



MANGALISO MTETWA
12029280
M(PROF): DISSERTATION

Figure 1 (cover): Tomatoes (Allahverdiyev, 2017)

Figure 2 (cover): Vegetable Salad (Olson, 2019)

Figure 3 (cover): Assorted Vegetable Lot (Ehlers, 2018)

DIJO

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DIJO

**AN AGRI-PARK (AGRO-PROCESSING PLANT)
TO EMPOWER INFORMAL VENDORS VIA URBAN
AGRICULTURE TO ELLEVIATE UNEMPLOYMENT
AND FOOD INSECURITY IN MAMELODI WEST**

by

Mangaliso Mtetwa

Submitted in fulfilment of part
of the requirements for the degree
Master of Architecture (Professional)

in the

**Faculty of Engineering, Built Environment
and Information Technology**

University of Pretoria

November 2019

DECLARATION

In accordance with Regulation 4(c) of the General Regulations (G.57) for dissertations and theses, I declare that this thesis, which I hereby submit for the degree Master of Architecture (Professional) at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

I further state that no part of my thesis has already been, or is currently being, submitted for any such degree, diploma or other qualification.

I further declare that this thesis is substantially my own work. Where reference is made to the works of others, the extent to which that work has been used is indicated and fully acknowledged in the text and list of references.

[Mangaliso Mtetwa]



DIJO

AN AGRI-PARK (AGRO-PROCESSING PLANT) TO EMPOWER INFORMAL VENDORS VIA URBAN AGRICULTURE TO ELLEVIATE UNEMPLOYMENT AND FOOD INSECURITY IN MAMELODI WEST

This dissertation investigates the re-industrialisation of our townships by using urban agriculture as a design driver. With global issues such as food pricing and population growth, these issues have had an impact on food as a resource. The proposal provides a food hub in Mamelodi. The architectural exploration of the design aims to create a space which can act as a catalyst for economic growth in the Mamelodi West. The plan seeks to create a food production space which connects existing networks found in Mamelodi. The systems are informal markets and spaza shops located in the area. The design proposal will revitalise the township economy to alleviate the food insecurity issue and unemployment found in the area. DIJO aims to create a closed-loop cycle of food production, food processing and food consumption. Also, to create an architecture that can empower the people of Mamelodi by having facilities needed to be competitive and creating a thriving economy. The project aims to develop an integrated approach with regards to "agri-food system", food production, informal networks and distribution within a framework of socio-economic ecosystem integrity.

Keywords: *Apartheid Spatial Legacy, Agri-Parks, Mamelodi, Re-Industrialisation, Township economy, Regenerative Design*



PROJECT SUMMARY

DISSERTATION TITLE:

DIJO: An Agri-Park (Agro-Processing Plant) to Empower Informal Vendors via Urban Argiculture to Elleviate Unemployment and Food Insecurity in Mamelodi West.

TYPE OF BUILDING:

Agri-Park

ADDRESS:

Mamelodi 608-Jr. Tsamaya Ave
Mamelodi, Pretoria, 0122

GPS CO-ORDINATES:

25°43'08.0"S 28°21'28.3"E

RESEARCH FIELD:

Environmental Potential

CLIENT:

Department of Agriculture, Forestry
& Fisheries/Department of Economic Development

KEYWORDS:

Apartheid Spatial Legacy, Agri-Parks, Mamelodi, Re-Industrialisation, Township economy, Regenerative Design

THEORETICAL PREMISE:

An architecture that facilitates empowerment.



EXPRESSION OF THANKS

*To my parents namely Dikeledi Dorothy Mtetwa
and Benedict Muzikayise Mtetwa*

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Proofread by Mbali Sebokedi

The people who gave support during this journey

NAMES OF YEAR CO-ORDINATOR AND STUDY LEADER

Co-ordinator: Arthur Barker

Study Leader: Jan Hugo

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DIJO

[*di-30*] noun

Any substance consumed to provide nutritional support for the body; form of energy stored in chemical form.

CHAPTER 1

INTRODUCTION

"It is estimated that up to 12 million 24.5% of the South African population go to bed hungry each day" (Hosken, 2013). Food insecurity is a global issue that affects everyone in our global economy. If the issue of the food insecurity is tackled, this will alleviate two main issues namely food insecurity and unemployment. The intention of this dissertation is to create alternative ways in which architecture can be a catalyst of economic development and positive change in the township. This topic is relevant because the South African government is trying to find alternatives to stimulate township economies for poverty and food insecurity alleviation. *"Unless, the rate of economic growth increases, there is likely to be even greater dependence on natural resources such as raw materials, and increased use of production methods that create pollution and waste"* (DEAT, 1999)

The study area is Mamelodi West. The reason this study areas was chosen is because of the future economic potential of the area and the proximity with the industrial edge. Currently, the City of Tshwane Metropolitan Municipality has a population of 3 275 152. 69% are between the ages of 15 - 64 are unemployed (StatsSA, 2018). The site chosen is a desolate site opposite Solomon Mahlangu Square, a newly constructed mall called Tshwane Regional Mall as well as close to the informal market. There is also a railway on the Southern boundary. *"Growth in the agriculture sector has been found, on average, to be at least twice as effective in reducing poverty as growth in other sectors."* (Nifa.usda.gov, 2019). Figure 7 indicates the agri-food system, the proposal seeks to find alternatives ways of addressing the system so that people have access to fresh produce.

Figure 6: The Sun Sets over the Township of Mamelodi. (Nath, 2015)



Figure 7: Connecticut Food System Alliance. (Medium, 2019)

1.1. RESEARCH QUESTION

We all consume food. It is a fundamental "human right which is part of our basic needs." (Gov.za, 2017) Which leads to the research question; how can architecture by regenerating a desolate site change the current food network in Mamelodi West to alleviate the food insecurity and unemployment?

Research (Sub) Questions

- How can architecture regenerate a site undergoing urban decay?
- How does the food network in Mamelodi West function?
- How can architecture create infrastructure to empower the informal vendor and small-scale farmer?
- Can architecture create an industrial typology which can bring benefit to the community?

1.1.1. Hypothesis

Architecture can create an infrastructure to facilitate the change in the food network in Mamelodi via Urban Agriculture.

Research Methodology

Contextual Mapping

- Another way of seeing the building is a distribution plant. So mapping out all the spaza shops, informal in Mamelodi.

Literature Reviews

- A critical understanding of regenerative theory in order to understand the process of exploration fully. A literature review that illustrates how urban agriculture has an impact on society.

Comparative Studies

- Comparative studies of food interventions in the vicinity

Semi-Structured Interviews

- Interviewing community members, informal vendors and distributors

1.2. GENERAL ISSUE

The main issue facing our country now is unemployment and food insecurity. There is a myriad of factors that contribute to this crisis. The Pretoria East Rekord published an article called East unemployed youth needed (Selaluke, 2017), which clearly illustrates the plight of the youth of Mamelodi. In the article, the local councillors that started an NPO called Bantu Bonke said " many young people commit crime because they do not have anything better to do so we started the project to get employment for young people." (Selaluke, 2017).

One of the solutions is the re-industrialisation of townships which can trigger economic opportunities in them. In rural areas, financial opportunities are limited hence why, the people who reside there go to the city in the hopes of getting employment or better opportunities, (United Nations Sustainable Development, 2019). Migration places an economic strain on an employee because most of the household income is spent on transport moving from Mamelodi to spaces where there are economic opportunities. By reintroducing industry in Mamelodi, employees are closer to their workplaces, and the township economy starts to develop from there.

One of the solutions is the re-industrialisation of townships which can trigger economic opportunities in townships. In rural areas, financial opportunities are limited; therefore, the people who reside there go to the city in the hopes of getting employment or better opportunities, (United Nations Sustainable Development, 2019). Migration places an economic strain on an employee because most of the household income is spent on transport moving from Mamelodi to spaces where there are economic opportunities. By reintroducing industry, employees are closer to their workplaces, and the township economy starts to develop from there.



Figure 8: Derelict Space. (Author, 2019)

1.3. URBAN ISSUE

As settlements start to develop, plots of empty land start to develop. These plots of land are predominant on the sides of railway tracks because their irregular site shape makes it difficult to develop. As a result, these spaces either become areas of appropriation or urban decay starts to occur. Urban decay is "...a city area that falls into disrepair and disuse" (Mang et al., 2012). Typical indicators of urban decay are areas in which the crime and unemployment rate is high, abandoned buildings and a desolate area. (Designingbuildings.co.uk, 2019). So, there is a correlation between unemployment and urban decaying because the indicators of urban decay are visible on site.

Socio-Economic Factors that bring urban decay according to (Designbuildings.co.uk, 2019)

- De-industrialisation
- Depopulation or changing population
- Urban Planning decisions
- Lack or new construction projects or urban renewal projects
- Prolonged riots and crime

These factors are evident in the context. A solution to this issue can be using regenerative theory. Regenerative theory can also find possibilities of intergrating the architecture into the existing context.

1.4. ARCHITECTURAL ISSUE

The architectural issue is that the industrial buildings are mono-functional, isolated entities in the landscape which do not integrate into the existing context. The dissertation seeks to challenge this typology by creating a building that has integrated into the community as well as bringing in a program that will have a significant impact in Mamelodi. If a building gets decommissioned and left abandoned, urban decay starts to form. This issue, coupled with urban decay and unemployment starts to create an unsafe environment which leads to a sterile environment.

1.4.1. Limitations

- The social/informal networks will be limited to the networks in Mamelodi West
- The Urban Vision of the group is limited to Mamelodi West as a study area

1.4.2. Delimitations

- There are a plethora of social issues in Mamelodi. For this study the targeted issues will be unemployment and food security


1.4.3. Assumptions

- Denneboom is a station which can distribute the produce along with the railway network at the main stations.
- The case study used was the Innovation Hub as part of the feasibility study.
- The numbers produced in the feasibility study is the best-case scenario meaning skilled labour and good yield of produce.

In summary, the dissertation aims to address unemployment and food insecurity. In the subsequent chapters, there will be an understanding of how these issues will be solved. In the next chapter, we delve into understanding the background of the study and the context.

CHAPTER 2





“The significant participation and meaningful inclusion of the people of the township into mainstream economy of Gauteng through their own township enterprises that are supported by the government and big business will be one of the key game changers... The townships must be self-sufficient and vibrant economic centres.”

- David Makhura
Premier of Gauteng

BACKGROUND & CONTEXT

2.1. ORIGINS OF MAMELODI

Mamelodi is a township situated in the East of Pretoria. Due to the Apartheid spatial planning, Mamelodi like most townships is located on the periphery of towns and cities to exclude black people. The apartheid government wanted to create two parallel economies which were black and white. This system could allow Africans to create their economy themselves, but the economic structure made it difficult for Africans to empower themselves (Marquard, 1969: 256). This then led to forced removals in the country.

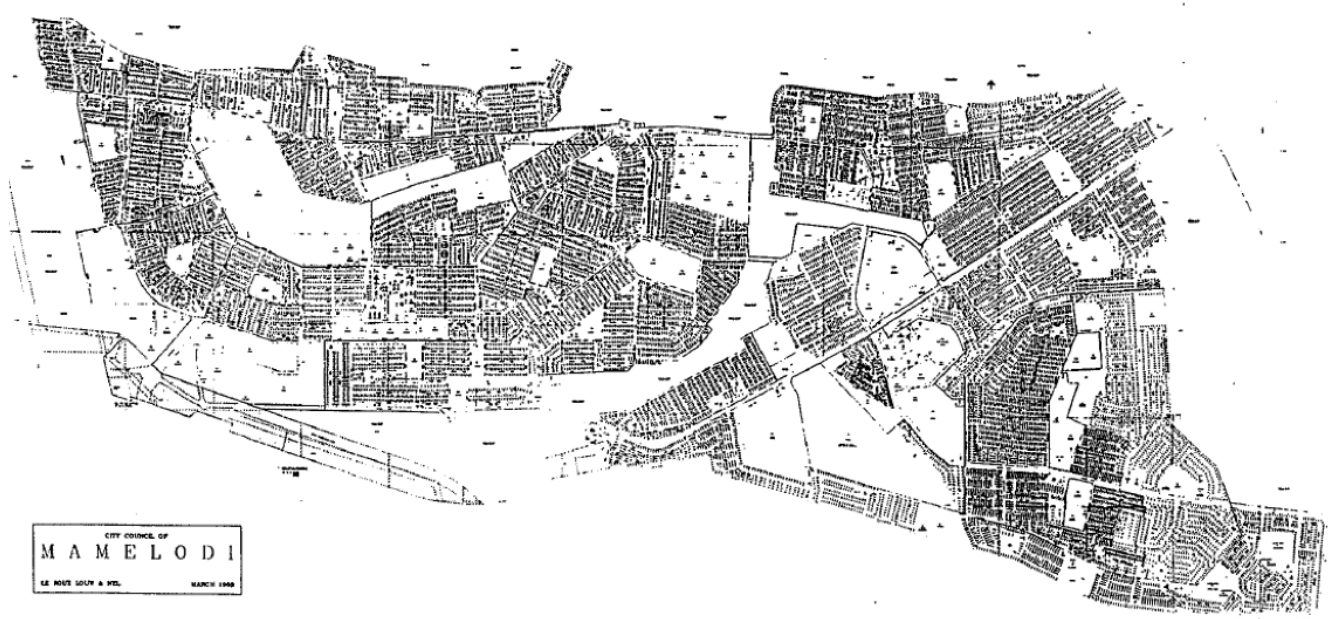


Figure 10: Mamelodi: Situation in 1988 (Le Roux Louw & Nel, 1991)

2.1.1. Places of Historical Significance Found Around the Site

Denneboom Station - Historically, "the railway stations Eerste Fabrieke and Denneboom was an important form of transport". (Walker et al., 1991: 24) Denneboom station is a busy train station that has informal vendors selling produce in the morning. According to Karim, (2017:1) "The Denneboom station traders have worked at the station for over 60 years".

Solomon Mahlangu Square - "The square marks the place of the 'Mamelodi Massacre' when 13 residents died and many more wounded during a rent protest action" (Deppe, 1994: 12). Struggle hero, Solomon Kalushi Mahlangu, is commemorated on this site because of his participation in the liberation of South Africa. This square is significant because, in 1993, it was one of the first memorial erected in the country.

2.1.2. Industry outlook in Mamelodi West

In order to understand the industrial history of the area, a case study of ArcelorMittal sets the scene. "IsCOR, with its first works in Pretoria, was established as a state company in terms of the Iron and Steel Industry Act, No. 11 of 1928. The main aims for IsCOR were to produce iron which could be used for electricity pylons, civil engineering purposes and create employment for the people of Mamelodi and surrounding areas (ArcelorMittal, 2019). The objectives of creating employment are one of the main aims of the dissertation. "During 1982 IsCOR was thus forced into the early closure of the two oldest blast furnaces at Pretoria" (ArcelorMittal, 2019). A plausible reason is "the world steel industry crisis that occurred during the

1970s and 1980s with the widespread recession occurring during that time".

According to Viljoen (2012) "In South Africa, of course, during the apartheid era, it was forbidden for the black majority to farmland within and around cities because that meant people were there to stay." This legislation was called the Natives Land Act. The legislation made it difficult for black people because according to Ledger (2016: 4) "92% of (of land) was exclusive to white farmers. The remaining 8% was farmed by black farmers who lead to significant pressure on the land". Therefore a sustainable food economy was difficult to achieve with limited resources for a high-density area. In the book, An Empty Plate (2016:23) Ledger suggests that the issue with our countries food insecurity started from here. Another important reason for having the Agri-Park (See Chapter 3) which is "Shared packaging and cold room facilities. Out-grower Model and on-site production" (DLRLD, 2018). Mamelodi is that there is a high demand for local fresh food. The building has to be close to the high-density area which is Mamelodi in this case.

2.2. GOVERNMENT'S ROLE

In 2019, the South African government published a report on Gauteng Township Economy revitalisation. "Government is committed to ensuring that the township economy contributes at least 30% of the Gauteng GDP by 2030" (South Africa, Department for Economic Development, 2019: 4). With these strategies, townships will become essential nodes in our cities, seeing that we are heading towards the fourth industrial revolution. "Radical economic revolution means challenging the continuing reality of poverty, unemployment and inequality" (South Africa, Department for Economic Development, 2018:8) in townships. The goal of township renewal is to create sustainable jobs, reduce poverty and inequality so that our townships can thrive in this current paradigm. The "Township economy had a minimal contribution of in the development of productive sectors in the economy" (South Africa, Department for Economic Development, 2019: 5). Can architecture contribute to township economic development?

In order to understand the economic drivers of our country, agriculture was chosen as the first study topic because it is one of the "fundamental human rights that seem to be ignored by government worldwide" (Ledger, 1992:30). Figure 11 indicates that agriculture

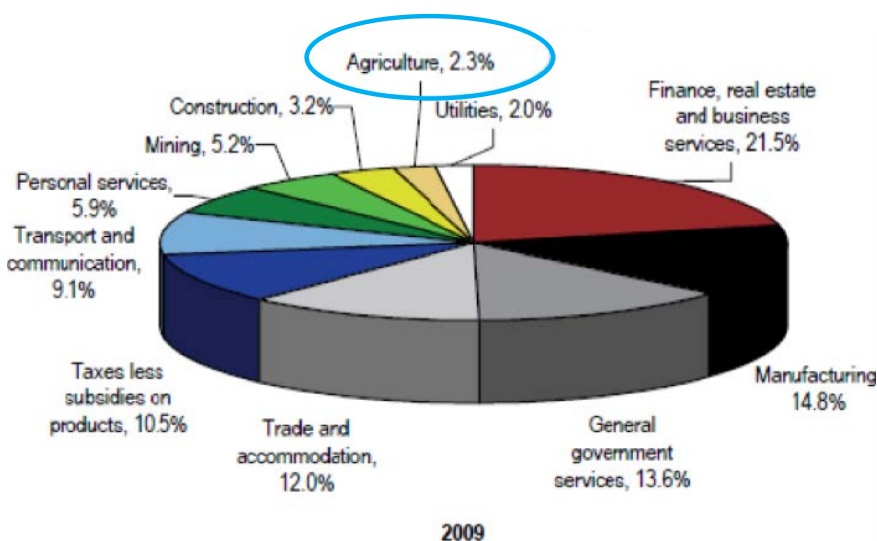


Figure 11: Contribution of agriculture to the Gauteng economy. (Makapaene, 2017),

contributes 2.3% to the economy. (Makapaene, 2017). According to the UN definition (UN Report of the World Food Conference, 1996). To solve the food insecurity issue, people have to have access to nutritious food that ensures a healthier life. Currently, in South Africa, there is food insecurity pandemic. We have people who cannot afford to eat based on the current economic climate. On the UN's Sustainability Goals, the second goal after No Poverty is Zero Hunger, which is essential in order to tackle the other goals. "The current food system is not working since we have over 800 million people starving in the planet."(WHO.Int, 2019)

UN (2001) states that "household food security is a function of inter-related processes that happen at different geographic scales: international, national, regional / district, community and intrahousehold." In order to solve the food infrastructure as a whole, there has to be a radical change in the food network. With regards to South Africa specifically The Human Development Reports (2003:5) argued that; "the real prospect for sustainable development in South Africa depends on confronting political challenges: that is, strategic political interventions that focus policies and support measures on achieving the goals of sustainable development" in the townships.

2.2.1. The Problem of Unemployment

According to Stats SA, "South Africa's unemployment rate increased to 27.5% at the end of the third quarter of 2018" (Fin24, 2019). A solution to this issue is by re-industrialising our township by agro-processing. The concept of Agro-enterprise has the possibility of employing activities such as packaging, processing, marketing and agricultural produce. For the rural poor. (Agro-industrial parks: Experience from India (2006).

2.3. URBAN ANALYSIS

For the Urban Analysis, the Mamelodi / Nellmapius Masterplan & the City of Tshwane Regional Spatial Development Framework is the basis of the group vision. The group urban vision was specific to Mamelodi West.



Figure 12: Mamelodi / Nelmapius Composite Regeneration Strategy. (GAPP Framework, 2011)

2.3.1. GAPP Architects & Urban Designers - Mamelodi/Nellmapius Masterplan

"The Siyakhana Initiative (SI) identified strategies to promote food security, health and sustainability within the context of the Tsololoso Mamelodi Regeneration Strategy" (GAPP Architects, 2011: 88). The various plots have been allocated for Urban Agriculture initiatives in Mamelodi. One of the plots identified will be the chosen site for the design.

For Urban Sustainability these were the priorities according to GAPP Architects that were submitted by SI (2011, 88)

- Waste management and recycling plan
- Energy and water security study
- Food security and urban agriculture strategy
- People's markets plan
- Public and Non-motorised transport plan

Urban Agriculture Promotion:

According to Food Security Policy 2008. Unused open spaces in Mamelodi are a top

priority for urban agriculture. (GAPP Architects, 2011: 88) These space need to be a productive environment, or they will result in urban decay.

People's market:

The framework proposes an infrastructure for the informal traders operating in Denneboom Station. The markets will be directly accessible to the community of Mamelodi. The markets supplied by urban agriculture allotments to foster the closed-loop system that leads to economic growth. (GAPP Architects, 2011: 90). With these interventions, the financial viability of urban agriculture within in a township setting is plausible.

The Tsamaya Road Precinct:

"The redevelopment of Tsamaya Road into a fully-fledged spine" (GAPP Architects, 2011: 105). Tsamaya road is an essential arterial for buses and taxis. (Figure 13) Showcases a cross-section of the proposed BRT system. The result of the strategy will densify the site to bring as much foot traffic as possible to the site.

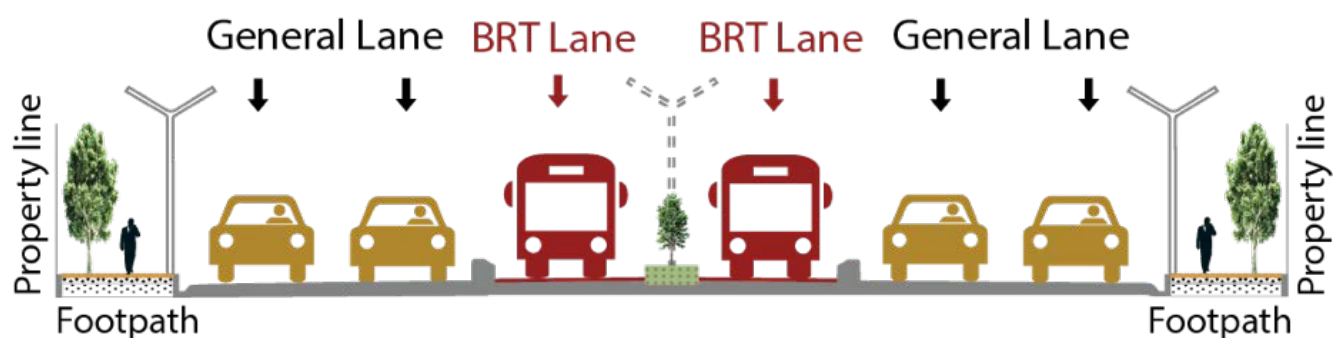


Figure 13: BRT Lane (Devadas, 2012)

2.3.2. Region Spatial Development Framework 2018

According to the Region Spatial Development Framework 2018 developed by the City of Tshwane, Mamelodi West is as a node of future development. The development which is going to take place is Transport Orientated Development which integrates different modes of transport. (City of Tshwane, 2019). Continuing with the TOD there will be densification in the area along Tsamaya Road in order to lessen the transport expenditure in households. The site of the design is for retail. (Figure 14) Illustrates what the draft proposes. The draft also speaks about creating mixed-use residential areas to increase building usage.

To summarise, the RSDF aim is to (City of Tshwane, 2019);

- Provide house options that can cater to people across income groups via densification and strategic location
- Create an environment of improved quality
- Enormously reduce the carbon footprint
- Have more impactful strategies for economic growth

The critique that on the proposal is that,

- The proposal address the existing social networks found in the area in order for township revitalization to happen.
- The densification will increase the volume of people going to the existing services which are limited. The proposal does not speak about how will it solve the issue.

Tsamaya Road and Waltloo road border the site.

