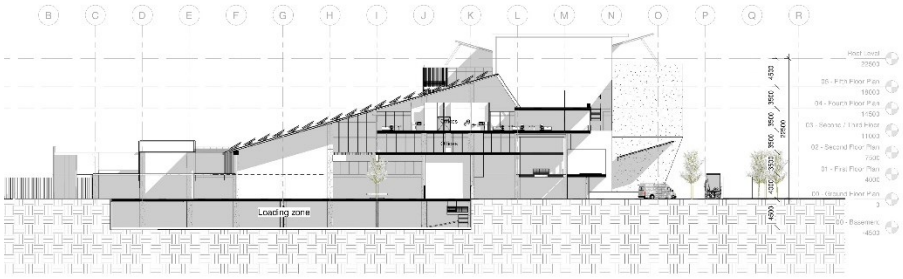

19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

Area Legend

- ablutions
- Ablutions/Change rooms
- Admin. Offices
- Area
- Bailing and sorting
- Bale Storage / collection Point
- Buy-Back Centre
- Cashiers
- Entrance
- Entrance foyer
- Femal Ablu. / change
- Female Ablu./ change
- Information, admin. & community centre
- Lift room
- lockers
- Male Ablu. / change
- Male Ablu./ change
- Mech.
- Metre room
- Multi-purpose Community Hall
- Pay station
- Receiving / Pay Point
- Storage / Lockers
- Storage Lockers 1
- Store / Workshop
- Store / workshop
- Tipping and sorting
- Weighing station
- Workshop/workspace

Area Schedule (Rentable)		
Level	Name	Area
Not Placed		
Not Placed	Area	Not Placed
Not Placed: 1		0 m²
00 - Ground Floor Plan		
00 - Ground Floor Plan	Information, admin. & community centre	1364 m²
00 - Ground Floor Plan	Entrance	91 m²
00 - Ground Floor Plan	Area	184 m²
00 - Ground Floor Plan	Bale Storage / collection Point	2318 m²
00 - Ground Floor Plan	Ablutions/Change rooms	55 m²
00 - Ground Floor Plan	Tipping and sorting	1050 m²
00 - Ground Floor Plan	Cashiers	59 m²
00 - Ground Floor Plan	Receiving / Pay Point	56 m²
00 - Ground Floor Plan	Admin. Offices	56 m²
00 - Ground Floor Plan	Weighing station	32 m²
00 - Ground Floor Plan	Male Ablu. / change	58 m²
00 - Ground Floor Plan	Female Ablu./ change	56 m²
00 - Ground Floor Plan	Store / workshop	73 m²
00 - Ground Floor Plan	Store / workshop	39 m²
00 - Ground Floor Plan	Store / Workshop	77 m²
00 - Ground Floor Plan	Male Ablu./ change	68 m²
00 - Ground Floor Plan	Femal Ablu. / change	68 m²
00 - Ground Floor Plan	Entrance foyer	45 m²
00 - Ground Floor Plan	Buy-Back Centre	522 m²
00 - Ground Floor Plan	Multi-purpose Community Hall	632 m²
00 - Ground Floor Plan	Storage Lockers 1	133 m²
00 - Ground Floor Plan	Workshop/workspace	133 m²
00 - Ground Floor Plan	Workshop/workspace	126 m²
00 - Ground Floor Plan	Storage / Lockers	117 m²
00 - Ground Floor Plan	Lift room	20 m²
00 - Ground Floor Plan	Mech.	37 m²
00 - Ground Floor Plan	Metre room	39 m²

Area Schedule (Rentable)		
Level	Name	Area
00 - Ground Floor Plan	Bailing and sorting	1121 m²
00 - Ground Floor Plan	ablutions	59 m²
00 - Ground Floor Plan	lockers	59 m²
00 - Ground Floor Plan	Pay station	29 m²
00 - Ground Floor Plan: 31		8777 m²
01 - First Floor Plan		
01 - First Floor Plan	Education & Training / Incubation / visitors access	1476 m²
01 - First Floor Plan	Linkbridge	697 m²
01 - First Floor Plan	Linkbridge	49 m²
01 - First Floor Plan	Walkway	786 m²
01 - First Floor Plan	Administration and Security control	286 m²
01 - First Floor Plan	Covered Patio	75 m²
01 - First Floor Plan	Covered Patio	163 m²
01 - First Floor Plan	Ablutions	103 m²
01 - First Floor Plan: 8		3635 m²
02 - Second Floor Plan		
02 - Second Floor Plan	Offices / DSW / Co-operatives	1666 m²
02 - Second Floor Plan: 1		1666 m²
03 - Third Floor Plan		
03 - Third Floor Plan	Offices / Municipality / Community participation	2221 m²
03 - Third Floor Plan: 1		2221 m²
04 - Fourth Floor Plan		
04 - Fourth Floor Plan	Offices / Municipality / Community participation	Not Enclosed
04 - Fourth Floor Plan	Lobby	21 m²
04 - Fourth Floor Plan	Stair	16 m²
04 - Fourth Floor Plan: 3		37 m²
05 - Fifth Floor Plan		
05 - Fifth Floor Plan	Offices	556 m²
05 - Fifth Floor Plan	Store	10 m²
05 - Fifth Floor Plan: 2		566 m²
Grand total: 47		16903 m²



10 Section A - A
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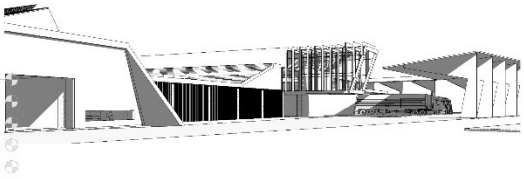
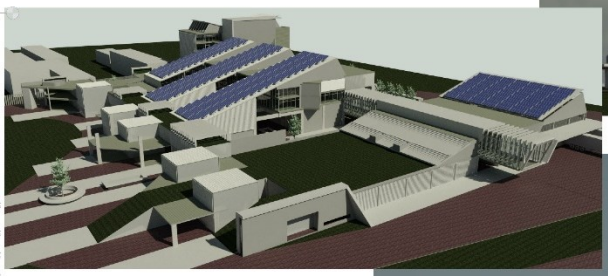
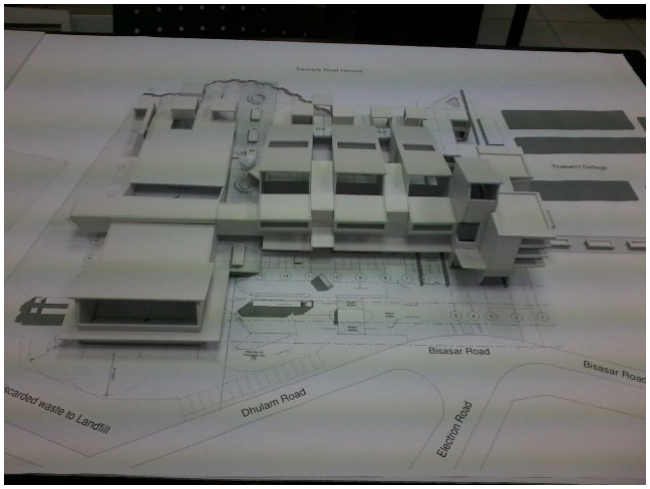
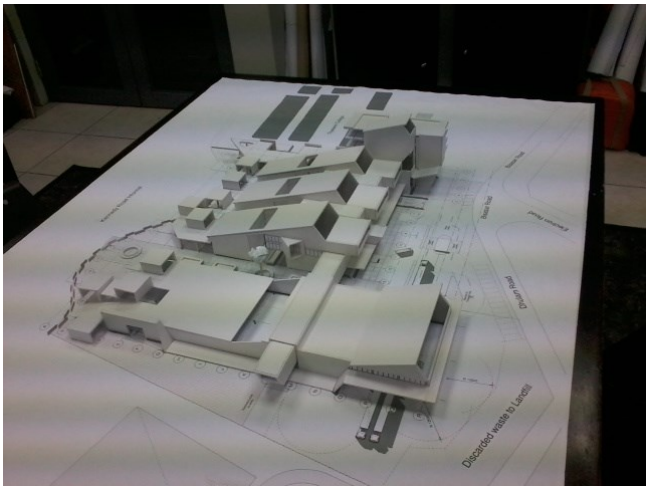
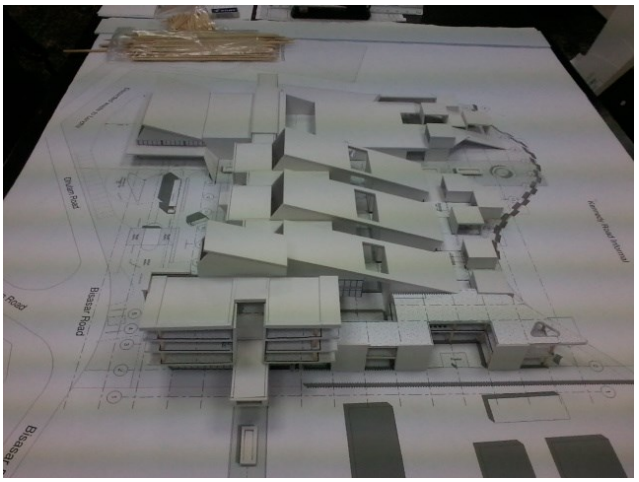