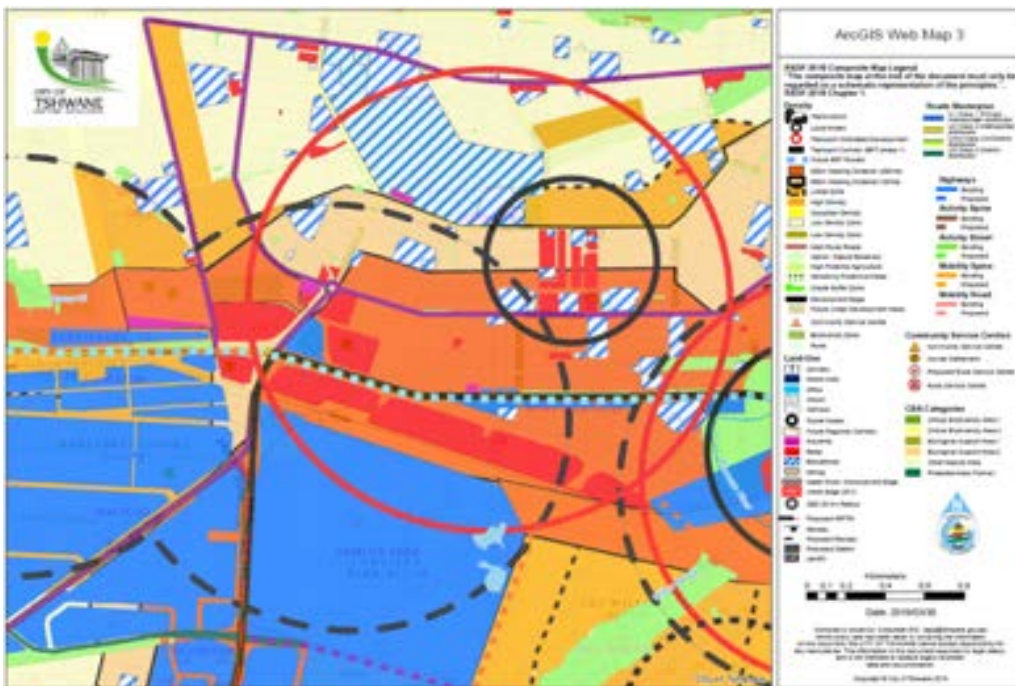


Figure 14: Site. (Tshwane GIS, 2019)

2.4. URBAN VISION - MAMELODI GATEWAY

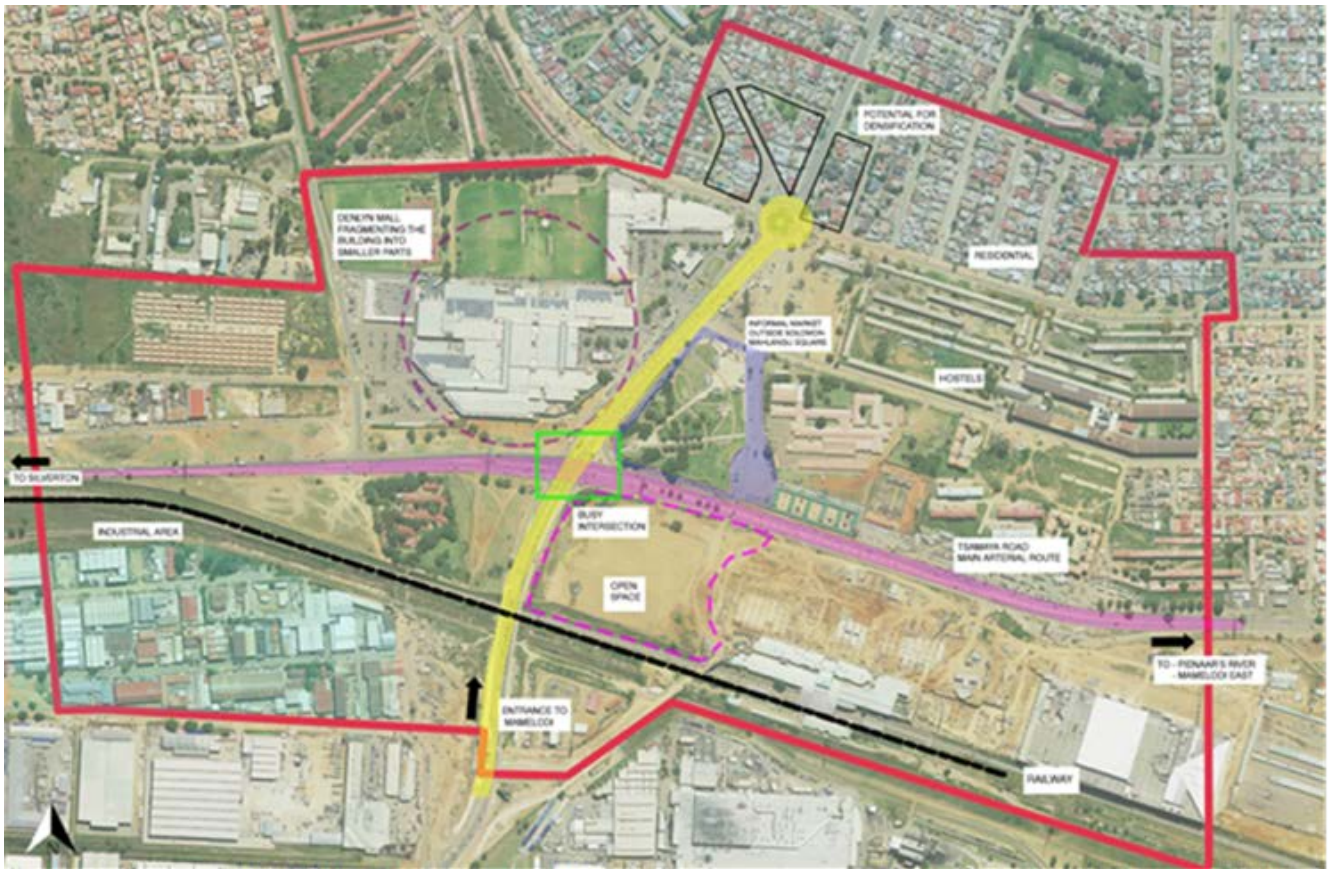


Figure 15: Block Vision. (Mamelodi Gateway, 2019)

The “Mamelodi Gateway” is the framework that is proposes the intensification of the study area. The reason that this area (Figure 15) was chosen for the block urban vision is because it is a “*place with significant history and identity of housing and a dependent area that suffers from mass migration*”. (Group Vision Framework, 2019:12).

The vision group focused on the “Spatial Legacy of Democracy” which is to investigate the rich heritage of Mamelodi through the spatial legacy over both its apartheid and post-apartheid era. The group aims were to re-inforce Mamelodi as an independent suburb that can it can is sustain itself as an economic entity. “Intensification” (Figure 16) as referred to the document speaks about bringing in different types of programmes in the area to stimulate economic growth.

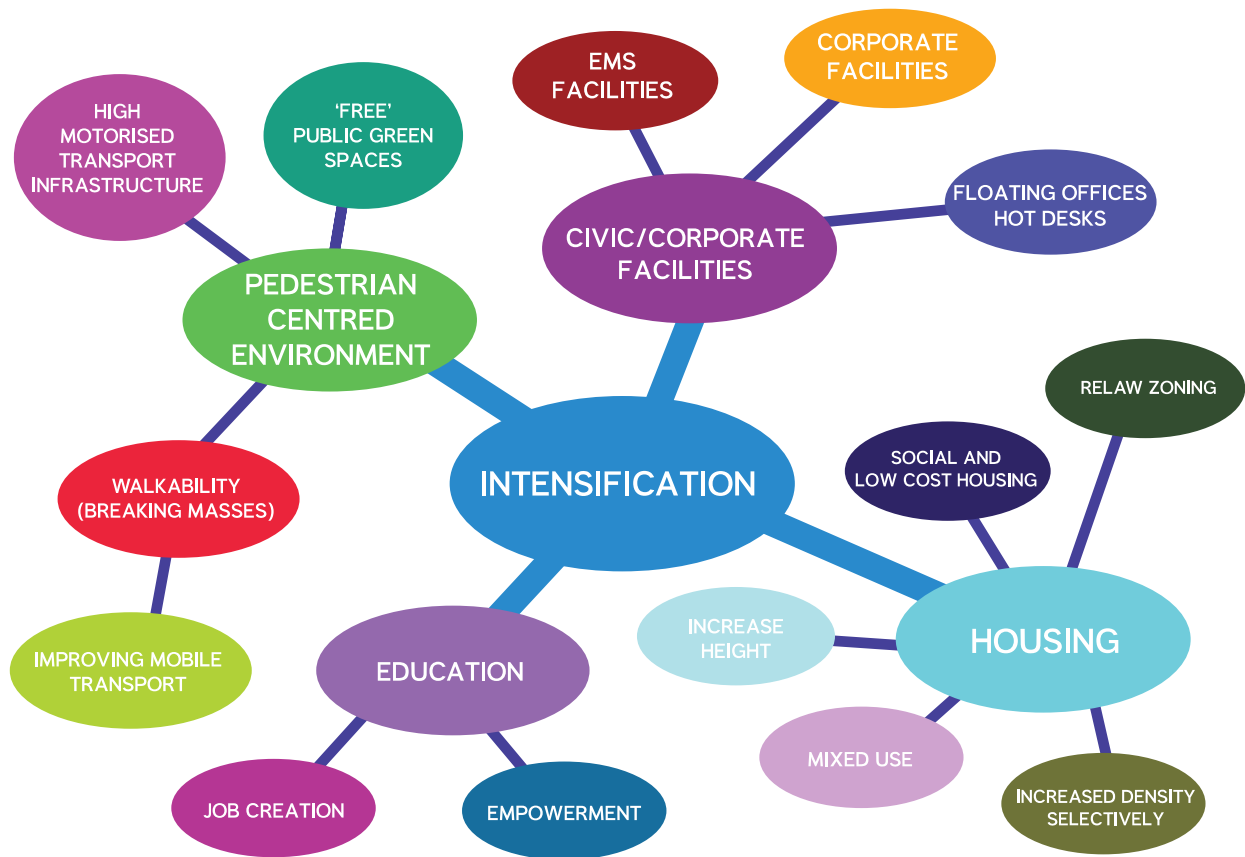


Figure 16: Intensification. (Mamelodi Gateway Group, 2019)

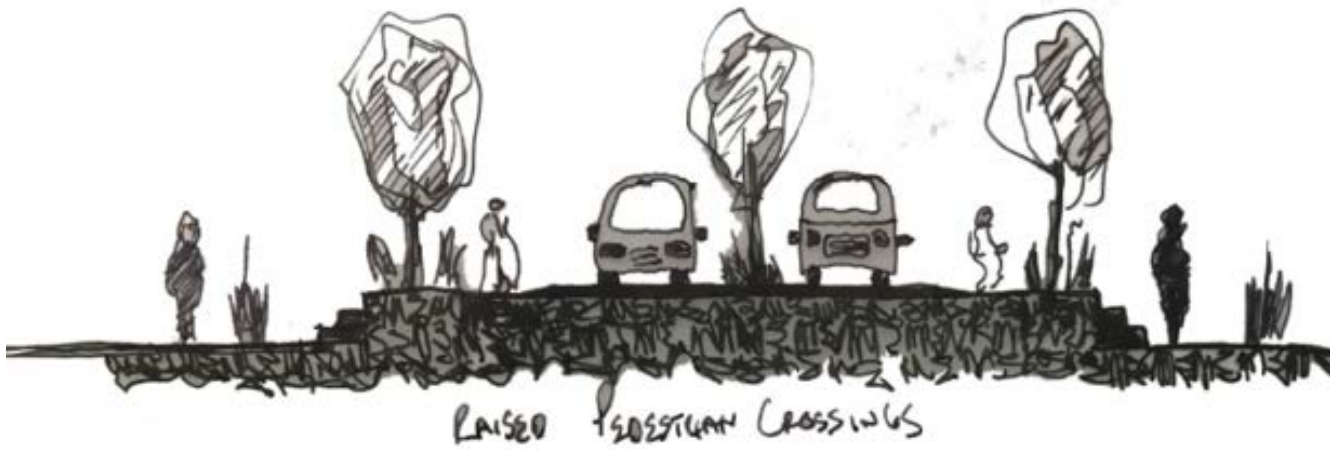
In the Urban Vision the group proposed a pedestrian centered environment where people are the main focus of the movement patterns. Important nodes such as the transport hub, malls, Solomon Mahlangu Square will have a raised pedestrian crossing for the disabled and pedestrians. These design interventions are to improve the walkability in the area (Figure 17).

How the Urban Vision relates to the design proposal is by finding out ways different ways of stimulating an economy. Re-industrialisation is the "economic, social, and political process of organising national resources for re-establishing industries (Oxford Dictionary, 2015: 126). When industries establish,

economic opportunities are created. Mamelodi West has an existing industrial edge which will be used as part of the design.

- The only critique I have for the proposal is that the group did not do enough participatory action research to understand the context better.
- The group chose to densify around the roundabout at Waltloo Road instead of densifying in Tsamaya Road since there is going to be a BRT system in the future.

Pedestrian Crossings



Pedestrian Promenade

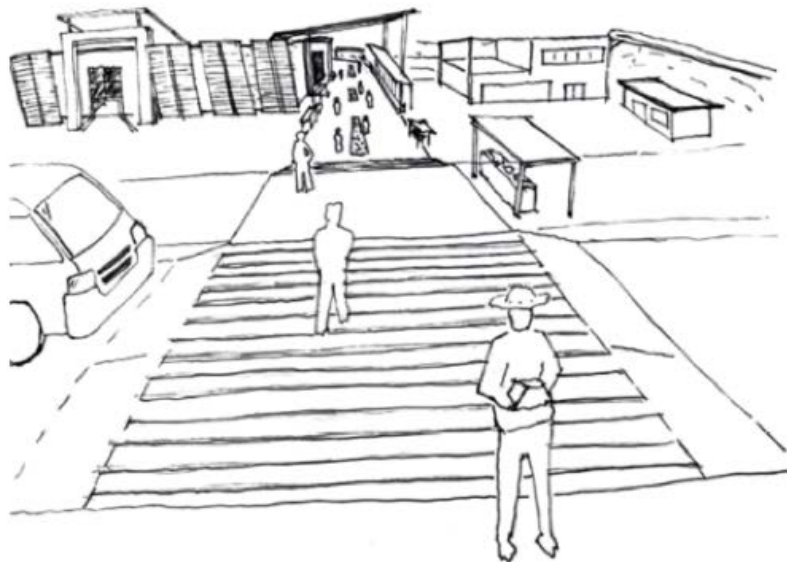


Figure 17: Pedestrian Upgrades. (Mamelodi Gateway Group, 2019)

2.5. SITE

2.5.1 Site Analysis

After undergoing the site analysis, the finding of the investigation is as follows.

- **Desolate Site** - In Mamelodi open spaces that have no function end up becoming spaces that undergo urban decay. The reason for the urban decline, people, see these spaces as a dumping site. The site desolate site has the potential for regeneration.
- **Industrial Zone** - Since the part of the thesis is challenging the industrial typology, the site has to be close to the industrial edge of the city.
- **Proximity to Retail** - There are two large malls on opposite sides of the site. The industrial-retail design has to come out with ways to creatively use the density.
- **Railway track** - The railway track can be used to transport the produce to other areas in the township such as Nellmapius which also has food insecurity issues. Also, the railway is a classic apartheid buffer. It will be interesting to see how architecture responds to the edge.
- **Transport Zone** - The site is also close to a transport route which can be used to distribute the produce to other areas.
- **People** - For the design to be successful, it has to be near the people. The nearest housing is

1 km away from the site. Foot traffic is needed to generate income for the informal vendors

- **Size of Space** - The site is 38 736 m², to accommodate food production design.

In terms of the other site analysis findings (Natural Resource Atlas, 2019)

- **Soil** - Undifferentiated shallow soils and land classes with limited land use options and grounds with structure favouring arable land use scarce or absent
- **Geology** - Shale, minor limestone/dolomite, basalt and tuff

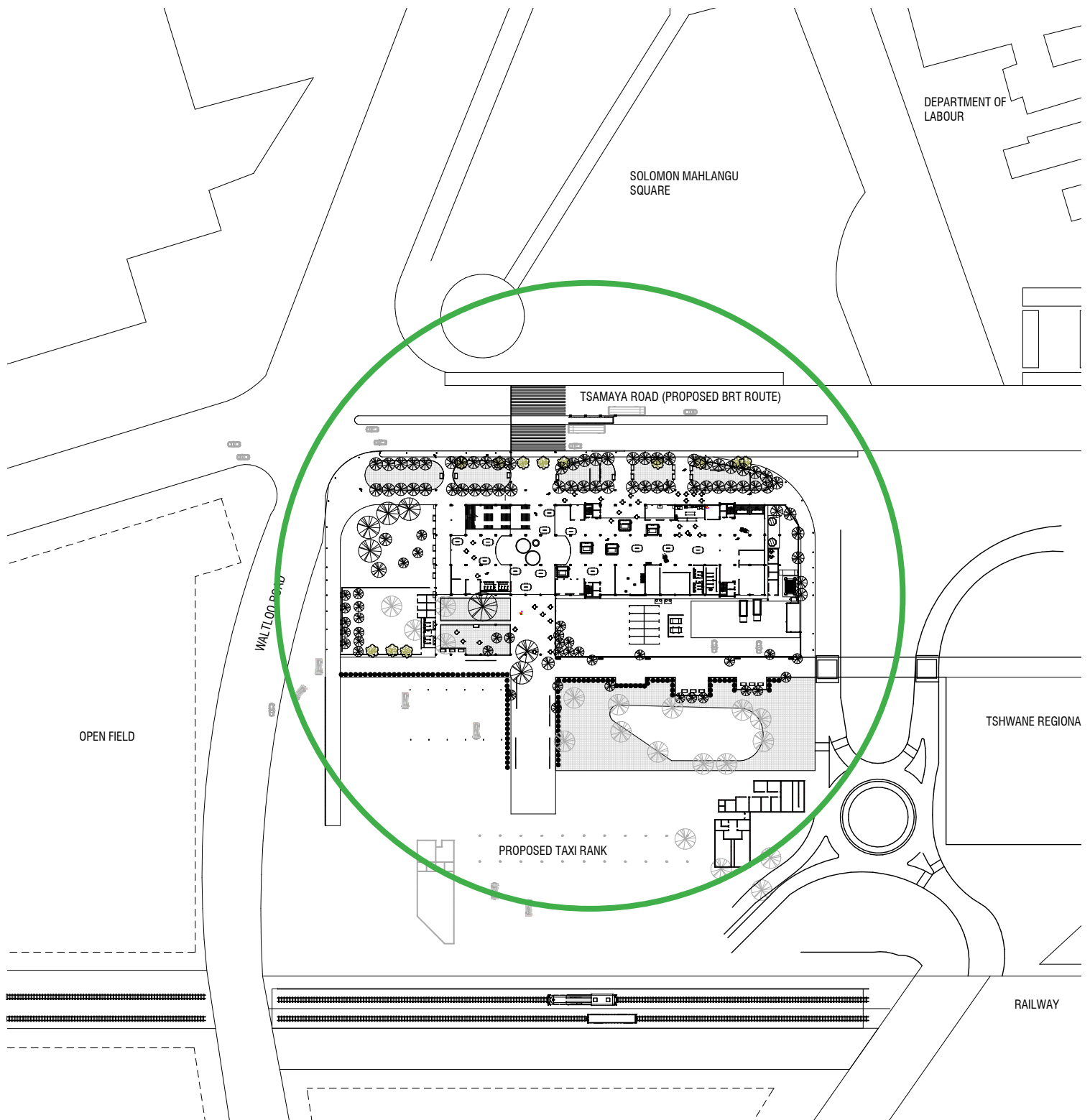


Figure 18: Site for Development (Author, 2019)

2.6. SITE POSSIBILITIES

- **Denneboom Station:** The train station which is still operating today is one of the major train stations in Mamelodi. On the periphery of the station, informal vendors that sell vegetables. The transportation hub has over 220 000 commuters foot traffic daily. One hundred twenty thousand people use the train, approximately 40 000 private vehicles pass the centre during peak hours. Also, about 25 000 people using buses and 772 700 use the taxi on a monthly (News e, 2019).
- **Existing Networks:** There are street vendors selling produce on the edge of the streets. The vendors can become part of the design. According to the City of Tshwane that "Informal Trade contributes to 35% of Tshwane Market Produce Market turnover" (City of Tshwane, 2012).
- **The site:** There is evidence of industrial activities that happened prior. Currently, urban decay is happening in the area, therefore, making it a brownfield site. The study area can thus be regenerated.



Figure 19: Informal Vendor at Denneboom Station (Author, 2019)

2.6.1. Site Selection for the Intended Programme

For an Agri-Park to be successful, the site selection requirements are namely, (Agro-industrial parks: Experience from India. FAO, 2006)

- **Underused open land:** The government has prioritised underused free space: Socio-economically depressed areas with abundant and underused agricultural land.
- **Household incomes:** The purchasing power of the population and average spending on foods by individual families from different socio-economic groups (Bizcommunity, 2019).
- **Power:** The presence of electrical infrastructure has to be near the site.
- **Water:** The availability of water for both industrial processing and agriculture. Investigation of rainwater harvesting and groundwater potential.
- **Railway:** Dry port, airport terminals and telecommunication - Railways and dry ports to be evaluated considering the current and oncoming national networks/projects.
- **Market potential:** A valuable market space needs to be available in the park for the long-term commercial viability of the park.
- **Access to commercial and support services:** The access to major stakeholders such as universities, financial institutions and co-operatives. These entities provide services that are needed to sustain the facility. Therefore, proximity to these spaces is paramount. (Agro-industrial parks: Experience from India. FAO, 2006)
- **Street Vendors:** Denneboom station has an existing street vendor culture that can continue on to the site.

2.6.2. The South African Food Network

The South African food network is a story of how pursuit of money and power can create has created food insecurity in the country. In the book *An Empty Plate*, (Ledger, 2012) argues that " this system is perpetuating poverty, threatening land reform; entrenching inequality and tearing apart our social fabric". Large retail companies are charging exorbitant prices for food which some people in a place Mamelodi cannot afford. So the winners in the agri-food system are the distributors and retail because they profit the most from the network. Which brings a question, why don't farmers start to become the retail agents?

"Preliminary research has found that most food waste in developed countries occurs in households and eating establishments, while in developing countries a greater proportion is lost on farms, during transportation and storage." (Allafrica, 2010). Addressing the network is crucial because apart from people going to be hungry there is this issue of wastage in the network. It is estimated that in South Africa only about 4.14% of food waste occurs at post-consumer stages, while the majority of food waste 8.67 million tonnes per annum is generated during agricultural production (26%), post-harvest handling and storage (26%), processing and packaging (27%) and distribution 17% Oelofse and (Nahman, 2013). The architecture has to respond to these challenges by creating a design that can reduce food waste in the food network.



mamelodi community health centre



MIEUJE MEAL IS GROWN IN THIS AREA TO NOURISH THE SPECIAL NEEDS CHILDREN

informal market



AN INFORMAL MARKET SITUATED ACROSS THE TRANSPORT TERMINAL OPPOSITED THE RETAIL SIDE

denneboom taxi rank



FOOT TRAFFIC IS HIGH IN THIS AREA. VENDORS ARE SITUATED ON THE EDGE OF THE ENTRANCE.

denlyn shopping centre



THE BUILDING FORM DOES NOT WORK IN AN URBAN SETTING. THE FORM NEEDS TO BE PERMEABLE.



denneboom centre



VENDORS ACT AS A THRESHOLD BETWEEN THE THE CENTRE AND THE CONSUMER.

informal market (ford plant entrance)



VENDORS ARE PLACED ON THE EDGE. THIS VENDOR SELL STRICTLY POTATOES.

scale and threshold of the area

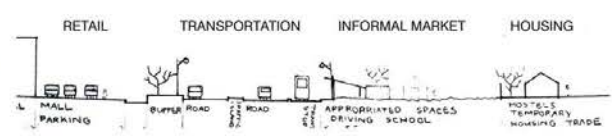


Figure 20: Site Selection and Site Analysis (Author, 2019)

mamelodi food network



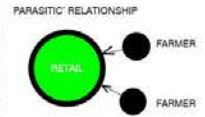
farming
PIENAARS RIVER
URBAN SUSTAINABILITY
URBAN FORESTRY PROJECT
WILL BE PILOTED HERE

distribution
TSHWANE FRESH MARKET
BUYS THE PRODUCE
WHERE INFORMAL VENDORS
BUY THEIR GOODS

farming
SCHOOLS
VEGETABLE FARMING IS BEING
DONE IN SCHOOLS.



farming
MAHUBE VALLEY



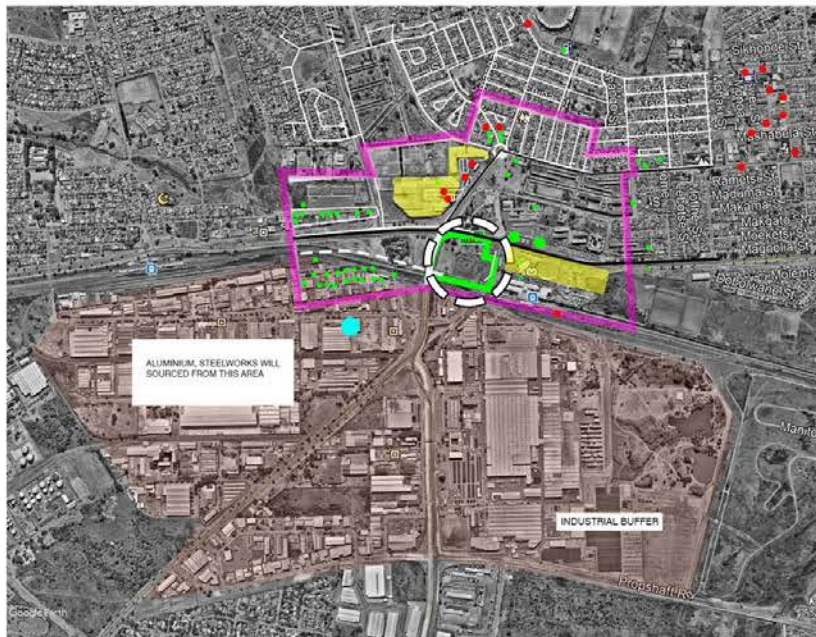
The farming network is located because it is close to Mame Mall, the Elandspruit and an informal market.

- Sikwanda Cooperative: 0.6 ha open field
- Mutandis Cooperative: 0.4 open field and 2 shade nets
- Pfj Cooperative: 0.3 open field and 3 shade nets
- Inyang Cooperative: 0.2 open field and 3 shade nets
- Kopang Cooperative: 0.3 ha Open field



MAMELODI GATEWAY (GROUP BLOCK VISION)

- retail**
INFORMAL MARKETS
- MALL**
- distribution**
WAREHOUSES
- consumption**
RESTUARANTS
- waste recycling**
COMPOST



macro

relationship between the stages



meso



1. TSHANE REGIONAL MALL (NEW)



"INFORMAL TRADE, INCLUDING FOOD AND CRAFTS TO BE SET UP AT DENNEBOOM STATION" (GAPR 2011)



micro

regenerative theory principle

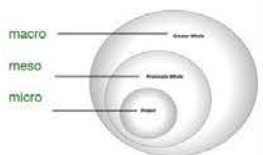


Figure 21: Mamelodi Food Network (Author, 2019)



Figure 22: Vendors stall. (Author 2019)



2.6.3. Vendors on Tsamaya Road

During the observational study, a vendor by the name of "Sfiso" did not complete his matric. He mentions that some vendors get their produce as far as Marabastad. Some of the profit they make goes to transport. So they are not making enough to get by. He sells R40 vegetable packs (Figure 14) to his clients. He works opposite the site next to the transportation hub. He placed his business there because there are plenty of people travelling from one place to another. Therefore identifying the need for food production in the area to cater to the local vendors.

"Foreign national entrepreneurs are through networks, bulk buying and ultimately offers goods and services at competitive prices" (South Africa, Department for Economic Development, 2018:12). The informal market in Mamelodi will need to use strategies to sell their produce. The Agri-Park will bring infrastructure for street hawkers to thrive.

2.7. FOOD

As part of the Maslow hierarchy of needs, food is a physiological need. The persistent nature of food insecurity inhibits sustainable development and growth in all aspects. Food insecurity happens because when the constant struggle is food insecurity, which becomes the main focus of the community instead of development issues. United Nations Development Project (UNDP) (2005:5). People that are food insecure tend to eat leafy vegetables such as spinach, cabbage and tomatoes because that is what they can afford.

Figure 23: Vendors stall. (Author, 2019)

2.7.1. What is the Diet in the Study Area?

Fieldwork was carried out throughout Mamelodi. A Mamelodi Agricultural Project is currently on-going, which is in Mahube Valley. On close inspection, the project is under-resourced because of the lack of infrastructure as well as the produce in the area. The main crops are spinach and tomatoes in the Agricultural Project. The issues faced in this project is funding for a tractor and a sustainable yield because when the crops get depleted, the informal vendors go directly to Tshwane Vegetable Market. Since the population of Mamelodi is low to income population, there is a higher chance of the people becoming food insecure. Spinach is an excellent source of vitamins and minerals. Since finances are an issue, the people living in the area cannot afford decent food. People resort to buying cheap, unhealthy food for example fried chips and fat cakes.

In brief, the urban vision outlined how this area of Mamelodi can be seen as a gateway to Mamelodi. The architectural possibilities of the area have been documented. The next chapter will follow up on how the context creates a symbiotic relationship with the program and how it starts to interrogate the research question.



Figure 24: Mamelodi Community Project (Author, 2019)

PROGRAMME

3.1. CLIENT

The client of the design is The Department of Agriculture, Fisheries and Forestry as well as the Department of Rural Development and Land Reform (DRDLR) since they are responsible for the Agri-Parks in the country. The government claims that by establishing Agri-Parks in municipalities, this will trigger economic transformations in rural regions (DRDLD, 2018).

3.2. WHAT IS URBAN AGRICULTURE?

The solution proposed for the food insecurity issue is urban agriculture. According to Jenkins (2018), Urban Agriculture has the potential to provide green space, cheaper and fresher produce. Since food is an essential need, urban agriculture needs to become a necessary part of urban development. Community farming will improve that health and nutritional standard of low to no income families.

Urban Agriculture is according to (Viljoen, 2015: 21);

- The location of the strategies is usually in towns or cities
- Generally speaking, for profitability high yield markets for fruit and vegetable
- Can be found on facades, boundaries, fences and fruit



URBAN



Figure 25: Field of Plants in Greenhouse. (Lambeth, 2019)

Jenkins (2018) states that the production and distribution of locally grown food through community gardens and urban farms are methods of alleviating food insecurity. Urban Agriculture encourages local food production for direct access to the consumer as well as opportunities for local economic development. This solution can start to solve the research question. According to the report by the Agriculture and Environmental Management Department (2009:1) due to economic reasons, food prices in the country are soaring. When food prices are high, this leads to households that cannot afford to purchase healthy food for their diet. As a result, poor people are the most affected by this situation and end up buying unhealthy food. In the context of Mamelodi, some residents cannot afford transport to get to work in town. By bringing in the Agri-Park in the context of Mamelodi, there will be job opportunities as well as stimulation of the local economy. An Agri-Park is an alternative solution to solve the current food network crises.

Since we are approaching the fourth industrial revolution, the future food process plant needs to have the following qualities. According to Wayne (2019), these are major vital elements that need to be taken into consideration when designing a food production plant of the future.

1. Structure An Agri open building that allows for flexibility".
(See Chapter 5 - Concept).
2. Process - Processes inside the building that would enable for enhanced food safety and the process of bringing foot traffic in the building
3. Utilities & Environment - Environmentally friendly, features that will lead to a sustainable building will be used, such as on-site water treatment and heat recovery.
4. Design - The envelope will also aid in energy savings. Energy-efficient strategies will be used, for example, a building envelope that makes people more receptive to the building as well as a designed landscape intervention.

In the township context, the idea of flexibility in mixed-used properties which can accommodate cultural/religious and commercial programmes inside a building. (SLF, 2017: 29). Since the urban fabric of townships is multi-functional, why does the new infrastructure design multi-functional as well? (Figure 15) indicates the Value Chain and where design possibilities lie.

3.2.1. Vertical Farming

To recapitulate, the "Mamelodi Gateway", the threshold to the township is these industrial spaces. Which can lead to a design possibility of using the existing roofs of the buildings for agricultural purposes. Vertical farming is defined as the concept of cultivating plants or animal life within skyscrapers or on vertically inclined surfaces (Despommier 2010). According to Dickson Despommier who is a leading researcher in the field of vertical farming list the most critical advantages of vertical farming which is namely (Despommier, 2012);

- No agricultural runoff
- There is consistent annual crop production
- Since it is inside a structure, there is no crop loss from weather events
- Water usage is lessened by 70% with no use of agro-chemical, no fossil fuels
- Allows repair of damaged ecosystems
- Remediate greywater
- Creates employment
- The community has access to fresh produce
- Adaptive Re-Use of the old abandoned building
- Can grow plant-derived drugs and bio-fuels

Another critical point is that land is becoming a scarce resource and farming itself uses a large amount of the world's land.

3.2.2. Building Intergrated Technical Food Systems

Andrew Jenkins has proven that it is possible to grow food within buildings. In his thesis, Jenkins was questioning the idea of having urban agriculture as a solution to alleviate food insecurity. So he created a case study to investigate the potential of Building Intergrated Technical Food Systems (Jenkins, 2019: 344) these are the metrics he was investigating.

- United Kingdom building-integrated technical food system metrics
- The collective inner urban area of UK cities - 5,486 hectares
- Productivity per annum - 2,743 million crops - 959,525 tonnes
- UK food consumption - 63.6 million tonnes
- Impact on food consumption - 1.5 %
- The population fed - 990,240 people
- Reduced demand for global agricultural land - 168,337 hectares
- Reduction in production of CO₂ - 659,000 tonnes = 832,700 cars = 6,974 fully-loaded lorries (Jenkins, 2019: 345)

The 1.5% impact consumption might seem like a small number, but the building systems technology will be able to produce "181.6 million crops per annum, at a value of £363.2 million" (Jenkins, 2009: 244). Which is substantial with regards to new building technology and the future this type of advancement beholds. For this to happen in Mamelodi, infrastructure must facilitate change.

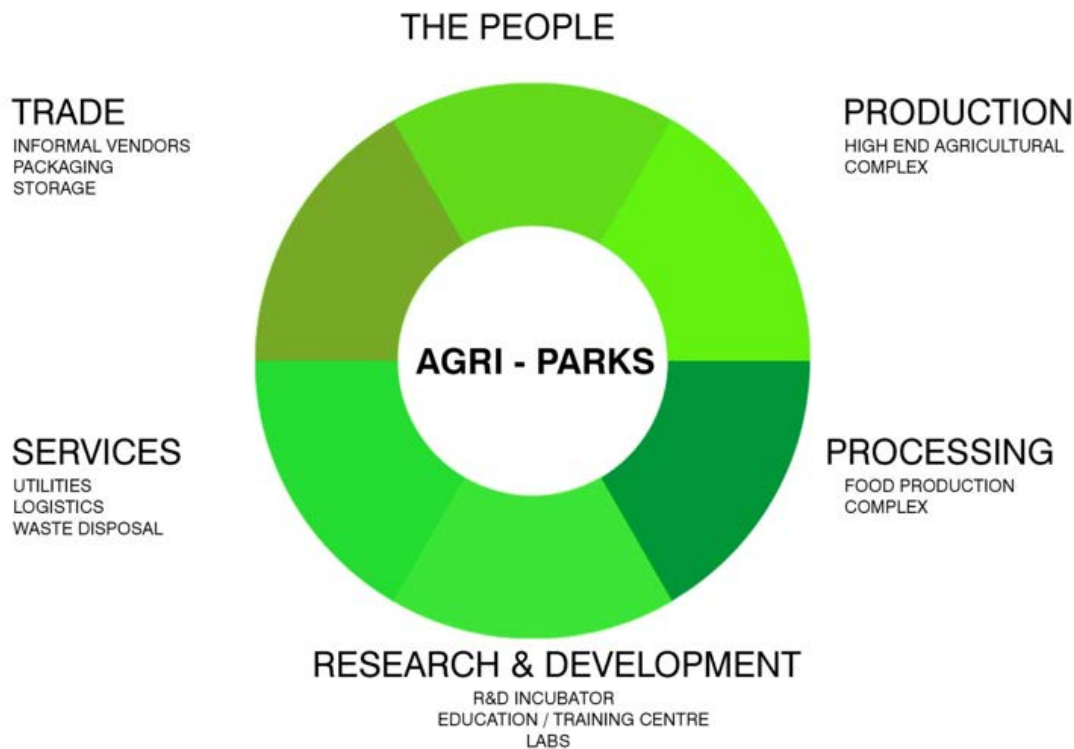


Figure 26: Agri-Park Concept Proposed by the Government (Adopted by Author, 2019)

3.3. AGRI-PARK (AGRO-PROCESSING PARK), THE PROGRAMME

The real-world problem, according to Corcoran (2019), is "Globally since the population in the world is continuously increasing, food production needs to increase by 70 per cent by 2050 for the increasing demand. As previously stated, the food network is an issue globally.

The proposed programme is Agri-park. It is a mixed-used development of agro-processing, training, skills development, processing, on-site retail of produce in peri-urban spaces (Figure 17) (DRDLD, 2018). The main benefits of processing goods on-site are for higher quality goods, lower-cost transport, produce is of higher quality, improved market and performance improved handling. (FAO, 2016: 9). For the study, the definition used will be "shared packaging and cold room facilities which uses and out-grower Model and on-site production" (DRDLD, 2018).

(FAO, 2016: 9). For the purpose of the thesis the definition used will be "shared packaging and cold room facilities which uses and out-grower Model and on-site production"(DRDLD, 2018).

3.3.1. The Benefits of Agri-Parks

According to the National Development Plan, one million jobs created in the agricultural sector by 2030 and one million hectares will be under production. In terms of the medium-term strategic framework, one million new jobs will be created in the rural economy by 2030, and rural unemployment will decline from 49% to less than 40% by 2030 (South Africa. Rural Development & Land Reform, 2017: 16-17)

Other benefits include according to the Department of Agriculture Each Agri-park is projected to contribute a minimum of 30 jobs onsite with emphasis on youth. One hundred fifty posts per agri-park when each Agri-park is running at full potential (Makaepea, 2017). Agri-parks will contribute to increased productivity, competitiveness and agro-industrialisation with consolidation and aggregation of interventions is critical.

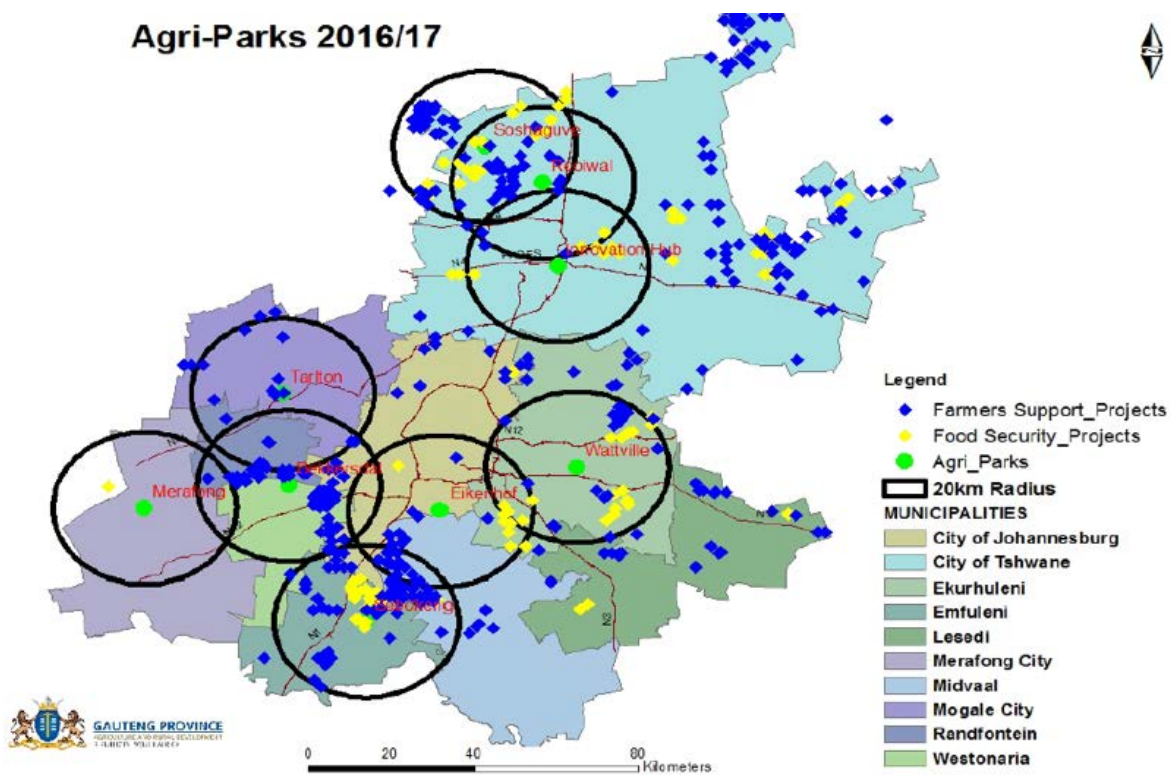


Figure 27: Agri-Parks Linkage to Neighbouring Farmers. (DARD, 2019)

3.4. SUB PROGRAMS/FUNCTIONS

The sub-programs chosen were to create a closed-looped system in the facility. Part of the closed-loop is produced, process and consume. The programs are namely;

- Shisa Nyama - To include other forms of entrepreneurship (Figure 18).
- Skills Development Centre - The Skills development centre targets the issue of unemployment as well as the poverty alleviation.
- Informal Trading Market - The produce generated from the building will need to be sold to the existing informal market and spaza shops to spark township revitalisation. Other sold includes fertiliser, tomatoes in a box and tomato paste.
- Public Space - This space can facilitate social infrastructure in the community. Open space is essential if the community will start having a better relationship with agriculture as well as area the community can come together.

3.5. GROWING SYSTEMS USED TO GROW FOOD

The drip irrigation hydroponic system is the chosen technology used for the dissertation. "The drip hydroponic system is widely used method among both home and commercial growers. Water or nutrient solution from the reservoir nourish individual plant roots in appropriate proportion with the help of pump" (Rouphael and Colla, 2005). The liquid is a nutrient mix.

The benefits of a drip irrigation system according to (Eartheasy.com)

- **Adaptability** - The drip irrigation system can easily be adjusted to suit the growing vegetables in the greenhouse
- **Growth Improvement** - Since the water supply of the system is continuous, the nutrient mix penetrates deep down into the soil to reach the root zone.
- **The saving of time** - One of the significant benefits is, the timer does automatic watering. There is also smaller amounts of water applied for a more extended period to create ideal growing conditions.
- **Ideal growing conditions** - Reduces fungal diseases which are spread quickly under most conditions.
- **Water saving** - Various studies have proved that the drip irrigation system uses 30 - 50% less water than other technologies of watering such as sprinklers.

creating a food economy

bi-product from the tomato processing unit

TOMATO PASTE

TOMATO SAUCE

TOMATO CANNED

TOMATO JUICE

FRESH TOMATOES

use in the township economy



programme link

shisa nyama

spaza shop (kota)

informal vendor (atchaar)

shisa nyama

informal vendor (veg pack)

SHISANYAMA'S TOMATO PASTE RECIPES TO MAKE DELICIOUS MEALS

KOTA'S ARE STAPLES IN TOWNSHIPS. [RE] MAMS WILL PROVIDE THE TOMATO SAUCE.

TOMATO ATCHAAR IS MADE BY HEATING TOMATOES. VENDORS WILL SELL THE PRODUCT.

TOMATO JUICE WILL SERVE AS A BEVERAGE CHOICE.

FRESH TOMATOES WILL BE SOLD BY INFORMAL VENDORS. CHEAPER THAN RETAIL BUT GREAT QUALITY.

Figure 28: Bi-Products (Author, 2019)

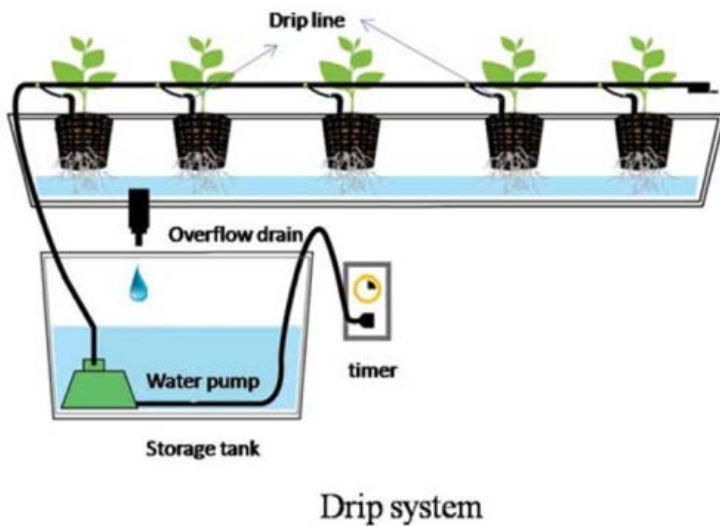


Figure 29: Drip Irrigation System (Sharma, 2019)

3.6. BUILDING INTEGRATED SYSTEMS USING THE BUILDING TO INCREASE FOOD

Continuing with the argument, building integrated systems are proposed. " Technical food systems utilise man-made components such as plastic trays and mechanical pumps to grow crops directly in water, without the use of soil, and promise increased productivity, as well as decreased water and energy use when compared with traditional agricultural systems." (Jenkins, 2018:1) This system is part of the design of food production. There will be systems to consume, store and prepare the produce. The system will aid the informal vendors in the community.

3.7. THE VEGETABLE PALETTE IN THE FACILITY

The plants chosen for the design were determined based on the following aspects;

- Most Profitable
- Vegetables that can convert to a different bi-products which can be sold.
- Vegetables that can integrate into the existing food network

The vegetable palette that is chosen is:

In Gauteng, approximately 6 million tomatoes are consumed every day in the province (NAMC, 2012). The tomatoes are the main crop that will be produced in the facility because it fulfils the abovementioned criteria. Also, the crops are processed into other products such as tomato paste, sauce, canned and juice (Figure 18). The processed foods are sold by the informal market as well as other business which can use the produce.


	PRODUCT	QUANTITY	PRICE
	Tomato	64,800 boxes	R 2,397,600.00/year
	Green peppers	36,000 boxes	R 1,440,000.00/year
	Cucumbers	28,800 boxes	R 2,304,000.00/year
	Lettuce	36,000 boxes	R 3,240,000.00/year
	Brinjal	11,200 boxes	R 672,000.00/year
	TOTAL	176,800 boxes	R 10,053,600.00/year

Figure 30: Estimate Revenue per Crop Commodity per Agri-Park (500 m2). (DARD, 2017)

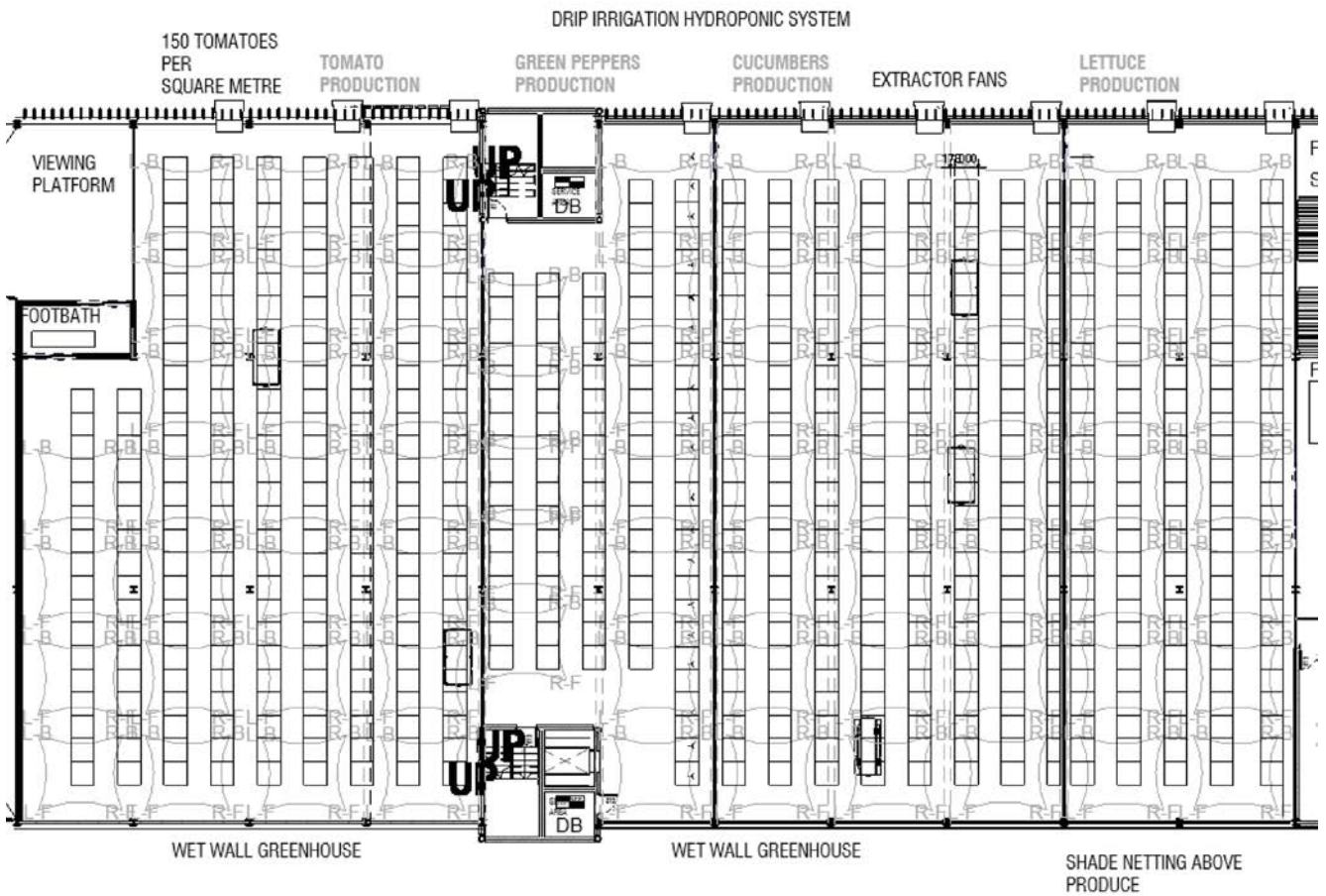


Figure 31: Greenhouse Design (Author, 2019)

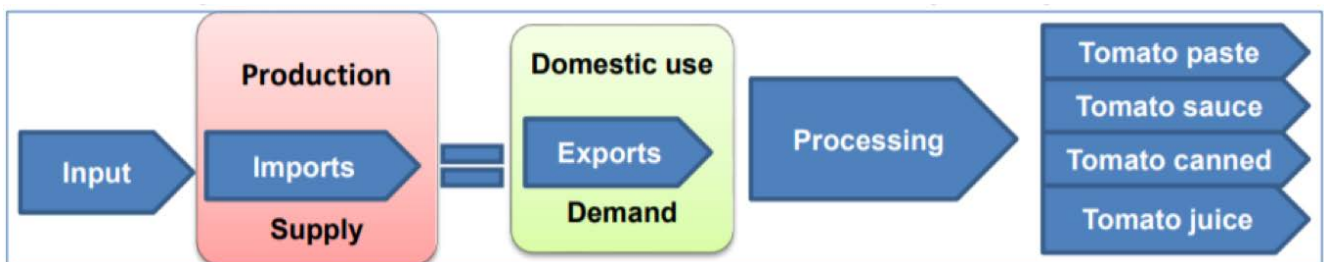


Figure 32: The Production Processing Plant Flow Diagram. (Innovation Hub, 2012)



Figure 33: The Sun Sets over the Township of Mamelodi. (Nath, 2015)

CHAPTER 4

THEORY

4.1. THEORETICAL ARGUMENT

The theoretical approach of the design is to understand the regenerative design principles. Then the policies will be applied in terms of the program and the Mamelodi context.

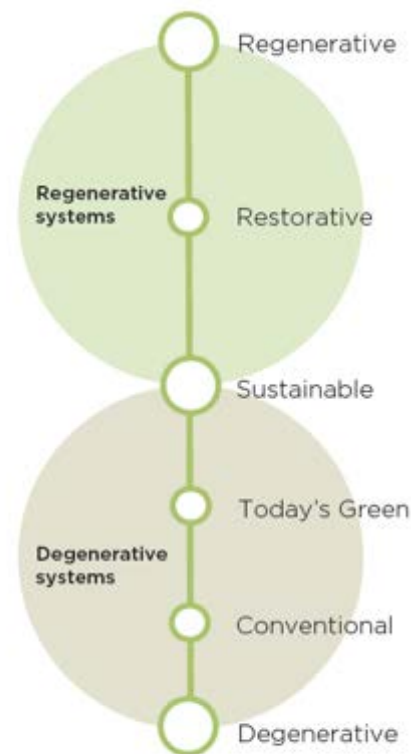


Figure 34: Moving from Degenerative to Regenerative. (Mang et al., 2016)

4.1.1. Regenerative Design

Regenerative design (Figure 23) is a holistic approach to design by understanding the intricate systems and processes involved. The word "regenerative" defines the process-oriented whole systems methodology that aims to restore sources of energy and materials. By using this method, there can be robust systems and mutual benefits that integrate nature and the needs of the society (Littman, 2014: 7). This theory will start to unlock different systems found in the area as well as integrate the social, economic as well as the environmental so that growth in the area can begin to happen. (Figure 24) Illustrates how regenerative architecture can become a living system design. Central to the regenerative design ideology is the whole living systems thinking which is defined by Mang et al., (2016: 6).