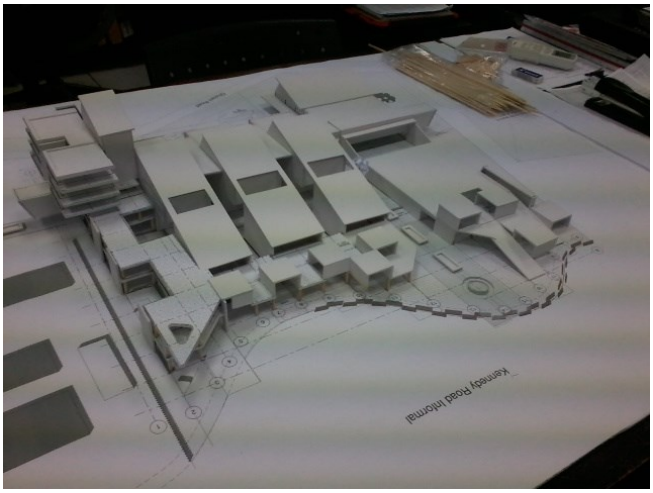


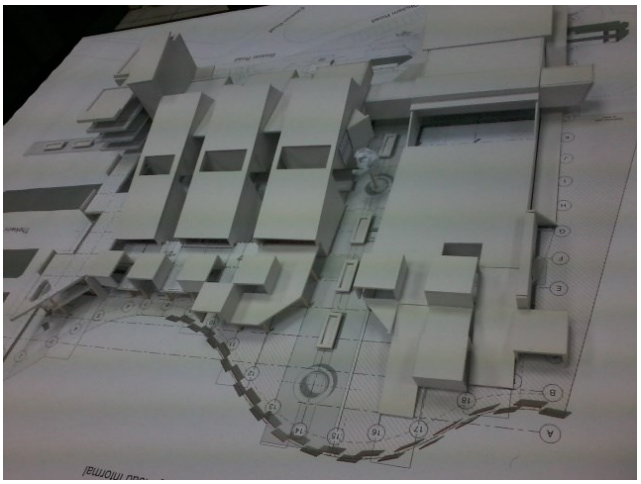

Electron Road
Dhulam Road
Bisasar Road
Thakwani College


Bisasar Road
Dhulam Road
Electron Road


Discarded waste to Landfill


Dhulam Road
Bisasar Road


Kennedy Road Inthormal



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