According to Breed (2013), the main requirements for sustainability are represented (Figure 25) " building of social capital (place attachment, identity and sense of place), the reclamation of the landscape (allotment gardens and permaculture) and broadening of function (multifunctional landscape and green infrastructure)." For the site to be regenerated, the design needs to fulfil these requirements. In the Regenerative Design book, Mang (2016:7) further elaborates on the notion by stating that our place should be ecologically designed landscapes whose multiple functions can serve the needs of the people Mang et al., (2016:7). The systems according to Mang "working systems that blend agro-forestry, intensive agricultural and gardening, aquaculture and recreation". The systems can lead to space where local citizens train young people to managed integrated ecologies.

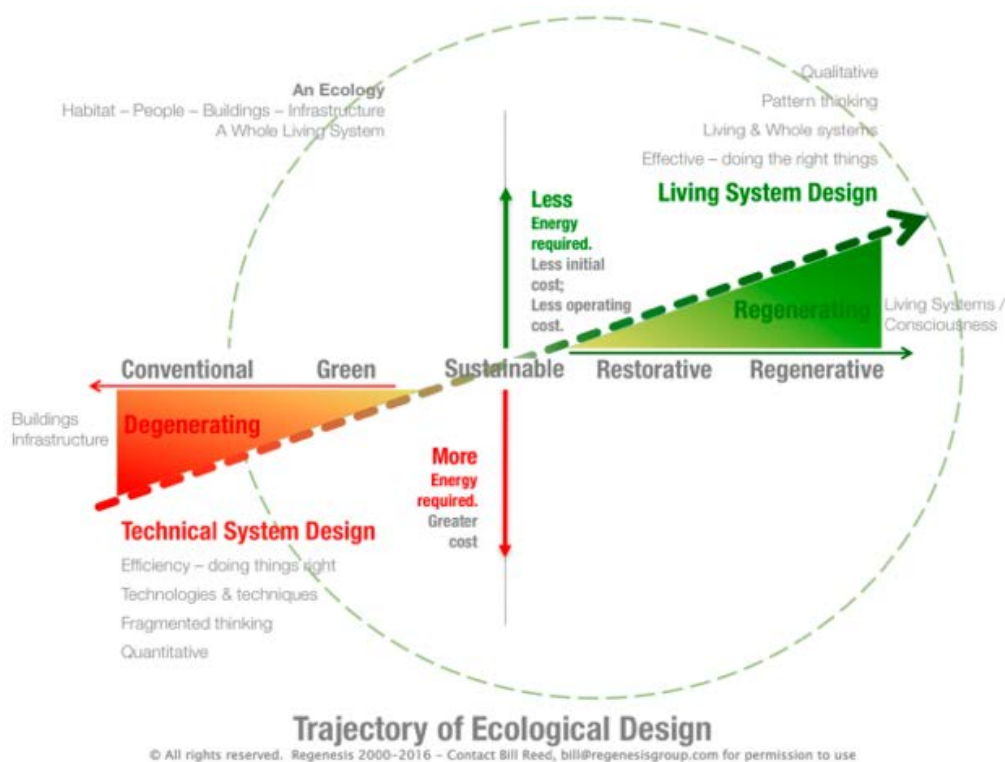


Figure 35: Trajectory of Ecological Design (Mang et al., 2016)

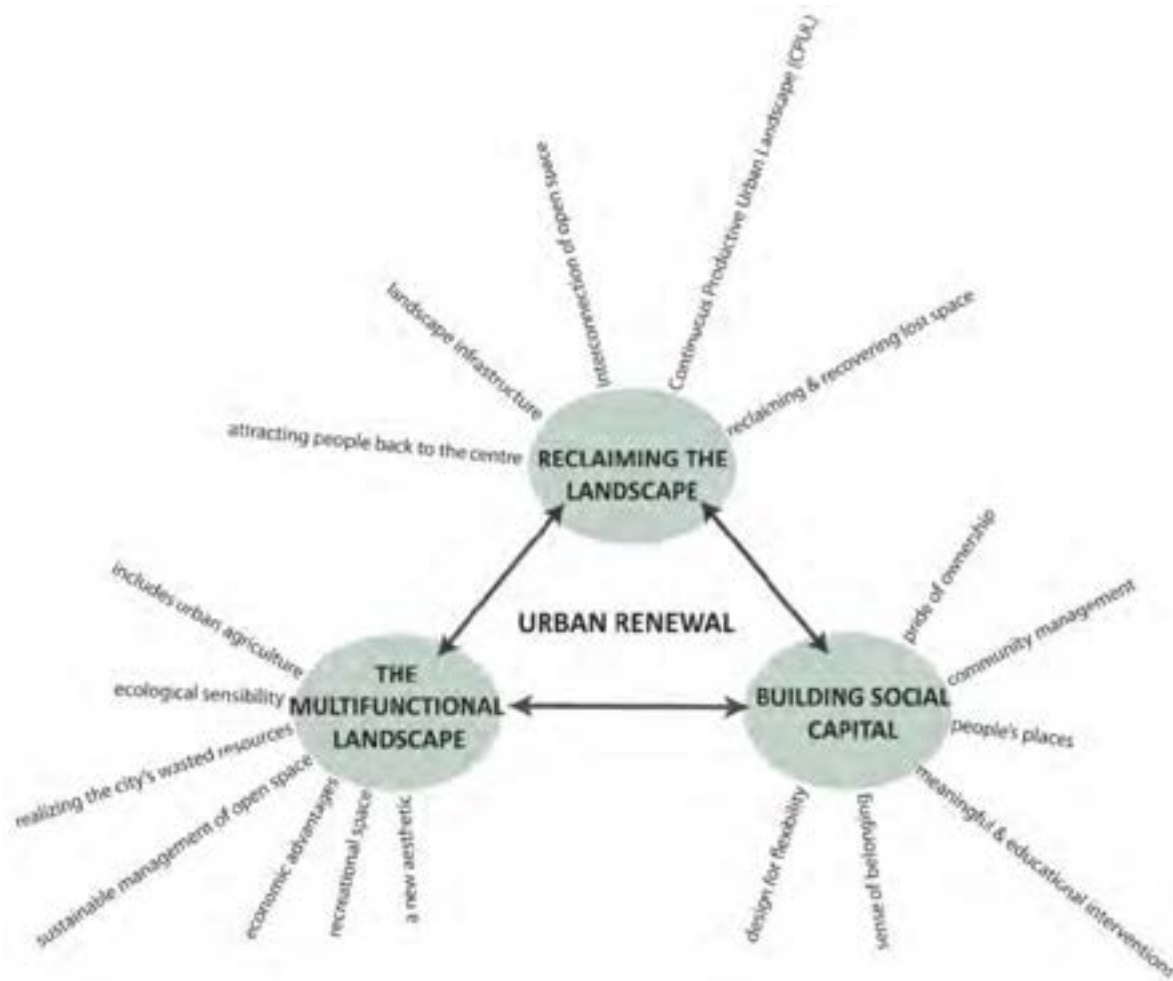


Figure 36: Research Methodology: Proposed Approach of Facilitating Sustainable Urban Renewal Through the Tripartite Relationship Between Reclaiming the Landscape, the Multifunctional Landscape, and Through the Building of Social Capital. (Rossi, 2012)

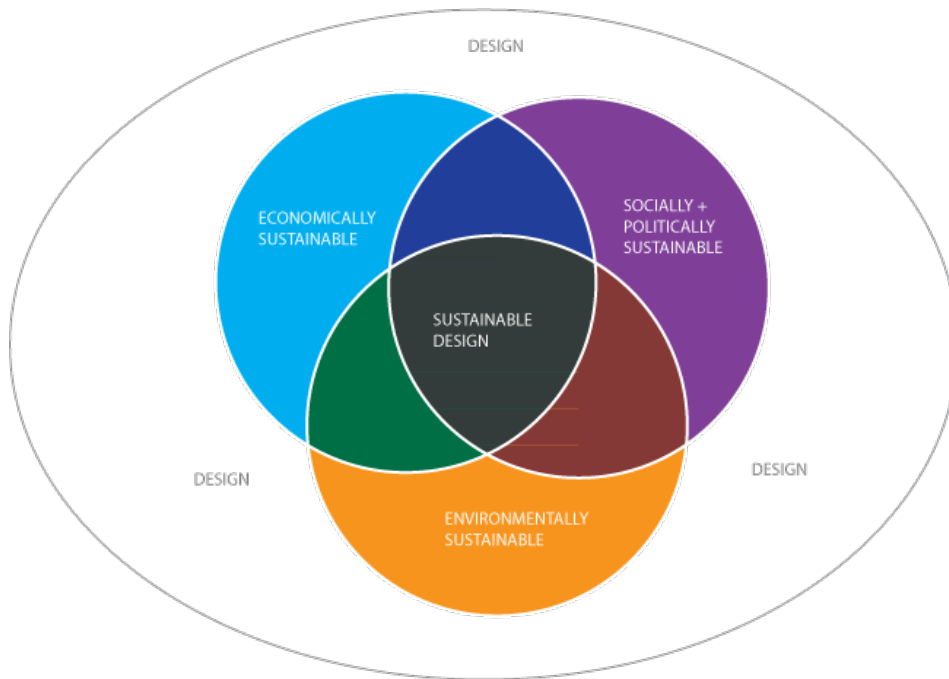


Figure 37: Sustainable Design. (Mang et al., 2019)

Regeneration theory understands the building from a social, economic and environmental perspective.

SOCIAL - The social aspect of urban agriculture is food security of the area as well as the nutritional issue (Sprecht, 2013: 34). The design is as a way to bring the consumer to the producer and people to start connecting with how food produced. The design will improve community food security, serve as a design inspiration, improving food security in the area and an educational facility for the community.

ECONOMIC - Moller (2008:16) indicates that the high unemployment rate in Mamelodi is at 63.6 per cent as this is part of the general issue at hand, by using architecture as the infrastructure to empower the informal vendors that in the area. Empowerment tool will trigger economic growth that will have an impact on the network in the area. The increase will lead to unemployed citizens attaining jobs. The prices of the product will be affordable for the

existing population since the building is accessible to the people of Mamelodi. Also, the farmers around in Mamelodi can process their tomatoes in the facility.

ENVIRONMENT - The meaning of Adaptive capacity is the ability for a system to be able to adapt to a situation which changes over time, for example, natural systems and social networks (Mang et al.,2016:10) For the study, Agriculture has the potential to provide benefits that are not necessarily related to productivity, but that can enhance the landscape of Mamelodi.

One of the regenerative strategies is understanding the whole before the design. "To create regenerative projects, the three levels of the system need to be taken into consideration which is the potential of a project, the potential of the place, and the contribution to a larger whole. This nestedness of potential is part of the reason for the ripple effect that regenerative projects can have." (Figure 25) Mang et al., (2016: 129)

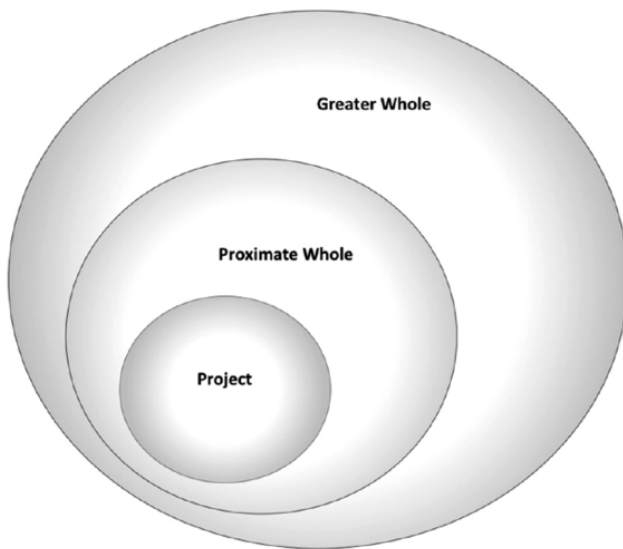


Figure 38: Every project is within its place (it is proximate whole), which is within a greater whole. (Mang et al., 2016)

Regenerative design response the food insecurity:

This about understanding the network that exists in the area for a design to have the full impact. "Regenerative Architecture integrates with its 'place' - with the more significant social and cultural systems present in its contextual milieu." (Pakard et al., 2011)

Greater Whole (Macro Scale) - In the project addressing the food network is critical. There is a farming community that is integrated into the design in Mamelodi, see (Figure 27)

Proximate Whole (Meso Scale) - This scale starts to have a direct impact on the design, which is the malls, informal vendors and taxi.

Project (Micro Scale) - The urban decaying issue found on site, as well as the problems identified in the Site Analysis.

Regenerative theory response to urban condition:

The site is currently undergoing urban decay. A suitable answer is by creating a building that has a positive effect on the community.

Regenerative theory response to the architecture:

Since the industrial revolution, the industrial typology has undergone minor changes. Industrial buildings still are mono-functional and isolated. Regenerative design challenges this idea by creating a model that has multi-functionality and architecture that integrates into the existing network. (Mang et al., (2016)

Regenerative theory response to the programme:

The Agri-Park is trans-programming which is "combining two programmes, regardless of their incapacibilities together with their respective spatial configurations" (Tshumi, 1996). By using trans programming, new spatial relationships form. Integrating the agri-food system into the existing township life will make life in Mamelodi sustainable. It will start to solve the issue of unemployment by creating new employment such as harvesters, growers and food distributors.

4.1.2. Productive Landscapes

Since there is a disconnection between consumers and producers of food, urban populations have a limited understanding of the food production process, therefore issues that exist in the food network usually go unnoticed (Viljoen, 2006: 21). Productive Landscapes are being used in because they present a solution to making Mamelodi a self-sustaining economic node. Multi-functionality of use works better for social cohesion as compared to mono-functionality. Since productive landscape promotes mixed-use, this can reduce transport costs between production, processing and retail to create a better local economy and a reduction in greenhouse emissions. A fertile dynamic landscape that builds resilience and adaptability to change social, economic and environmental stimuli. The most significant environmental benefit

of urban agriculture is the reduction of food miles; therefore, there is lower carbon dioxide emissions and embodied energy (Department for the Environment Farming and Rural Affairs, 2005). The design of the dissertation will also bring direct access to the product for the people of Mamelodi.

4.1.3. Urban Agriculture, Food Industry & Sustainability

In the world, urban growth has placed enormous strain on food production. All the stakeholders in the food network must find ways to supply the ever-increasing food demand and sustainable food production, according to some scholars, is the solution. Currently, there are innovative buildings which combine production food on a large scale in urban areas (Sprecht 2013: 34). By having a programme such as an Agri-Park, the environmental benefits of this endeavour can start to save and recycle the resource and reduce the distance of receiving fresh produce. In economic terms, the benefits are the “provision of public benefits and commodity outputs” (Sprecht,2013:34). The bi-products in the design will re-integrate into the park resulting in a closed-looped system which is one of the strategies used in a regenerative system.

Principles of Regenerative Design according to Mang et (2016: 3-4)

- Design for evolution - Designing for future development that will occur, which will lead to the concept of adaptability.
- **Response:** The building will be a semi-flexible structure to allow for a change in the programme

- Partner with space
- **Response:** These principles speak about understanding Mamelodi as space and the potential it has
- Call forth a collective vacation
- **Response:** The community needs to know why is this structure created for them and optimise the use
- Actualise stakeholder system toward co-evolving mutualism
- **Response:** The Department of Rural Development and Land Reform was consulted throughout the design process since the branch is responsible for agri-parks.
- Work from potential, not problems
- **Response:** Mamelodi has plenty of opportunities with regards to the social capital and informal industry.
- Find distinctive, value-adding roles
- **Response:** What will make this project unique is the program. Transprogramming offers new design opportunities
- Leverage systemic regeneration by making nodal interventions
- **Response:** The node that the design on Tsamaya Road and the different transport interchanges. Tsamaya Road is the main route in Mamelodi.
- Design that proves to be developmental
- **Response:** Bring in a new programme that has meaningful change will start to bring offer ways of solving the world's problems

- The actualisation of a self requires the simultaneous development of the systems of which it is a part, Become a systems actualiser.
- **Response:** The Agriculture Small-Medium enterprise has untapped potential because most of the entrepreneurs need infrastructure for growth.
- Systems are an integral part of the design
- **Response:** For the Hydroponics plant, evaporative cooling cools the area.

In summary, the regenerative design will be the leading design theory in the dissertation. How the principles worked and understood will be used in the design. The major theoretical principles are understanding how does the building affect the whole. Other theories, such as social infrastructure will supplement the argument.



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CHAPTER 5



PRECEDENT STUDY

The precedent used in the investigation will guide in terms of the design development and understanding the complex spatial relationships that exist.

5.1. SITE/FACULTY VISITS

The innovation hub was investigated to understand the production and processing of produce.



Figure 40: The Agri Park in the Innovation Hub. (Author, 2019)

Name: Innovation Hub

Location: LC De Villiers

Function: Hydroponics Plant

Design Application: The Innovation Hub is as a case study for the thesis. This area grounded the feasibility study. The typology, as well as the environmental consideration, will be used in the scheme.



The Agri-Park (Figure 28) is in the experimental farm in LC De Villiers. The Agri-Park clients are Pick n Pay and Woolworths. Observation of the tomatoes suggests that the plants are of high quality with regards to the shape and not defects. The packaging is done on-site. The hub can produce 10 000 tomatoes monthly.

Name: Tshwane Fresh Fruit Market

Location: Marabastad

Function: Distributor of Produce

Design Application: The Tshwane Vegetable Market is an ecosystem within an ecosystem. The focus of this facility is aquaponics.

The Tshwane Fresh Produce Market (Figure 29) is a principal market that, in essence, distributes fruit and vegetable to Tshwane as well as the rest of the country (CoT, 2015). The exchange aims to empower small scale farmers and various producers within the capital, and compliance testing is carried out to ensure the food is up to standard. As a result, food security and food safety reduce (CoT, 2015) The informal vendors have to travel 32 km for the vegetables and fruit. The market is 58 957 square meters and includes cold rooms and wholesalers.



Figure 41: Tshwane Fresh Fruit Market. (Author, 2019)

Name: La Apieza Centre

Location: Kameelfontein Estates

Function: Aquaponics Centre

Design Application: Aquaponics, in essence, is the combination of hydroponics and aquaculture. Aquaponics is a complex system of biological processes. Eco-systemic is integral in creating an aquaponics centre. The design solution can start to generate architecture from such a process.



Figure 42: Aquaponics Centre. (Author, 2019)

5.2. CONTEXTUAL PRECEDENT

The Baragwanath Transport Interchange (Figure 31) designed by Urban Solution is essentially a mixed-used design, which caters primarily to the public. The building is in an area of Soweto, which is underdeveloped. The structure is set to trigger economic growth as well as develop public spaces in the region (Deckler et al., 2006:66). There was a need for a transport node in this area of Soweto, especially since it is close to Baragwanath Hospital.

The success of the project comes from the fact that there is high pedestrian traffic. There is a symbiotic relationship between the different types of programmes in the design. The plan is to accommodate 500 street traders, with associated storage facilities, management offices and support infrastructure. Transport planning includes 22 bus ranking bays to serve the long and short distance commuters, 650 minibus taxi holding, ranking bays representing 12 different taxi operators serving the routes between Johannesburg and Soweto. (Deckler et al., 2006:66).



Figure 43: Baragwanath Transport Interchange. (Deckler et al, 2006)

Name: Baragwanath Transport Interchange

Architects: Urban Solutions

Location: Johannesburg

Function: Transport Interchange

Design Application: Concrete and brick were chosen because of their robustness, especially where there is a high volume of pedestrians. The synergy between the different programmes is successful.

Since the Apartheid spatial legacy is present, transport interchanges are essential nodes for most townships. The building intended to create an economic node where transport, and a market can be acknowledged for its importance in the context, especially if it one of the busiest interchanges. (Archidatum, 2019). Apart from the functional aspects of the design, it has become a gathering space for the commuters. Community engagement approach to the design were stakeholders such as people from the taxi industry, officials in the taxi and bus industry as well as the informal vendors. The process took approximately six years to complete. (Deckler et al., 2006:85). As one enters the building, there is a clear visual link through the market. There is a linear axis that connects the programmes of the building. The vendor network is present in the space. The bustling taxi industry represented by twelve different operators have a combined requirement for approximately 800 holding bays and ranking. (Archidatum, 2019).



Figure 44: Baragwanath Taxi Rank in Diepkloof, Soweto. (ENCA, 2017)

5.3. FORMAL PRECEDENT



Figure 45: Perez Art Museum: (ArchDaily, 2019)

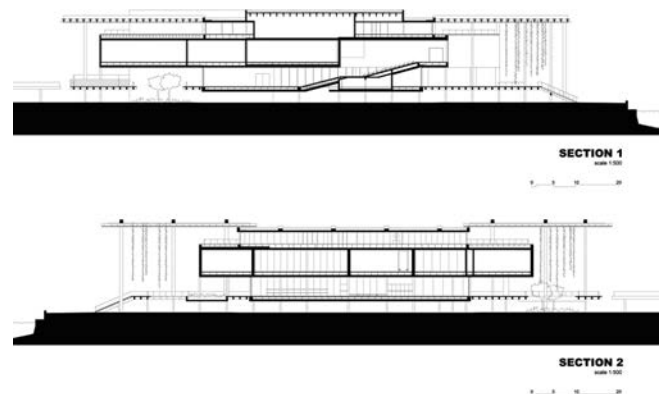
Name: Perez Art Museum

Architects: Herzog & De Meuron

Location: Miami

Function: Museum

(Figure 32) Concrete columns support the building roof. Underneath the canopy is a public space for the people of Miami. This open space acts as a threshold between the building and the streetscape. This space welcomes people into the building. The water was one of the significant design informants because the art inside the museum has raised the ground because of the storm surge level (Archdaily, 2019). The plant and roof combine to minimise the temperature difference between inside and outside in hot weather (Archdaily, 2019). One of the most critical spaces in the building is the stair. The stair is an event space or space where people can gather.



How the architecture of the building expresses, is by the vegetation, columns, platform as well as the veranda that, which occupies the site as a whole. (Archdaily, 2019). Since galleries do not have a specific dimension, there was freedom for the architect to play around with different shapes and forms. "There is a weak layer between the inside, and the outside, (Archdaily, 2019) added Herzog. The flow of these spaces is mainly because the building blurs the lines between inside and outside.

This design has become a landmark for the city of Miami.

What makes this design successful is that it was able to use the lush vegetation and climate of Miami and turn it into great architecture. As stated previously, the environmental informants ended up becoming the central concept of the design. (Arcdaily, 2019).

Design Application: The tree-like canopy that is supported by concrete columns is also space making. There is no inside or outside; Herzog and De Meuron blur this spatial continuum. The landscape has been brought as part of the design to reinforce the blur further. The museum consists of anchor areas which servant spaces and entertainment areas which that acts as served spaces

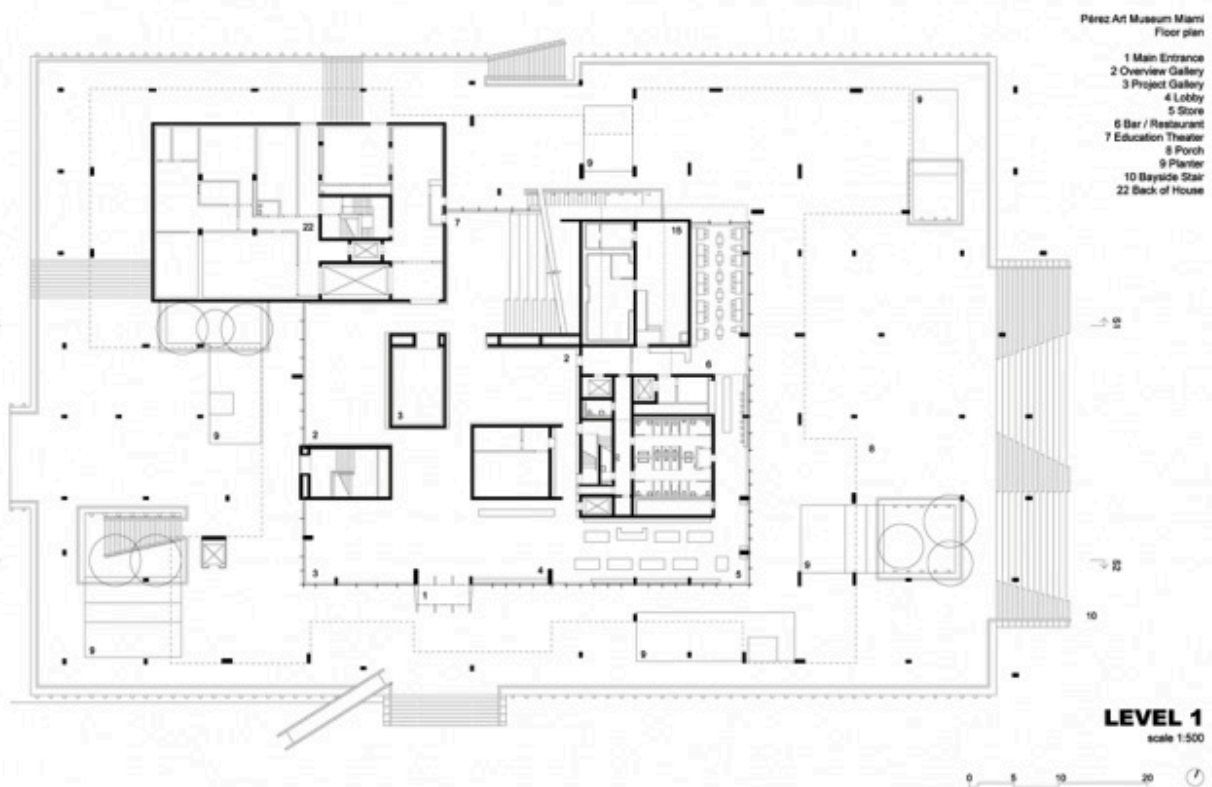


Figure 46: Floor Plan, Level 1. Perez Art Museum Miami. (Lalueta, 2013)

5.4. FUNCTIONAL PRECEDENT

Name: Research Center ICTA-ICP

Architects: UAB/H Architects

Location: Barcelona Spain

Function: Research Center ICTA-ICP

From the onset, the building was about responding to the challenges faced in the sustainability paradigm. A research study to understand what do the user need and to use the structure. (Archdaily, 2019). This design theory can start to inform the regenerative design theory.

(Figure 33) Structure: Concrete is used mainly of its compressive strength and structural purposes; in this precedent, for passive comfort inside the building. (Archdaily, 2019). The skin of the building is bioclimatic. The aids in the base comfort of the space, as well as solar gain and ventilation, are regulated. As part of the regenerative theory, organic and recycled materials are the building's construction. The water conservation aspect is by using rainwater, greywater, yellow and wastewater.

Design Application: On the facade, the structure looks like a box building, but on the plan, it is a porous building that has the feel of a city. The research centre enhances the whole water cycle by reducing demand and consumption through the reuse of wastewater, greywater, and rainwater. (Archdaily, 2019). Since the design is about creating a building that gives back, the systems will also contribute.



Figure 47: Research Centre ICTA-ICP. (Archdaily, 2019)



Figure 48: Gugulethu Central Meat Market. (CS Studio Architects, 2019)

5.5. TECHNOLOGICAL PRECEDENT

Name: Gugulethu central meat market

Architects: Carin Smuts Studio Architects

Location: Gugulethu, Cape Town

Function: Meat Market

Akin to the Baragwanath Transport Interchange, the Gugulethu Meat Market underwent as many workshops, meetings with local stakeholders and negotiations. At the beginning of the design, a European style market was the idea. As the traders and local stakeholders started to get involved in the project, the design evolved to a more contextual response, according to CS Architects. The street

vendors request was to create a wall that can effectively block the prevailing winds from the South and West. This form an L-shape typology.

The Meat Market project (Figure 34) is was chosen on the basis that it is a highly industrial building but can still cater to the consumer who needs to braai meat with his scale. How the design understands range is successful. Same as the Perez Art Museum, the giant wave roof covers the whole trading area. The roof, which a wave-inspired the form provides the vendors and client with shelter for a great space. At night time, the wave-like ceiling lights up. The lights create the impression that the roof is floating which was one of the design intentions. Roller shutter doors close the space during the night.

Design Application: The principle of creating a space for informal vendors as well as the large abattoir is designed well in the Market. The understanding of scale in terms of this space works for an informal vendor in the Agri-Park.

To summarise, the precedents chosen will have an impact on the design. The link between all of these programmes is the response to the user and how the user uses the space. The analysis of the precedents will bring a better understanding of how the form of the building and how to make it work better. The examples of the design will inform that design development.

CONCEPT

The proposal seeks integrated architecture with the existing community of Mamelodi by creating social infrastructure, which is the subcategory which focuses on social services and design (tangible or intangible) that have a social benefit. Mang et al., (2015:6) argue, for example, libraries and public spaces. These spaces have an impact on the citizens because space is resilient and brings a positive outcome to the citizens. The aim is to develop a design that can assimilate with the existing networks, for example, food and social. The plan seeks to create a multi-functional landscape and architecture for the Mamelodians. With this design, the Mamelodians can also understand the agricultural food system, as a space for social infrastructure.

CHAPTER 6



Figure 49: Gogo a Champion to All. (Mpumalanga News, 2014)

6.1. CONCEPT APPROACH

The conceptual approach in the dissertation is Adaptable Architecture. Adaptability is a design strategy that focuses on services, spatial functions and structures that are flexible in responding to inevitable changes in the functional aspects of the design over some time (Schmidt, (2016)). This ideology rejects the idea of a static building but favours a more flexible structure that can evolve to fit functional and societal changes. For adaptability to be a robust current emphasis, on the physical structure needs to shift towards how the building can adapt for the user or the context. A more adaptable architecture will stay in service for longer, and the utilisation of the design will be more efficient. The adaptability of structures enhances the long-term performance of a structure.

The stimuli for the adaptation will be primarily of the user and the crop rotation. A building that can adapt to a change is paramount for sustainability (Graham (2005)). The term adaptable architecture describes an architecture from which specific components can be changed in response to external stimuli, for example, the users or the environment. Leileveld, (u.d.) and Schmidt (2016) argues that there is a need for adaptability because efficiently defined spaces were not usable in a different configuration, which can lead to unused space. As previously stated, unused space can lead to urban decay.

One of the adaptive architecture strategies is an open plan design. Open plan design involves, according to Louis Kahn, ""the separation of servant spaces from served spaces as a way to reduce obstructions in the building where circulation and service ducts are located"" (Schmidt, (2016)).

These design strategies allow for the building to be adaptable and, thus, able to change in certain circumstances

6.1.1. Why is Adaptability Remarkable?

Buildings are an asset to an industrialised economy in terms of financial, physically as well as a cultural aspect. The sparse use of buildings is apparent in urban areas in cases of urban decay as well as poor management and maintenance. For material choice durability is essential. Durability allows for assemblies and systems that require less repair and replacement. Currently, technological advances are going at an increasing rate. Building fails to satisfy the new requirements that are needed, such as provision for more space or a change in function. A construction that can adapt can start to be the solution to the abovementioned issues. Croxton (2003) states that "if a building does not support change and reuse, you have only an illusion of sustainability." Sustainability is an integral part of the design process which can make buildings last longer and serve the needs of the users.

6.1.2. What Makes a Building Adaptable?

Stewart Brand (1994) categorises the different layers of a building into the stuff, space plan, services, skin, structure and site. Duffy (1989) understands the layering principles by having four layers in the building. The 'Shell', is the overall structure as well as the foundation with can last until 50 years. The services can last up to 10 to 15 years. The scenery is the specific elements such as partition, finishes and furniture with the last 5 to 7 years. These are changed at any time and are the most flexible, Duffy and Henney (1989:62). One of

the strategies to make a building design to adapt quickly is by the "integration of the components which allows for the component removal from the building". Brand (1994) further elaborates on uses the principles of adaptability to allow the users to adapt the building to their needs. Slaughter (2001) also reinforces the ides providing dedicated system zones which is akin to Louis Kahn's theory of "served and servant spaces".

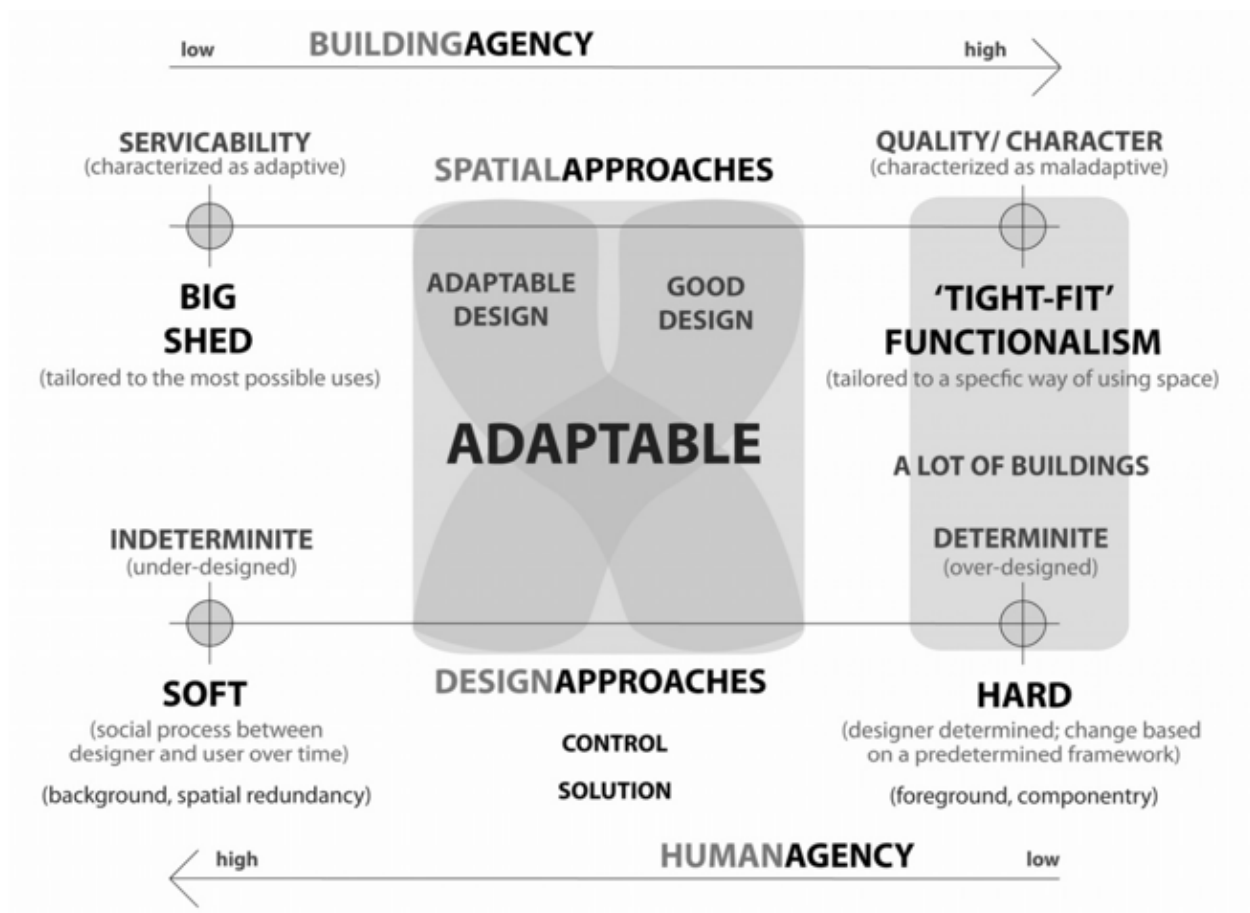


Figure 50: Adaptability Scale. (Brand, 1995)

(Figure 35), Schmidt (2010) defines an adaptive building with the following principles namely;

Performance-based buildings - Part of architecture is performance-based buildings. The main aims of the strategy are maintaining and the functionality of the building. These factors are important in terms of the people, programme and planning of the design. Slaughter (2001).

Building Responsiveness - The responsiveness aspect comes from the fact that a building can respond to specific changes that occur in the environment through location and variable mobility. This principle is related to the concept of adaptability. Hoberman et al., (2009).

Accessibility - According to Lifetime Homes (2009) to describe making spaces accessible for all concerning stages of life and various special physical conditions. The accessibility challenged in different types of situations and multiple stages of life experience.

Open Plan - Part of the adaptability strategies is creating space in which from a large scale can divide into smaller sections, which allows for flexibility of the design. Gelis (2000).

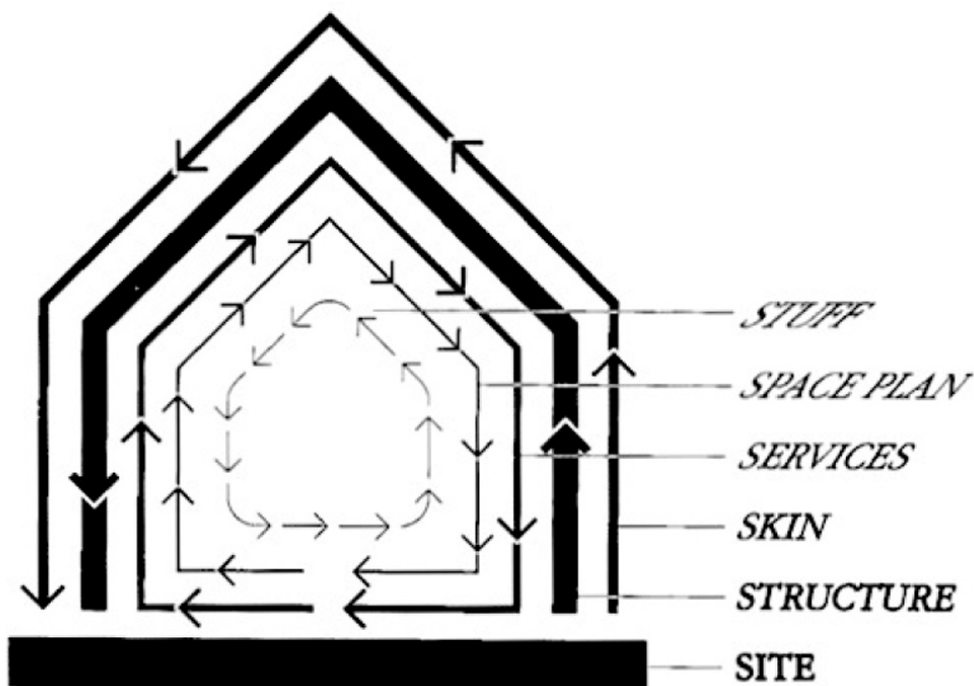


Figure 51: Building Layers. (Brand, 1992)

The following quote can summarise an adaptive building, "an adaptive building has to allow slippage between the differently-paced systems of site, structure, skin, services, space plan and stuff." The adaptability concept, (Figure 36), according to Stewart Brand (1995: 38), is divided into these aspects.

SOCIAL: The social aspect of the design in creating places in which people that work in the building can have a space to congregate and gather.

STUFF: Movable items such as furniture or a phone, which can be replaced monthly or daily.

SPACE PLAN: The spatial planning that is in inside the building. An example is the floors and buildings of structures.

SERVICES: The services in the scheme will be electricity, gas, HVAC system, fire as well as the water. These services will be placed under the roof of the structure to allow for the servant and served spaces in section. Also, a plant room is part of the scheme.

SKIN: For the skin of the building a steel louvre system is proposed. This will be used to shade the processing area as well as bring enough sunlight into the greenhouse facility.

STRUCTURE: According to Stewart Brand, the load-bearing and foundation elements are in a nutshell expensive to change Brand (1995:38). A portal steel structure houses the services and functions. The material is selected for the plan because the idea of flexibility and adaptability can be carried through with the material.

SITE: The "site is eternal" as stated by Brand (1995: 38), the spatial location which will last forever.

SURROUNDINGS: The surroundings of the building. The fact that it is in Mamelodi will have an impact on the design of the structure.

6.1.3. How the Concept Relates to Important Design Considerations of the Scheme

SITE: According to the GAPP Architects Framework (2011:88), "the city policy will start to promote the use of unused open spaces for urban agriculture".

PROGRAM: The Agri-Park programme in itself is multi-functional space. As the design evolves, there might be other instances of trans-programming happening where the informal market meets the processing area and how these different programs work in unison.

USER: Space will provide an area for a multitude of users. The primary user will be the informal vendor who adapts to a particular space to create income. As investigated in the research, vendors have to adapt to street edges, taxi edges as well as building edges.

HERITAGE: Denneboom station is a site of heritage significance because it has passed the sixty-year threshold. As previously stated, the station accounts for 250 000 pedestrian traffic daily; therefore, that will densify the building and make it the long term use feasible.

SUSTAINABILITY: Adaptive architecture is a sustainable strategy. The construction method is a framed structure with flat slabs. The construction method can convert into different spaces and functions. Other advantages that relate to the sustainability aspect is modular construction, shorter building time; it is cheaper and less waste compared to typical construction methods.

THEORY: One of the regenerative design principles is adaptability. The concept of the scheme had to be related to the argument. (Figure 37) indicates the different strategies in which a designer can use to maximise the adaptability concept.

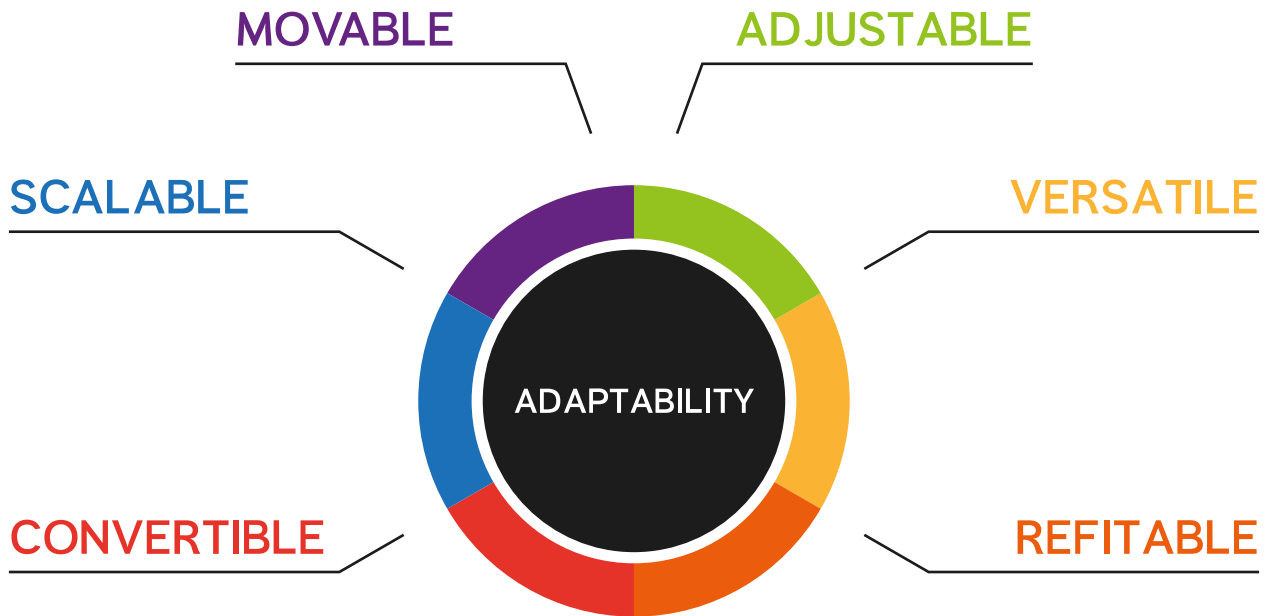


Figure 52: Design Strategies for Adaptability in Buildings. (Adaptable Futures, 2012)

The programmatic concept of an Agri-park is to challenge the existing typology of industrial buildings by creating an agri-park that makes a difference to people.

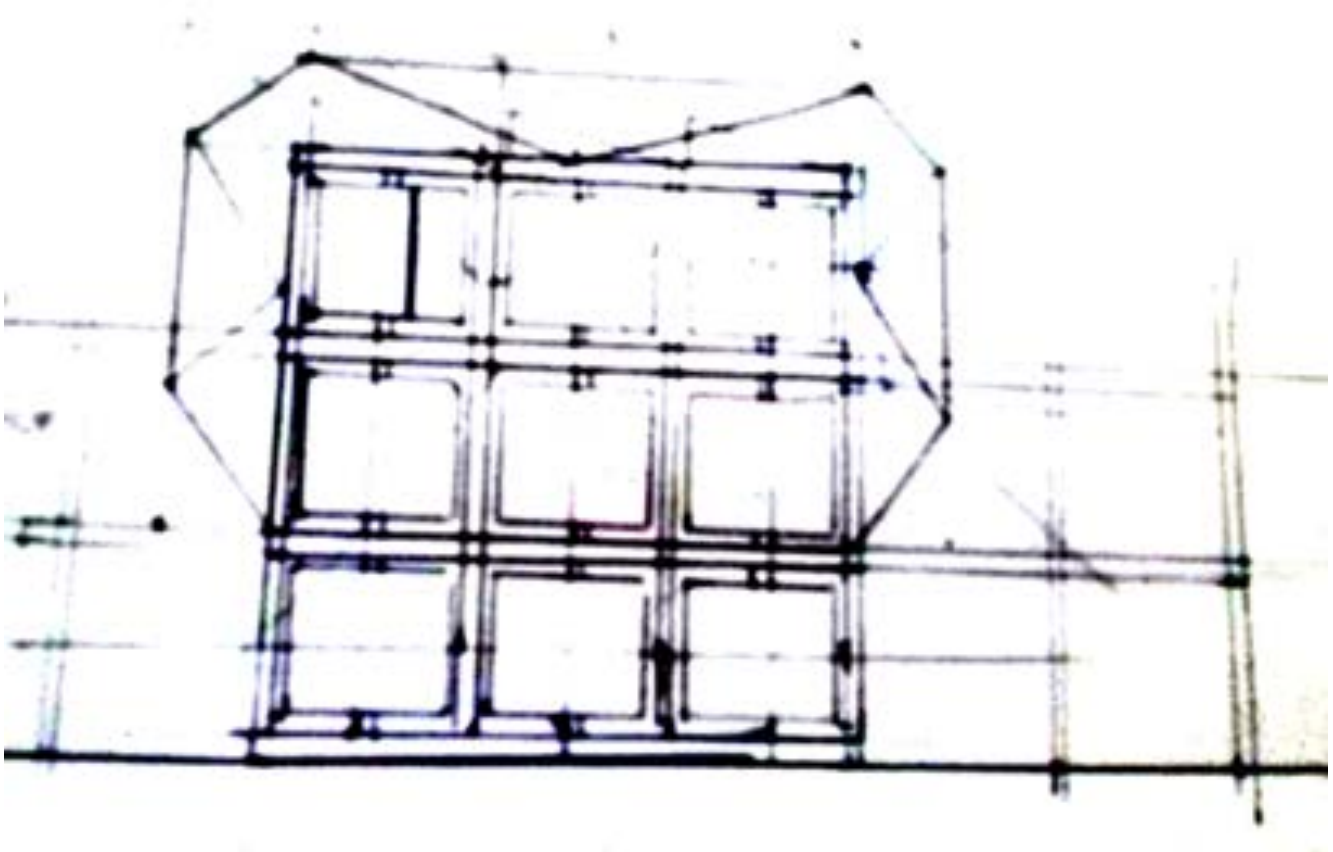


Figure 53: Concept Sketch of an Adaptive Shed. (Author, 2019)

6.2. FINAL ARCHITECTURAL CONCEPT (IDEAS TO CONCEPTUAL SCENARIOS)

Part of the architectural concept is about the understanding of layers in the Mamelodi context. Thus we should see buildings not as finished, stationary works but as work in progress that will change over a period in time to suit technological, functional and aesthetic changes in civilisation (Figure 38). As Hertzburger (1991), Schmidt (2016) once famously said that the user of the building has a significant influence in terms of the identity of the building. Therefore architecture should facilitate areas of space in which the user can influence in whichever way possible.

To summarise, the concept chapter starts to signal the design intentions of the dissertation. Adaptability can begin to create new ways in which people can interact with architecture as well as architecture that responds to peoples changing needs. Chapter seven is the beginning of the design resolution of the thesis leading up the technification.



Figure 54: Composition-desk-document-545053. (Generation 2.0. 2019)

CHAPTER 7

DESIGN DEVELOPMENT

The scheme of the dissertation started as a food production plant. As the designed further progressed, there was a need to create space for the displaced informal vendors because of large retail chains that have firmly placed their grips on the township. The greenhouse was a later addition because part of the regenerative theory is sustainability. In this particular case, reducing transportation miles which can create food waste and more expensive produce. Lastly, the final program became an Agri-Park which is "Shared packaging and cold room facilities. Out-grower Model and on-site production" (DLRLD, 2018). This programme summaries the overall intention of the design of empowering informal vendors to be more competitive in the retail industry.

7.1. INFORMANTS THAT WILL INFORM THE DESIGN

The primary informants are the industrial buildings which are situated around the site and understand how come they do not serve the communities interest. The industrial building typology will inform how the building responds to external stimuli.

7.1.1. Contextual Informants

- Social: The people of Mamelodi are low to no income group; therefore, the type of vegetables and the pricing of the vegetables will be guiding on their affordability.
- Informal Vendors: In the circulation diagram of the site, there is an indication of people moving through to Denneboom Station. Since most of the informal vendors are on the edge of the site, a pathway edge will be integrated as part of the design to activate the space. There is also an informal vendor network around the site (Figure 39).



Figure 55: Mapped Formal Trade. (Group Vision, 2019)

• 7.1.2. Physical Informants

- Heritage: Denneboom Station is a heritage building because the informal vendors in the area have been operating in the area for over 60 years. The material of the station can inform the material palette of the design. On the Northern area of the site is the Solomon Mahlangu Square the square has historical significance because of the "Mamelodi Massacre" took place in that area. How this informs, the design is bringing more people to the site.
- Railway: Is also an apartheid buffer which cuts races or different functional zones together. The railway can be used for distribution of the design and above the railway can be seen as an opportunity to bring separated spaces together.
- Tsamaya Road: This road will be a BRT route in the future, next to the site, a newly completed mall, a transportation hub and an informal market.
- Mall & the taxi rank: The mall adjacent to the site will have a significant impact in terms of the foot traffic in the area. The taxi rank brings added foot traffic.

The study area has different modes of transportation to aid the food network, which includes tuk-tuks, taxis and buses. As stated by Ledger (2016, 75) "Transportation is critical in the food network". For the food to move from one place to another, there has to be a mode of transport; therefore, understanding how transportation operates in the food networks is paramount.

7.1.3. Form Informant

- The function of the programme is for the people of Mamelodi. Space was direct access to fresh produce is found. The user of the area will start to understand how the agri-food system operates.
- Production: Agro-Processing is a complicated process in the food industry.

7.1.4. Function Informant

- The function of the programme is for the people of Mamelodi. Space was direct access to fresh produce is found. The user of the area will start to understand how the agri-food system operates.
- Production: Agro-Processing is a complicated process in the food industry.

7.1.5. Theory Informant

Regenerative Design: The main design theory will be regenerative design which will be the main theory informant. The definition of "A regenerative system makes no waste; its output is equal to or greater than its input; and part or all of this output goes toward creating further output - in other words, it uses as input what in other systems would become waste" (REGENERATIVE.com, 2019).

CONCEPTUAL SKETCH

"During the Industrial era, machine and technology played a very important role in the experimental projects of the Avant-garde. The comparison of architecture with a machine is typically for this period" (Corbusier, 1924). In the sketch of the design the idea of industrial architecture/agriculture started to form.

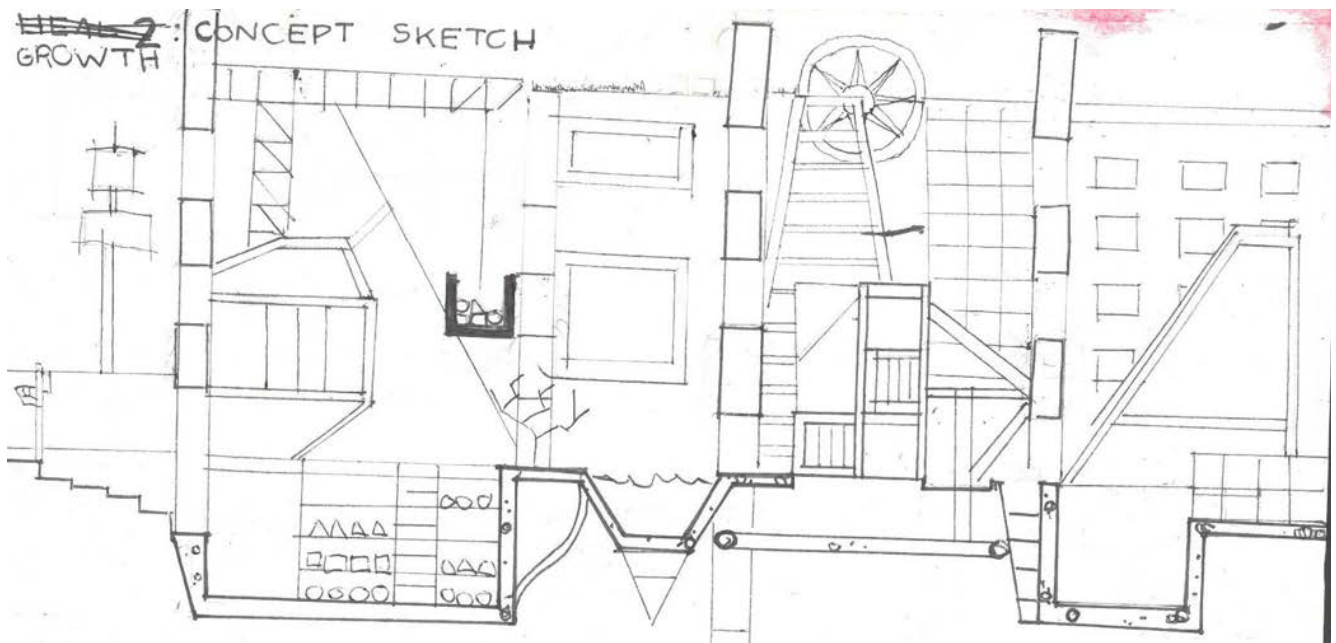


Figure 56: Early Conceptual Sketch: The early conceptual sketch speaks about industrialising, where man vegetables can be created to create value to the people. (Author, 2019)

The industrial process of producing food inspired the conceptual sketch (Figure 40). Food crops will be around the building, and green walls to create a cooler microclimate. Shipping containers can be used to store the produce in the facility. Cranes will be used to move the product to specific spaces so that they limit people moving to individual spaces. The area can become its city.

7.2. ITERATIONS OF THE DESIGN

ITERATION 1

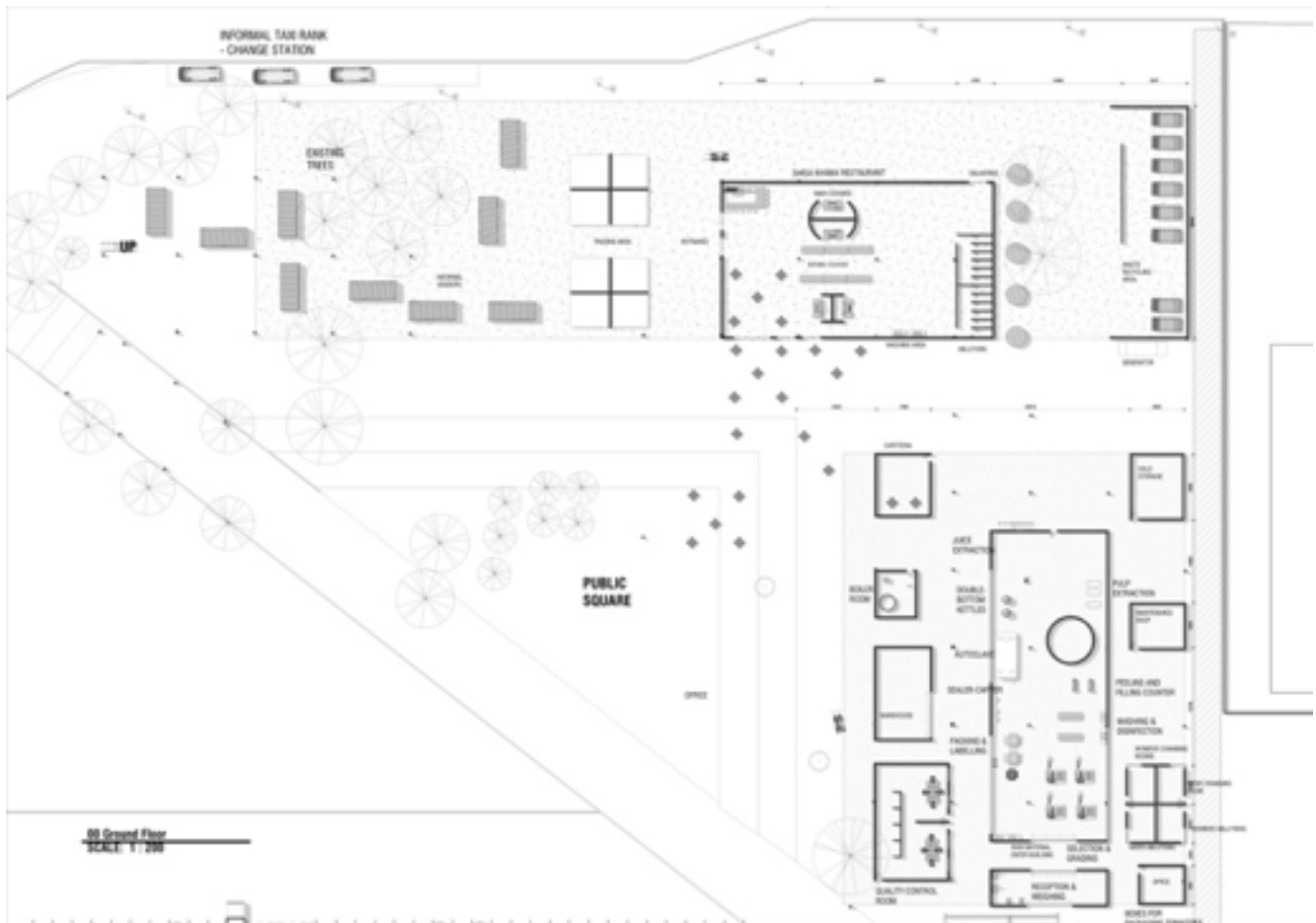


Figure 57: L-Shaped Building. (Author, 2019)

The first draft of the plan sees the Shisa-Nyama and the informal vendor space placed on the northern edge of Tsamaya Road to activate the street edge (Figure 41). The processing area is on the Eastern side, which creates the L-shape typology. A prayer space is acknowledged by placing trees around the space for a defined space. A public space for the people commuting to Denneboom station to use as a destination space.

ITERATION 2

The plan was a courtyard typology in which the negative space created becomes the courtyard (Figure 42). The greenhouses are scattered around the site so that each of the entrepreneurs can start to generate income for the chosen area. On the section, the crops use evaporative cooling. Extractor fans are commonly used to take out some of the air. The primary issue with the design is the discontinuity in the scheme that was changed in a later stage. The roof of the Market Space started to communicate vibrancy similar to the Gugulethu Meat Market Precedent.

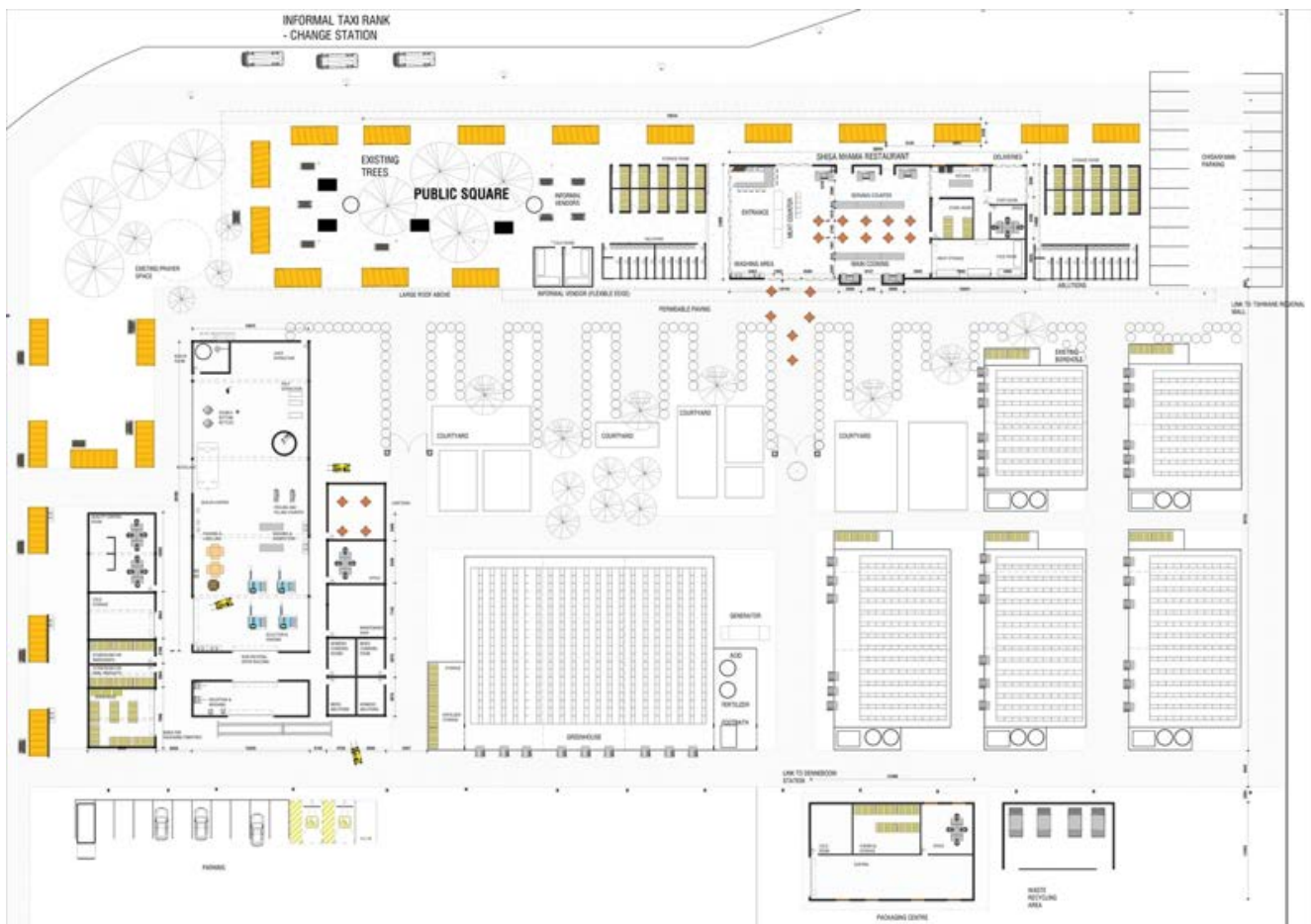


Figure 58: C-Shaped Site Plan. (Author, 2019)

ITERATION 3

For the third iterations, all the functions of an Agri-Park contained into one building. Similar to the Centre Pompidou in Paris by Richard Rogers and Renzo Piano. A central axis is proposed, where the service relate to the axis (Figure 43). Mang et al., (2016) ideas of wholistic thinking are seen in the building by understanding the context from large scale to micro-scale. Taxi Rank is included as part of the design scheme. The mall pedestrian edge is continued into the design scheme. A link between Solomon Mahlangu Square and the taxi rank penetrates through the building. Also, there is a need for public space in Mamelodi. The social infrastructure is placed at the Northern and Southern Side of the building. The greenhouses create the rhythm by being repetitive along the axis. The greenhouse house correlates with the mall to continue the fabric. A productive landscape is placed on the front edge of the site to guide the consumer into the building.

The taxi rank is on the Southern side of the site to louvres.

This diagram starts to bring the fire escapes into the design (Figure 44). As well as a terrace for the Western Elevation. On the Western and Eastern facades, vertical louvres will be included, on the Eastern and Northern facade will be horizontal louvres.

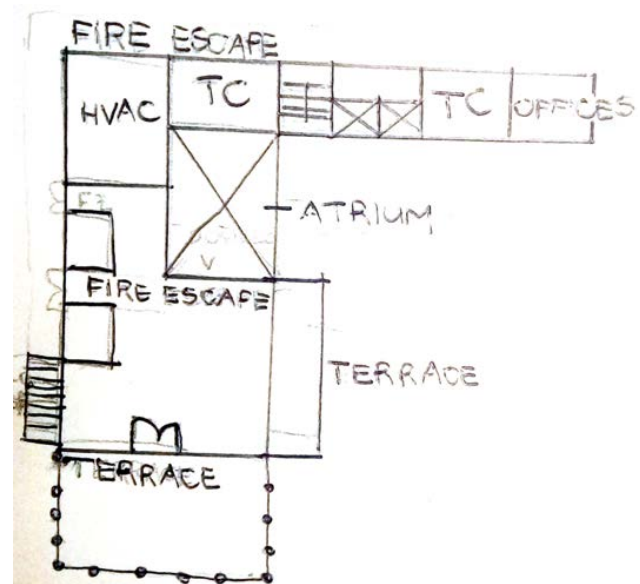


Figure 59: Programmatic Summary. (Author, 2019)

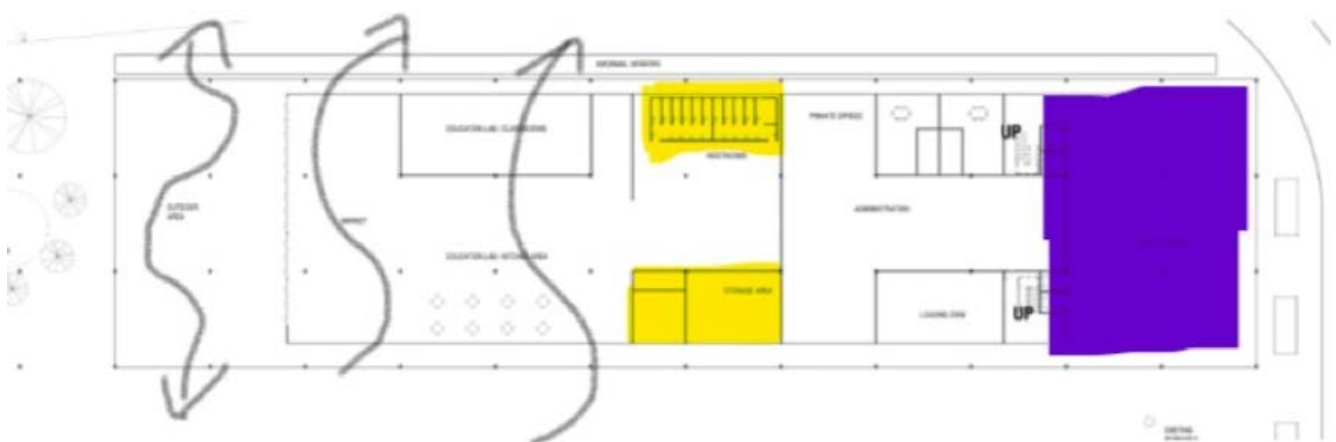


Figure 60: One Building with Three Main Functions. (Author, 2019)

ITERATION 4

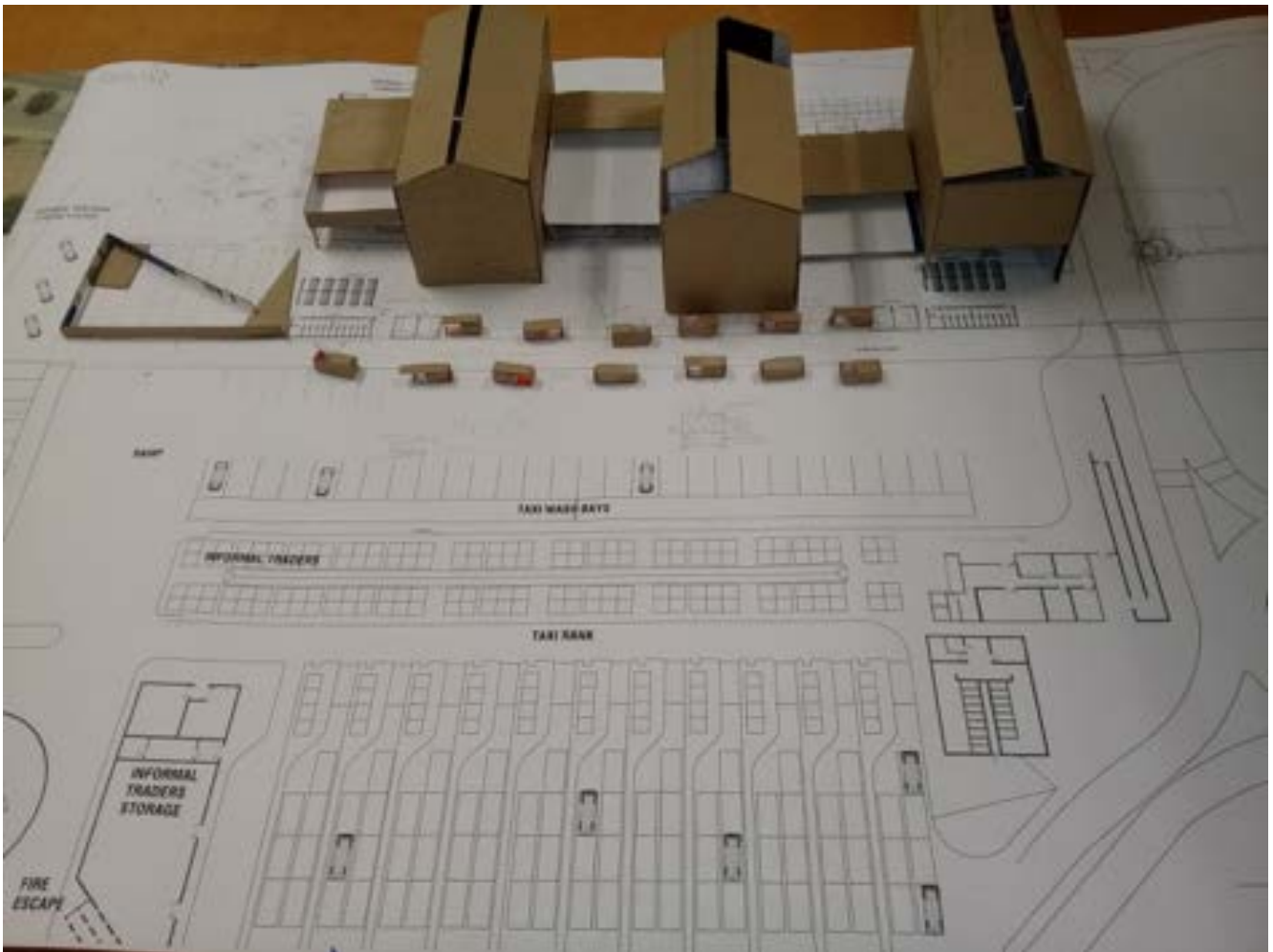


Figure 61: Preliminary Model. (Author, 2019)

Three greenhouses are placed on the site to bring a different silhouette to the elevation (Figure 45). Each of the greenhouses produces a dissimilar vegetable. The massing exploration indicates the processing issues that may be present in the typology. The program research resulted in the vegetable palette of tomatoes, brinjals, green peppers and cucumbers. The vegetables are commercially successful and can integrate into the dietary needs of the people living in Mamelodi. A community garden is brought in the design for skills transfer.

One of the significant adaptive architecture strategies which are structural redundancy starts to become an important design decision. Structural redundancy allows for the building to be scalable, creates extra space and extension of the building itself in the future.

ITERATION 5

In the fourth iteration, Steward Brand's concept of the "Adaptive Shed" starts to come to form. Where there is permeability on the first floor because plenty of informal vendors will use that space to sell their products (served space). (Figure 46) Servant spaces include the toilets, storage and vertical circulation. As part of the sustainability aspect, multi-functionality is explored. The programs chosen are activities that are found in Mamelodi, namely churches & event spaces and programs which are scarce, such as community halls and spaces for entrepreneurial support. The multi-functionality bring long-term sustainability of the project.

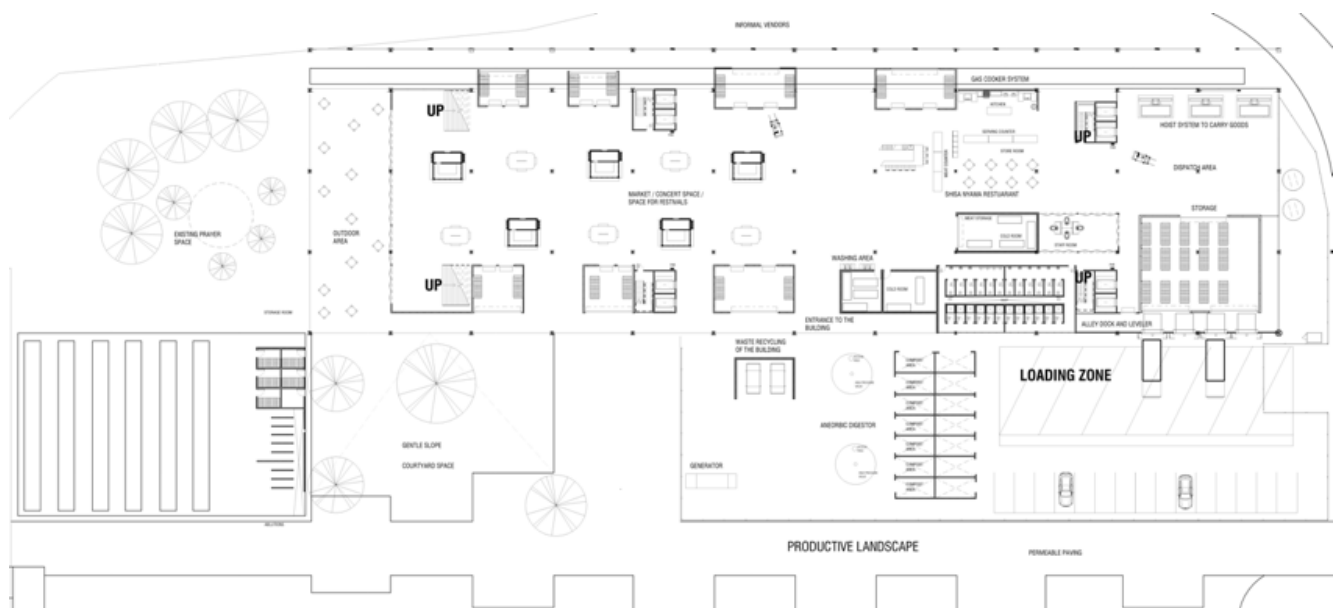


Figure 62: Addition of the Anaerobic Digester. (Author, 2019)

ITERATION 6: SECTIONAL EXPLORATION

(Figure 48) A section was drawn to understand the intricacies of the building. The part investigated the potential of a portal frame structure. The informal vendors placed right on the street edge for potential customers with a roller shutter door. The in-between space in the pedestrian walkway. During the investigation, the section had too many materials, which will make it cumbersome to construct. One of the principals of the regenerative design is, Systems are an integral part of the design. The castellated beam spans across the building as well as the opening spaces for services to be retained.

The roof is a sawtooth for ventilation and daylight strategy for the greenhouse. H-Columns will support the roofs, ground and the beams. The rainwater gutter is a steel formed gutter on top of an I-Beam.

7.3. SPECIALIST MEETINGS

During August, specialists were brought in for consultations as part of the design development. The date of the queries is next to the specialist.

Mohamed Suhale Baksh/Mechanical engineer (05/08/19) - During the consultation, Mohamed Suhale Baksh advised firstly on the isolating human contact with the facility so that there is no contamination in the greenhouse or the processing facility. Since Gas cookers are the design, SANS Part O is applied. Another suggestion was the compartmentalisation of different processes for safety purposes.

Professor Piet Vosloo/Architect & Landscape Architect (05/08/19) - The Professor main issue

with the design is the ventilation in the building. Indirect cooling as a strategy because of the maintenance cost. The saw-tooth roof because of the distribution of sunlight from the roof.

Carl Veyso/Structural Engineer (16/08/19) - The Red Book, states that instead of having the 10 m x 10 m, the structure can be expensive, especially when there is a large span. A cheaper solution has a column in 10 m x 5 m grid system. For the beam system, a castellated beam to house services in the structure.

Coriene Van Reenen/Architect (specialist in Acoustics) (26/08/19) - The primary acoustic consideration was the sound from the processing area. The advice given was related to the addition of acoustic ceiling tiles to absorb the noise from the informal vendor space. This intervention will not affect the semi-public office setup on the first floor.

For the creation of a closed-loop cycle, anaerobic digester (Figure 46) is part of the design. The digester was creating a source for energy for the gas cookers that will be used by the informal vendors. The composting pit converts the leftover plant stalk into fertiliser which is sold by the informal vendors.

7.4. DESIGN SOLUTION/SYNTHESIS (ANSWER TO THE PROBLEM)

The solution for the food insecurity and unemployment issue in this thesis is urban agriculture. How the design aims to solve this issue is by creating a flexible renting model in which informal vendors for a small amount of money can rent out space for six months. After the six months has lapsed another vendor can use the facility so that the building can be beneficial to the community.

7.5. CHARACTERISTICS OF THE DESIGN

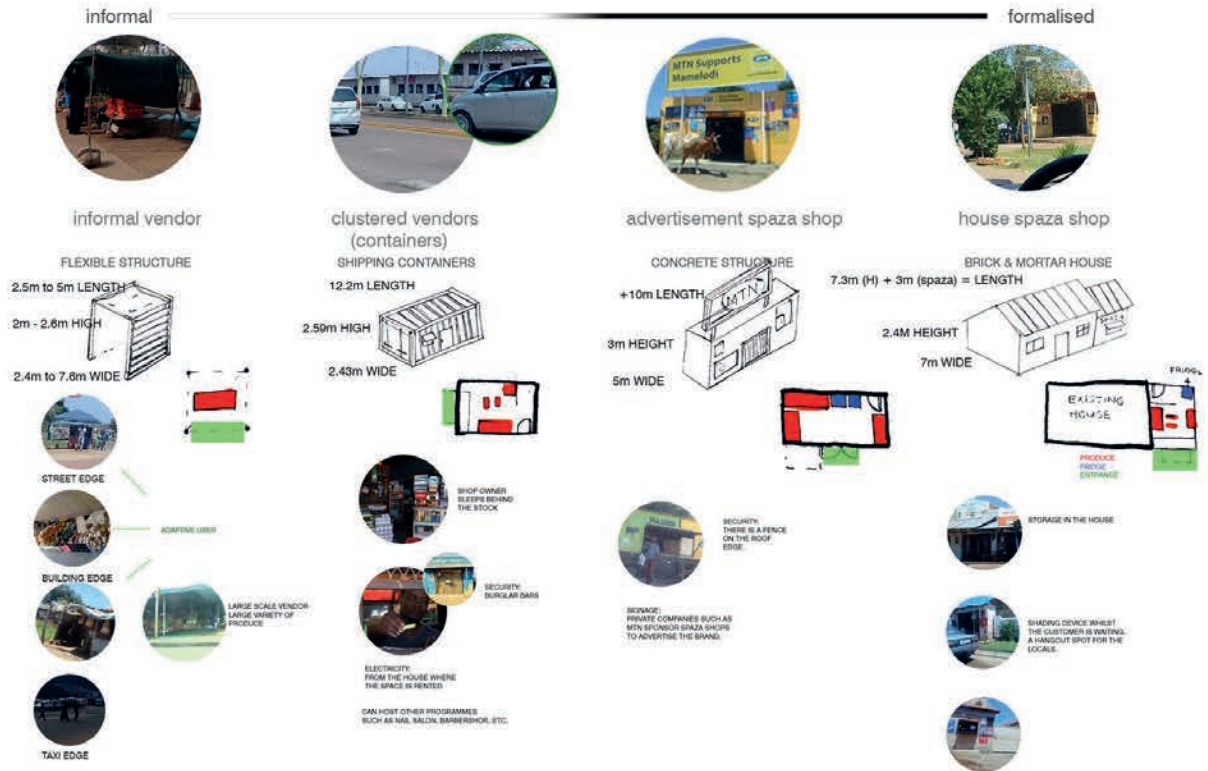
The building, in essence, is an adaptive shed that has consumption, production as well as processing in the same structure. The architecture comes from the technification as well as how the users use the buildings for their clients.

7.6. SKETCH PLANS (FINAL DESIGN)

The sketch plan starts to communicate the idea of private and public to spaces. The ground floor is permeable to allow for circulation. The servant spaces are on the southern edge of the building. The column spacing is 10 m x 5 m grids to allow flexibility and for the vendors to be able to use the space according to their own needs. If there is a surplus of vegetable or bi-products of the tomato, the bi-products distribute to other informal vendors in Mamelodi. A productive landscape is on the mall edge. The edge will allow the people to sit and relax as they are waiting for a taxi or moving from one space to the other.

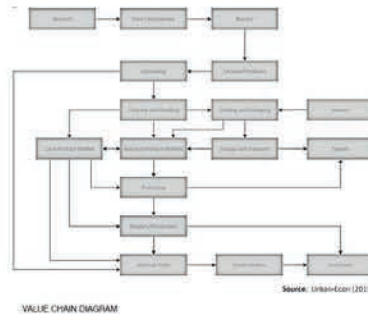
The development shows the investigation of scale, processes, different thresholds and trans programming. The design starts to resolve the food insecurity by having a second floor dedicated to growing plants. Unemployment reduces by creating spaces in which people can create an income.

informal vendor analysis



job creation at the agri-park

AGRI-PARK
EMPLOYMENT OF 30 JOBS (NET)
MAXIMUM OF 150 JOBS WHEN AGRI-PARK IS WORKING AT FULL CAPACITY



informants

context

- ACTIVE EDGE
- ACCESS TO SPACES
- TRAIN RANKS
- PROPOSED BRT SYSTEM
- RAILWAY
- PEDESTRIAN ACTIVITIES
- CURRENT NETWORKS

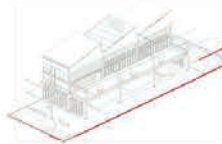
function

AGRI PARK
AGRO PROCESSING
PUBLIC SPACE



form

ENVIRONMENTAL CONCERNS
USER
CONCEPT OF ADAPTABILITY
FUNCTION



technology

RE-USED BRICK MATERIAL FOR PUBLIC SPACE AND PROMENADE



EMPLOYMENT LOCAL PEOPLE ARE USED FOR CONSTRUCTION



STEEL FRAME WILL BE USED FOR THE DESIGN



DENNEBOOM STATION IS A HERITAGE BUILDING THEREFORE THE MATERIALITY WILL BE CONSIDERED.



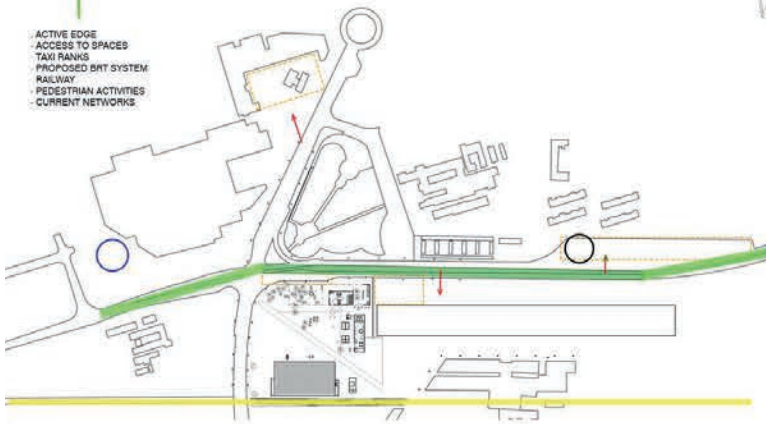
INFORMAL VENDOR CONTAINERS WILL BE USED IN THE DESIGN



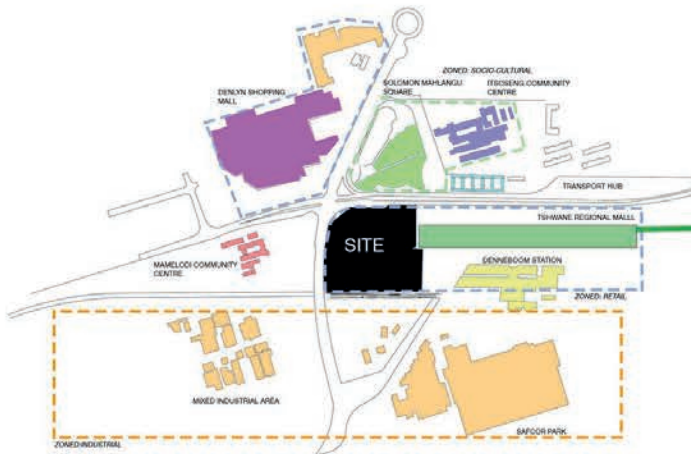
SOLOMON MAHLANGU SQUARE IS SET TO BRING TOURISTS.



EDGE CONDITIONS THE SURROUNDING AREAS



contextual informants



TSHWANE REGIONAL MALL



PHOTO: SVA ARCHITECTS

- ACCESSIBILITY
- ACTIVE EDGE
- PEDESTRIANS GOING TO DENNEBOOM



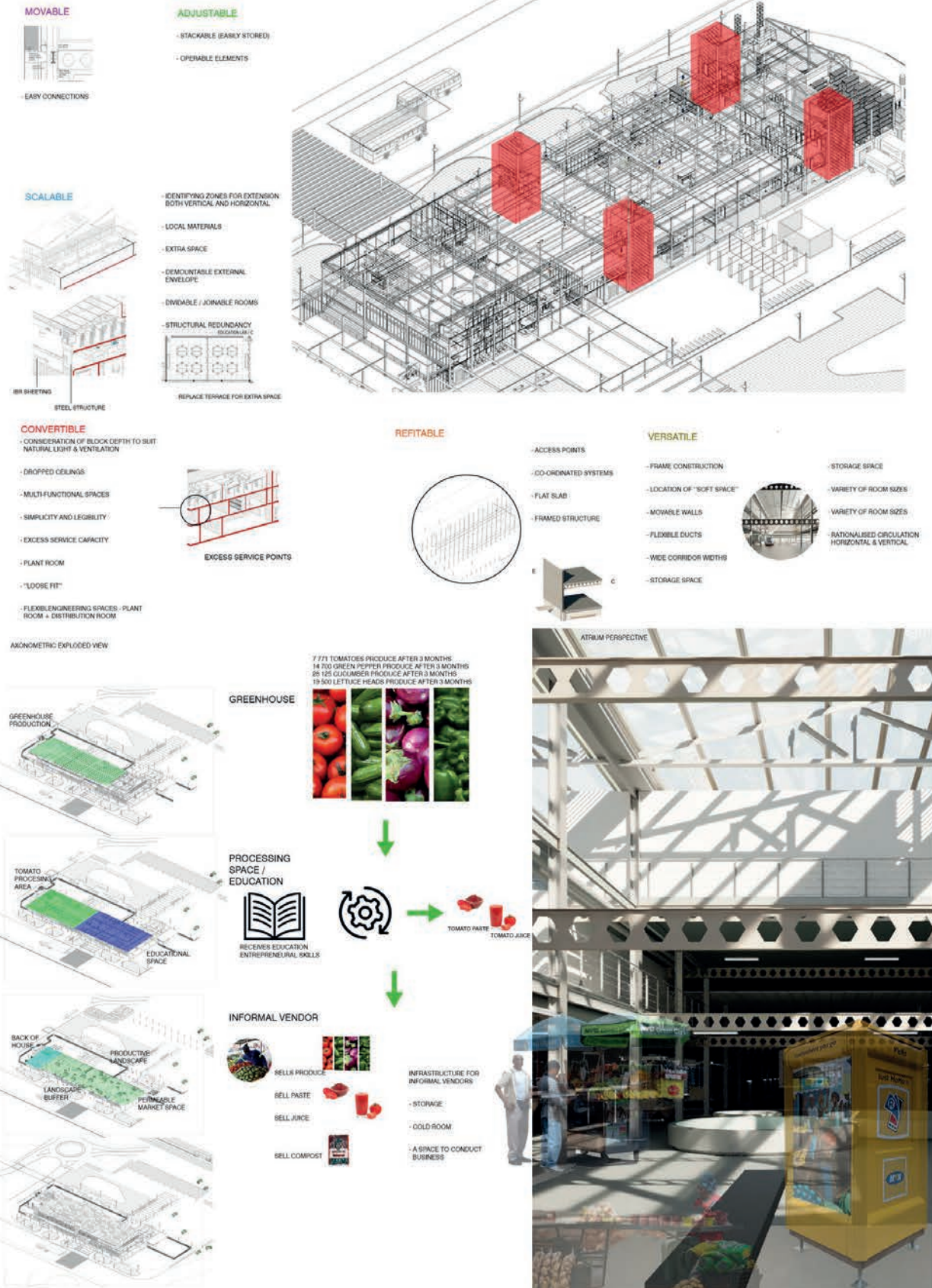
PROPOSED BRT ALONG TSAMAYA ROAD



THE SITE IS SITUATED IN-BETWEEN TWO MALLS



adaptive architecture strategies (based on mass / program flexibility)



architectural process

<p>1</p> <p>FOOD PRODUCTION - A PRODUCTION HUB WITH A PUBLIC SQUARE THAT HAS A WALKWAY BRIDGE.</p>	<p>2</p> <p>COURTYARD TYPOLOGY - A MAIN THOROUGHFARE TO DENNEROOM STATION (SISA NYAMA) TO SPILL INTO THE PUBLIC SPACE INFORMAL VENDOR MARKET</p>	<p>3</p> <p>MIXED PROGRAMME FACILITY - PROGRAMS ARE SCATTERED ON THE SITE - AGRI-PARK STARTS TO FORM - "CONSUME, PRODUCE, PROCESS" - CANTERING ROOF STRUCTURE - EDGES CONNECT THE DIFFERENT BUILDINGS - INFORMAL VENDORS ON EDGES</p>	<p>4</p> <p>ADAPTIVE SHED - ALL THE PROGRAMMES ARE INTEGRATED INTO ONE BUILDING - "VILLA SAVOYE LIKE" STRUCTURAL SYSTEM - SERVICE RETICULATION BECOMES MAJOR DESIGN CONSIDERATION - SERVED AND SERVANT SPACES DEFINED</p>	<p>5</p> <p>AN AGRIPARK - LANDSCAPE IS INCLUDED TO MAKE THE DESIGN HUMAN-CENTRIC - PERMEABLE GROUND FLOOR - SITE IS DENSIFIED - MULTI-FUNCTIONALITY IS ACHIEVED - LIGHT FILTERS INTO THE BUILDING VIA POLYCARBONATE SHEETING</p>
<p>FLOATING ROOF INFORMAL VENDORS ARE SELLING IN CONTAINERS</p>	<p>SECTION 2 TIMBER SCREEN IS PROPOSED WITH A WALKWAY TO VIEW SOLOMON MAHLANGU SQUARE</p>	<p>SECTION 3 A STEEL STRUCTURE FOR FUTURE DEVELOPMENT AND INFORMAL VENDOR ORIENTED SPACE</p>	<p>SECTION 4 POLYCARBONATE SHEETING IS USED TO BRING LIGHT ON THE SKIN OF THE BUILDING</p>	<p>SECTION 5 - TRUSS CONFIGURATION RESOLVED AS WELL AS SPACING - ROOF ORIENTATION RESOLVED</p>

<p>CENTRALITY THE FACILITY CONCENTRATES PROGRAMS AND THE DIFFERENT ACTIVITIES AROUND</p>	<p>FLEXIBILITY THE INTERCHANGING OF DIFFERENT PROGRAMS CAN EASILY BE REORGANISED</p>	<p>PUBLIC SPACES SPACES FOR SOCIAL INFRASTRUCTURE AND INTERACTIONS</p>	<p>PERMEABILITY GROUND FLOOR IS COMPLETELY PERMEABLE FOR INFORMAL VENDOR VISIBILITY</p>
<p>VENTILATION LOUVRES VENTILATION THROUGH THE ROOF TO MAINTAIN HUMAN COMFORT</p>	<p>SOCIAL STAIRCASE SEATING AREA FOR THE PUBLIC WHICH CONNECTS ALL THE FLOORS</p>	<p>STACKED PROGRAMMES ON-SITE PROGRAMMES TO EMPOWER THE INFORMAL VENDORS</p> <p>GREENHOUSE PROCESSING AREA INFORMAL VENDOR RETAIL</p>	<p>CONNECTION TO FARMERS FARMERS IN MAMELOO USE THE PROCESSING FACILITY</p>
<p>PUBLIC TRANSPORT BUILDING IS CLOSE TO TRANSPORT INFRASTRUCTURE E.G. BUS, TAXI'S, ETC.</p>	<p>STRONG AXIS S.M.S AXIS CUTS ACROSS BUILDING FROM TAXI RANK TO SOLOMON MAHLANGU SQUARE</p>	<p>RETAIL ENVIRONMENT THE BUILDING IS IN-BETWEEN TWO MALLS</p>	<p>BRICK CORES BRICK CORES KEEP THE BUILDING STABLE AND HOUSE THE SERVICES</p>

design summary

TSAMAYA ROAD

PEDESTRIAN FRIENDLY ENVIRONMENT

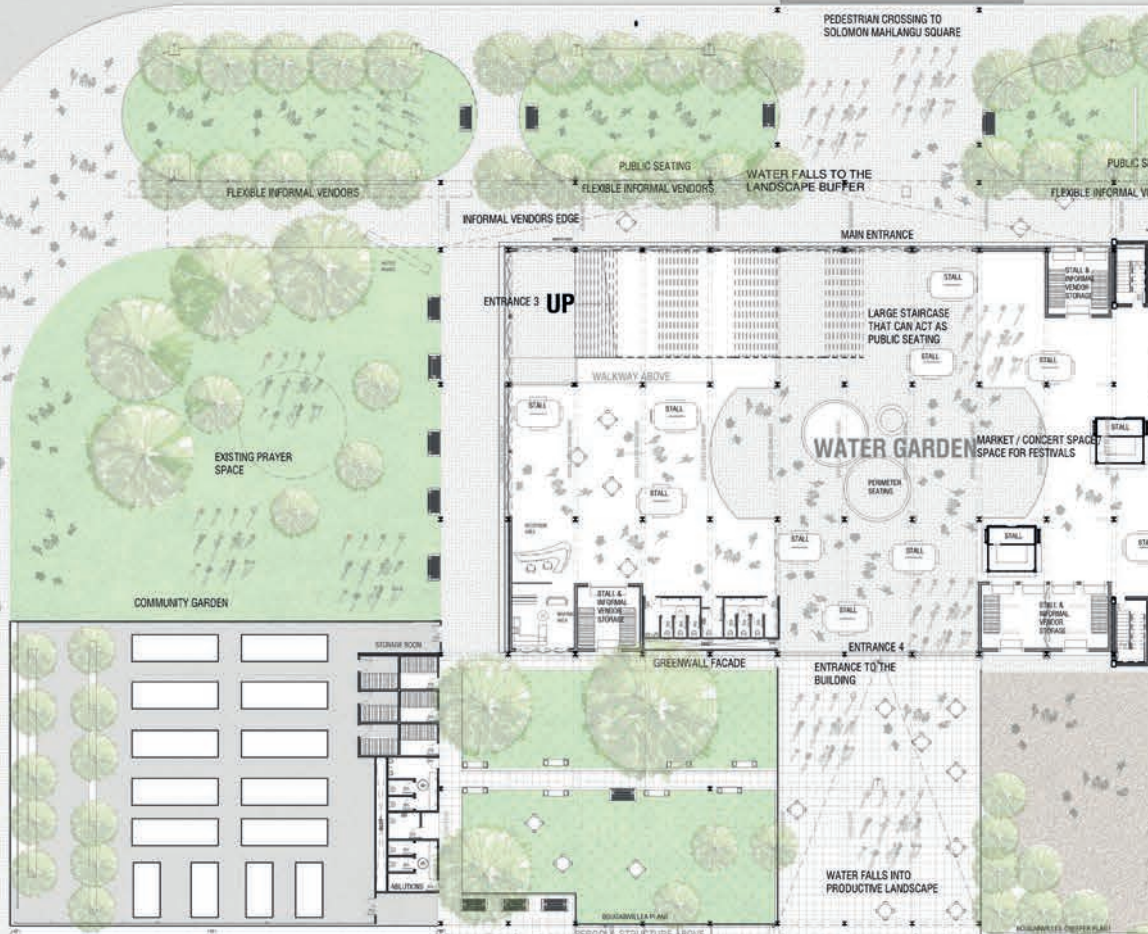
OVERHEAD ST

TRUNK STAT

WALTLOO ROAD

INFORMAL TAXI RANK - CHANGE STATION

HOLDING BAYS



VIBURNUM PLANTS TO GUIDE PEDESTRIAN TO THE MALL

CAR PORT STRUCTURE OVERHEAD

TAXI WASH BAYS

STALLS

PRODUCTIVE LANDSCAPE

CENTRAL AXIS TO SOLOMON MAHLANGU SQUARE

TAXI RANK

INFORMAL

Figure 65: Rendered Ground Floor Plan. (Author, 2019)



(PROPOSED BRT IN THE FUTURE)



LANDSCAPE BUFFER

GRASS

INFORMAL VENDORS

ENTRANCE 2

STALL & INFORMAL VENDOR STORAGE

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FLEXIBLE INFORMAL VENDORS

INFORMAL VENDORS EDGE WATER FALLS TO THE LANDSCAPE BUFFER

BIOGAS COOKER SYSTEM

SHISA NYAMA RESTAURANT

WASHING AREA

CONDENSER (FOR 1ST FLOOR)

WASTE RECYCLING OF THE BUILDING

LOADING ZONE

PERMEABLE PAVING

RETENTION POND

LOWEST POINT ON A RELATIVELY FLAT SITE

MOUND

TAXI FACILITIES

PEDESTRIAN CROSSING

TSHWANE REC NEWLY CONST

LINE TO CHIBRECO (STATION)

STUDY CORRIDOR AND ELECTRICITY PENETRATION WITH UNDERGROUND CABLES

RAMM WATER HARVESTING 9 x WATER TANKS +20 L

ELECTRICAL SUBSTATION

DISPATCH AREA

STORAGE

MEAT STORAGE

COLD ROOM

LV

MV

AWLEY DOCK AND LEVELER

HOIST SYSTEM TO CARRY GOODS

UP

UP

UP

UP

UP

UP

UP

UP

UP

UP

UP

UP





TECHNIFICATION

8.1. TECHNICAL CONCEPT

The technical concept will follow the adaptive concept discussed in chapter six.

SITE: The design of the site is in between two malls, the site itself is relatively flat.

SOCIAL: The building's primary focus will be growing and processing food. The informal trade will ensure that the building is used throughout the week to limit the one-dimensionality of structures

STUFF: The movable furniture in the space

SPACE PLAN: The space plan will be flexible to allow different configurations for the vendor.

SKIN: The skin of the structure is a combination of Klip-Lok and polycarbonate sheeting. At night the building resembles a lamp and helps create a safer environment.

STRUCTURE: For the structure to adapt a steel-framed building is a form that maximises flexibility (Figure 48).

Primary: The Primary structure is the steel-framed structure. The steel is placed in 10 m x 5 m intervals to allow for flexibility of use in the building.

Secondary: Prefabricated modular units are the infill of the building. If the material wears out in the future, it is easily replaceable.

Tertiary: Services such as the mechanical vents.

SURROUNDINGS: The Architectural Issue of the was the mono-functionality industrial buildings. By densifying the site using public transport and the existing buildings, foot traffic for the informal vendors' is maximised.



TECHNIFICATION



Figure 67: Grayscale Photography of Scaffoldings. (Pixabay, 2019)

8.2. TECHNICAL DESCRIPTIONS (STRUCTURE, TECHNOLOGIES AND MATERIALS)

8.2.1. Materiality

Primary - Steel Construction

The material chosen for the construction project is steel. According to Bruno et al., (2009:10), the advantages of steel include its cost, non-combustibility. As part of the concept of adaptability, sustainable buildings tend to favour construction methods that are flexible light and durable. All steel is recyclable. The reason for this because steel does not lose any of its inherent physical properties during the process of recycling.

Steel can be pre-fabricated and brought on site. The impact on the design is a shorter construction time as well as being a way in which local labour can work towards a specific goal.

The materiality of the design stems from the existing buildings around the site. Also, the concept of Adaptability guided the material selection process. The Denneboom station uses Pretoria brick and steel. This material palette informs the materiality of the building (Figure 49). "Standardisation and prefabrication of systems is also beneficial in providing adaptability of services" (Webb et al., 1997)

Polycarbonate Sheeting

The significant advantage of polycarbonate is that it brings is that it is easy to install, lightweight. Polycarbonate sheeting is virtually indestructible. UgPlast (2019). Which will be an ideal material for maintenance purpose and can also be recycled.

Perforated Steel Sheeting

For the walkways on the 1st and 2nd floor perforated steel sheeting will be used to continue the industrial language and for light penetration.

Secondary - Concrete and Brick Infill

For the cores of the design, rectangular concrete columns are required for stability. Also the four brick cores, the vertical circulation of the services will be housed in the cores.

Composite Floor Slab

For the floor slab, composite flooring is chosen "A ribbed composite floor slab performs better than solid slab as the exposed perimeter of the decking permits the greater transfer of heat in a given time step, and the effective slab depth exceeds the minimum depths noted above for heat storage over a daily temperature cycle". The floor slab, Composite slab is chosen to use the compressive strength of concrete and tensile strength of steel.

The structure system of the building is a rigid frame which is 10m x 5m. Figure VI, indicates the layers in the building.

The Castellated beams are a focal point of the Design because that is where the services are housed and allows the building to become adaptable. The effective structural system offers a variety of design options.

Load is transferred to the H-Columns which are used as the vertical members to carry the structure.

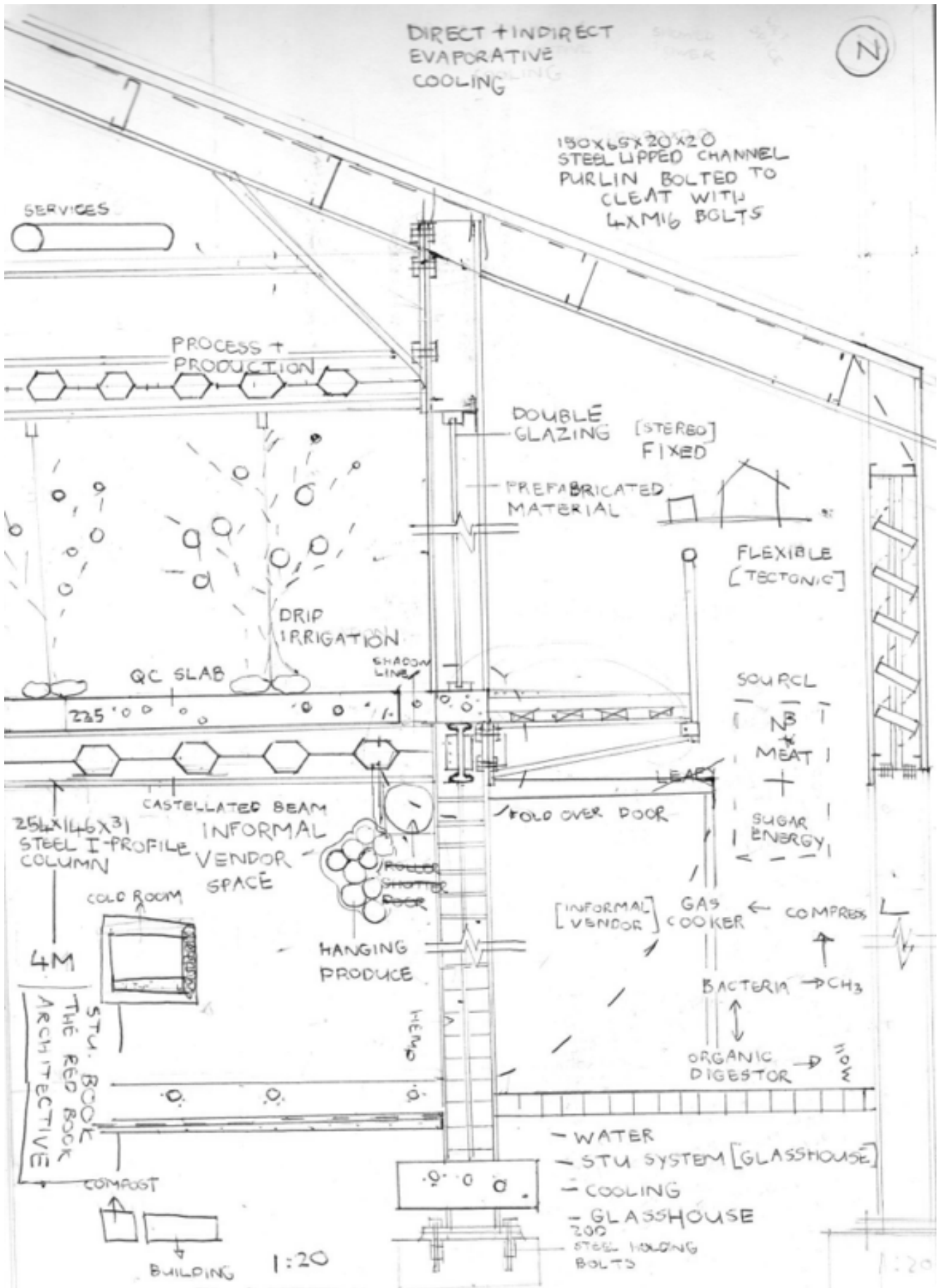


Figure 68: Conceptual Technical Section. (Author, 2019)



DIJO PROPOSED BUILDING
PALETTE

EXISTING MATERIAL PALETTE
AROUND THE SITE

materiality

BRICK (COROBRIK)

POLYCARBONATE SHEETING



STREET VENDORS STRATEGICALLY
PLACE THEMSELVES AROUND THE
STATION

GOOD LIGHT



DENNEOOM STATION



STEEL



CONCRETE



LANDSCAPE



KLIP-LOK SHEETING



DRYWALLING SYSTEM



DESOLATE SITE



TSHWANE MALL



SITE



INFORMAL VENDOR

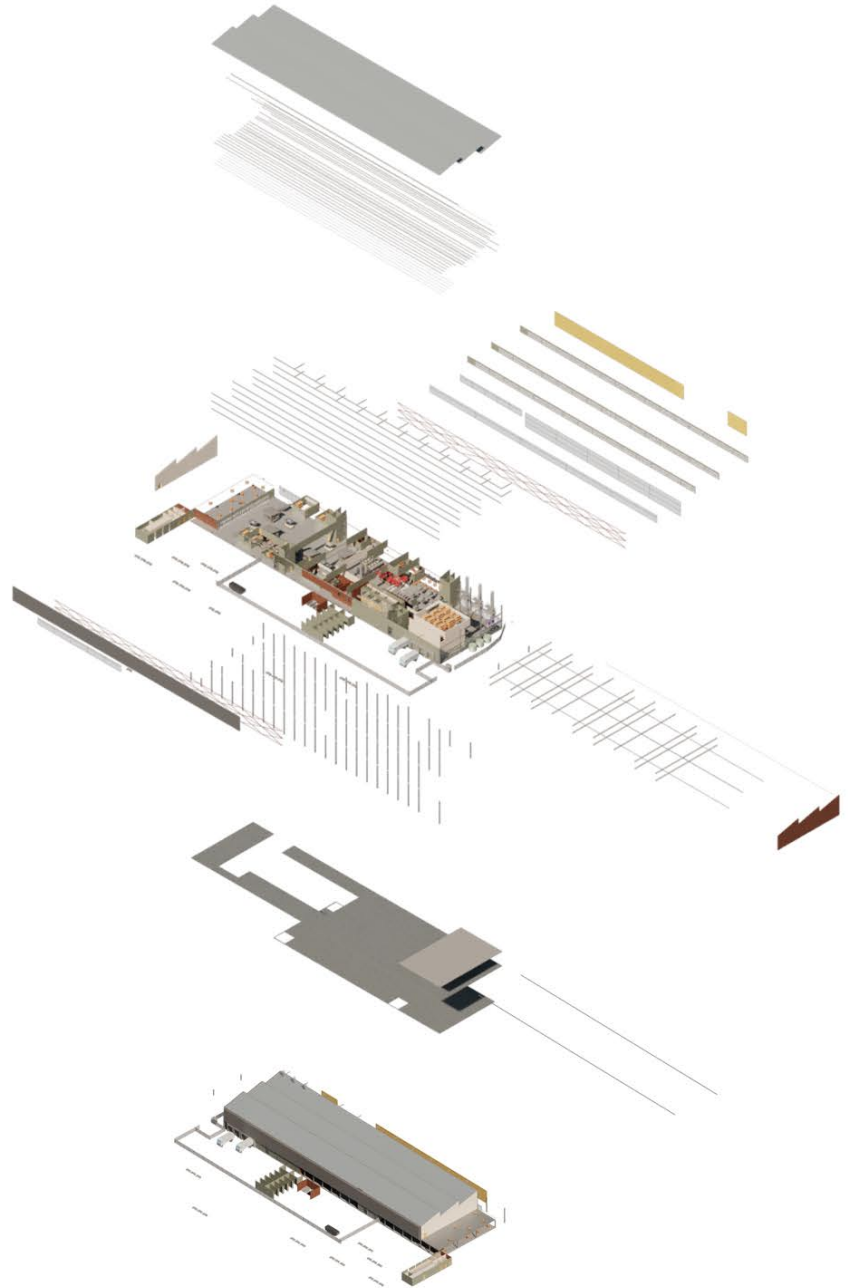


ROOFING
IBR ROOF ON C-CHANNELS

STRUCTURE
- H-COLUMNS
- CASTELLATED BEAMS

FLOORING
- COMPOSITE DECKING

COMPLETED FORM
- TECTONIC



STRUCTURAL SYSTEM

ADAPTABILITY CONCEPT (STEWART BRAND)

SKIN
POLYCARBONATE SHEETING

STRUCTURE
STEEL STRUCTURE

SPACE PLAN
FLEXIBLE SPACE

SERVICES
- SERVANT AND SERVED SPACES
- CANTILEVER BEAM CHANNEL

SITE
- MAMELODI

SOCIAL
- BUILDING SPACE THAT FILTERS
TO THE COURTYARD (URBAN SPACE)

SURROUNDINGS
- IN BETWEEN TWO MALLS

8.3. ENVIRONMENTAL STRATEGIES

Daylight Strategy

The atrium in the design will allow light to penetrate the darker spaces in the building. The saw-tooth roof will allow much needed daylighting into space for the plants in the building. The use of polycarbonate will also bring light into space.

Fire Escape Strategy

In case of a fire, there are plenty of staircases which a person can access to vacate the building.

Thermal Comfort and Ventilation Strategy

The floor plan is a 1:5 ratio which allows for cross ventilation. Insulating the drywall will improve thermal comfort. The insulation that will be used is IsoWall Insulation (2500mm x 600mm x 45mm). For the greenhouse, there is evaporative cooling. For the processing floor, an air conditioning system will be used to cool the air in the space.

Ground Floor - A combination of Natural Ventilation and Fans to encourage air flow.

1st Floor - An HVAC system that releases the hot air out of the building and also brings cool air inside.

2nd Floor - Cool air comes into contact with the Greenhouse Wet Wall membrane. Wet walls are cooling devices for greenhouses which are cooling pads within an aluminium wall. They use a pump to circulate water through the wall and a fan on the opposite side of the wet wall to cool the evaporated water. The water is recirculated and cools the air in the grow environment, continuously.

Water Strategy

Water will be collected from the roof. The water will be transferred to the Jojo. Then the water is pumped to the water purification system. From there the water will be used for basins, the hydroponics system and toilets via the Castellated beams and service core.

On the Northern Edge, the water will slope to the informal vendor walkway to the surrounding vegetation.

The Retention pond is to retain water collected from the surface, reused for irrigation purpose and to promote ecology.

Electrical Strategy

Solar Panels will be used in the design. The Solar energy that will be created will be stored in solar batteries which are found on the Eastern Edge. The electrical trays will be fixed on the Castellated beam. Alternatively, there is an Sub Station on Site.

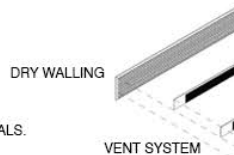
ROOF:
1200mm x 1200m IBR ROOF SHEETING FIXED TO C-SECTION
150 X 65 X 20 X 20 STEEL LIPPED CHANNEL PURLIN BOLTED TO
CLEAT WIT 4 X M16 BOLTS

JOIST
254 x 146 x 31 STEEL I-BEAM PROFILE SPACED 10 M.
BOLTED WITH 4 M8 BOLTS.

BEAMS:
CASTELLATED BEAMS SPACED IN 5M INTERVALS.
FOR THE STRUCTRE AND DERVICES.'

COLUMNS:
305 X 3025 X 97 STEEL H-PROFILE COLUMN TO
STEEL BASE PLATE

GROUND FLOOR:
COMPOSITE FLOORING STRUTURE
STEEL = TENSILE
CONCRETE = COMPRESSION



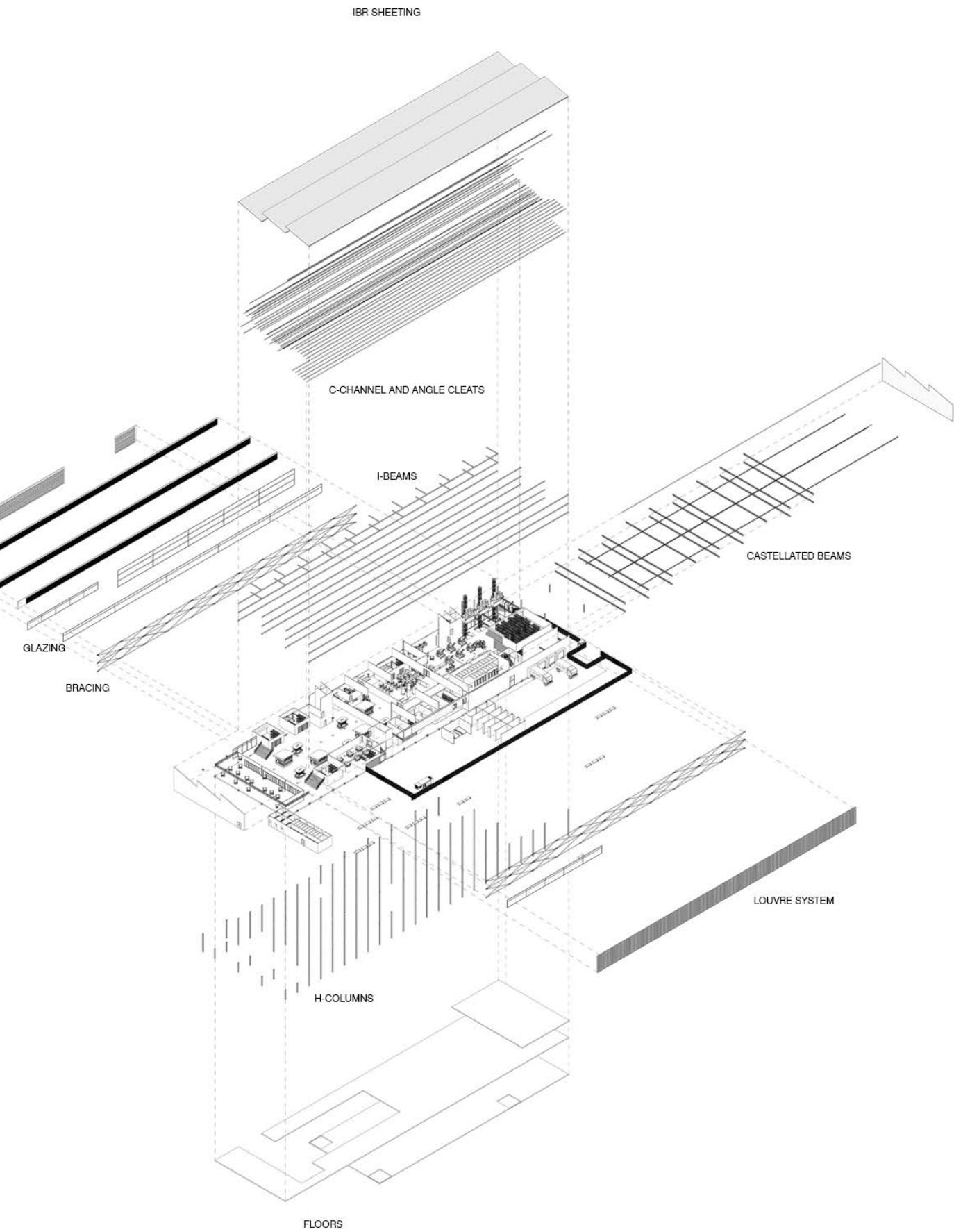
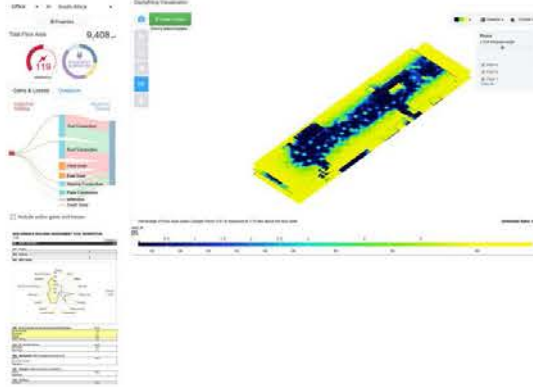


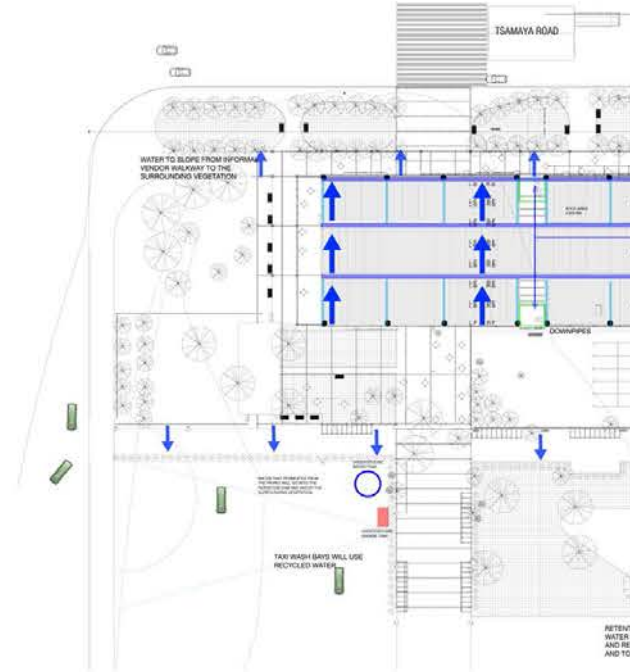
Figure 71: Axonometric of the Shed Indication Layers in Terms of the Structure and Material.
(Author, 2019)

environmental strategies

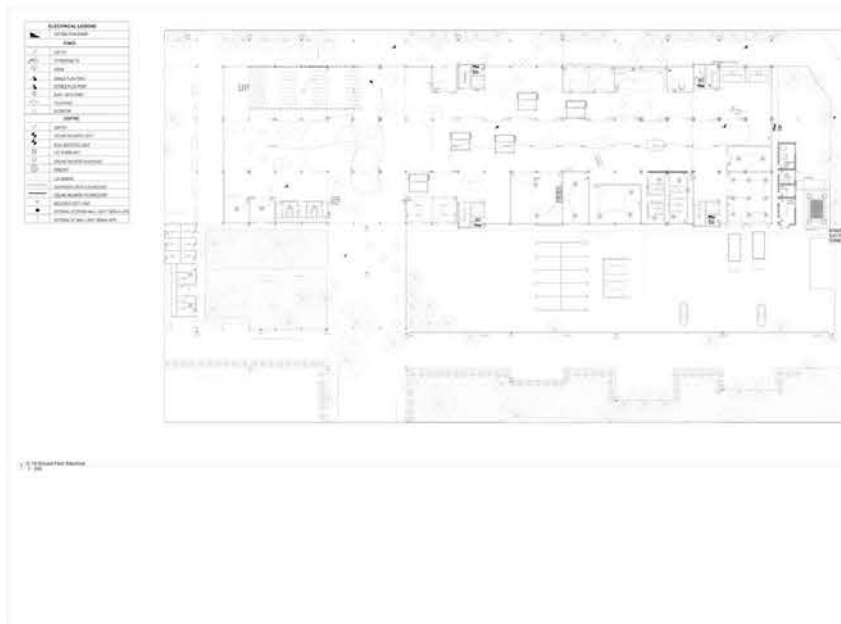
BASE CASE (SEFAIRA)



WATER STRATEGY



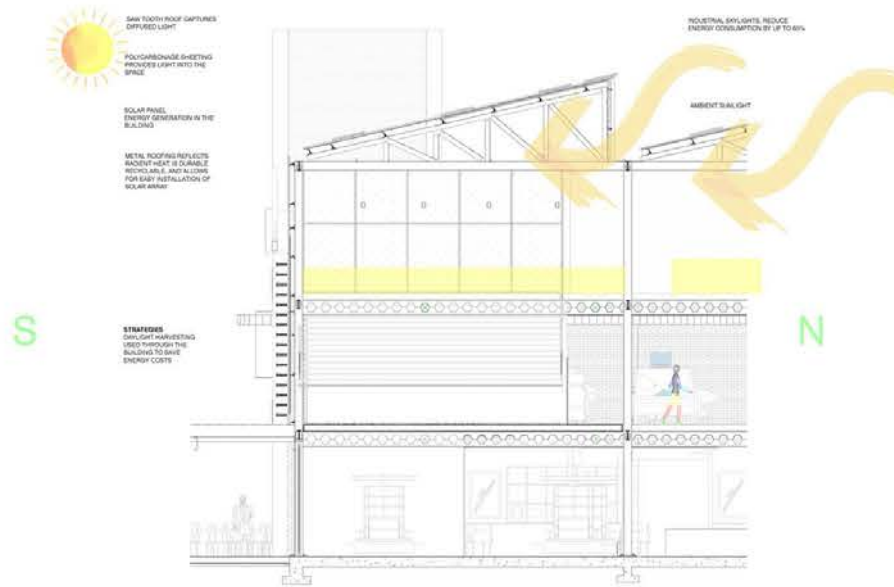
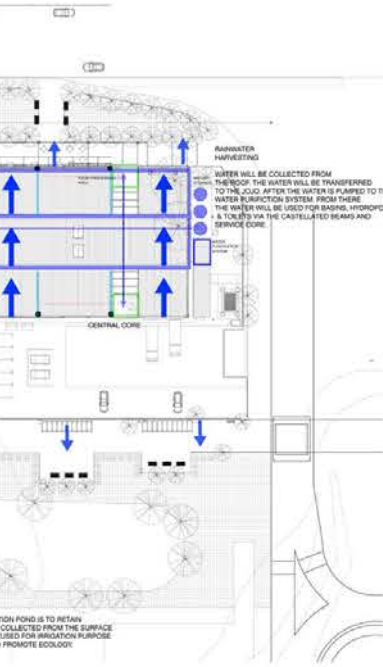
ELECTRICAL STRATEGY



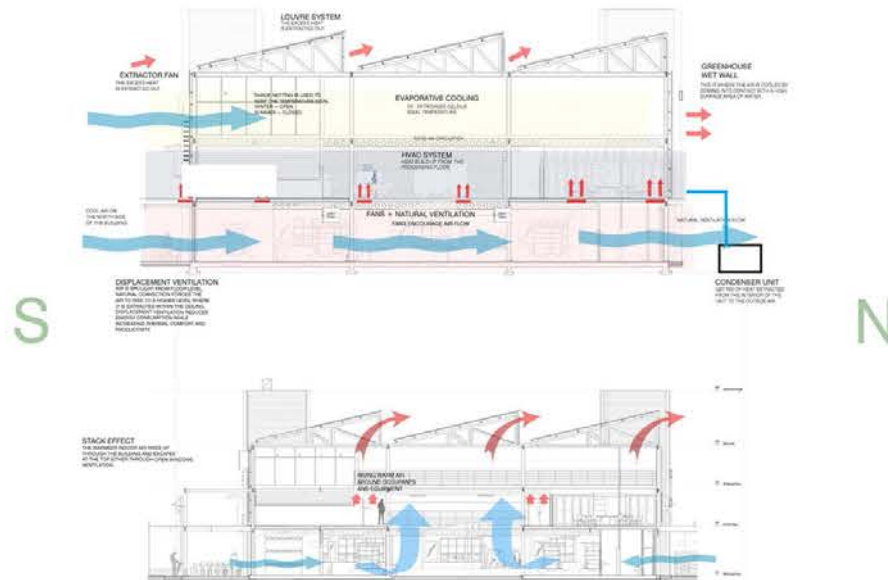
FIRE PLAN STRATEGY



DAYLIGHTING STRATEGY



VENTILATION STRATEGY



ventilation systems

8.4. 'GREEN' RATING

SBAT

In the analysis of the SBAT, the results show that the building is successful in terms of Transport, Water and Access. These aspects were the main focuses of the design as well as the Service and Products.

Social Performance - The dissertation has an excellent location which is the gateway to Mamelodi. The transportation available includes a taxi rank, Denneboom station train and BRT system, which is found on the Northern Side of the Site. The destination spaces are the Denlyn Mall as well as the new Tshwane Regional Mall. There is easy access to clinics, affordable food and exercise opportunities on the productive landscape. Proximity to education (Primary or Secondary) is within walking distance, for scholars to use the facility. The building might be high in terms of operational and capital costs but environmental strategies lessen the cost in the long run. These strategies include "served and servant space" in which maintenance of services is also lessened all the environmental strategies included as part of the design. The social staircase is one of the design features that allow for social cohesion in the building where the user can have a view of the activities found in the building and outside. Lastly, the multi-functionality of the building will allow for different uses and functions to occur in the building.

Economic Performance - One of the major design drivers is empowering the informal vendors. How this is accomplished is by understanding the

immediate needs of the primary user which is the place for storage, infrastructure to compete with the huge retail corporation, visibility to customers and to lessen the transports that lessen profit margins. The other employment opportunities include taxi marshalls, greenhouse specialist, processing artisans, landscape designers and educators. DIJO will successfully create an economic by using the existing fabric of Mamelodi.

Most of the materials of the buildings are sourced from the industrial edge that is on the Southern Side of the side. The rest of the materials such as Polycarbonate Sheeting can be sourced from Silverton which is 10 km away from the site. The people of Mamelodi will have direct access to fresh produce and food will be cheaper and higher quality.

Environmental Performance - The building does support biodiversity by having a retention dam located nearby of the structure. The food production is on-site, it serves as a bonus. The waste strategy involved having the leftover plant stalks placed inside the compost pit. The stalk converts to fertiliser which is sold by the informal vendors. The rest of the waste created by the building is recycled by the township recyclers found in the area.

The buildings openings and the envelope do meet the energy criteria. Rainwater strategies are used to fill the nine 20 000 litre tanks. The solar panels on the roof generate the majority of the energy creation of the building.

SUSTAINABLE BUILDING ASSESSMENT TOOL RESIDENTIAL

1,04

Achieved
3,5

SB SBAT REPORT

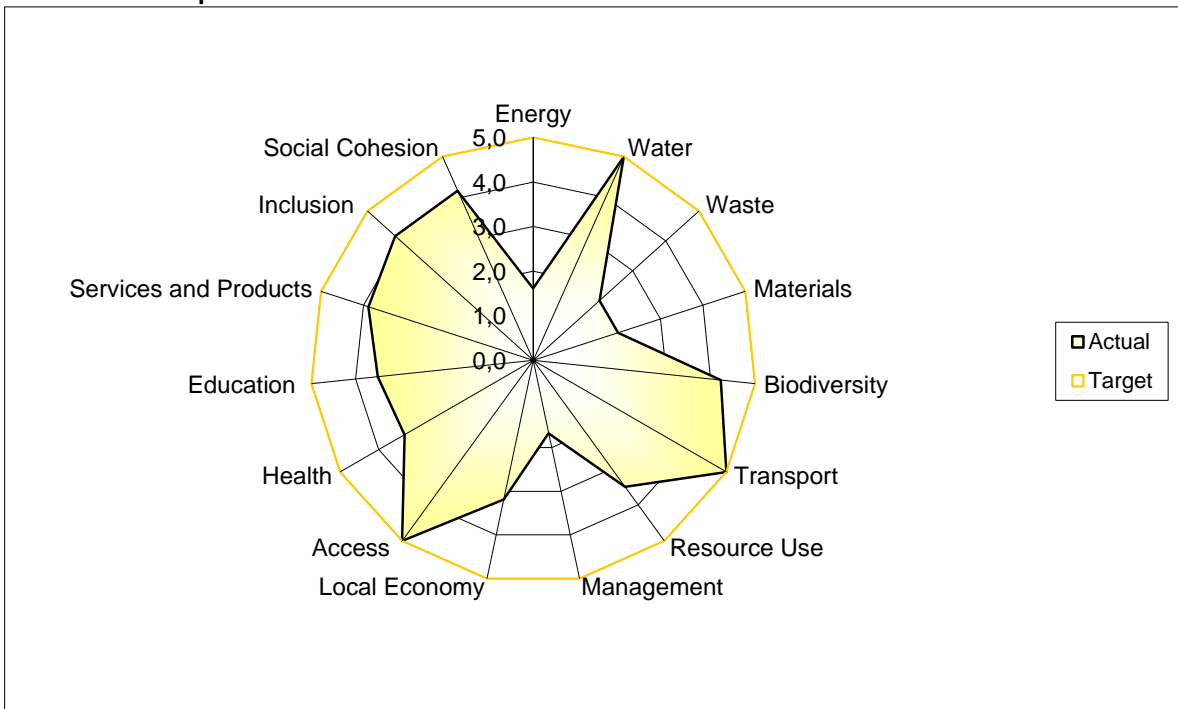
SB1 Project

	0
--	---

SB2 Address

	0
--	---

SB3 SBAT Graph



SB4 Environmental, Social and Economic Performance

	Score
Environmental	3,0
Economic	3,7
Social	3,8
SBAT Rating	3,5

SB5 EF and HDI Factors

	Score
EF Factor	3,2
HDI Factor	3,5

SB6 Assessment: SBAT assessment carried out by

Name	Date
Assessor number	
Signature	

SB7 Validation: SBAT assessment validated by

Name	Date
Signature	

SB8 Validation

Number	Date
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Figure 73: SBAT. (Author, 2019)

8.5. SOLAR STUDY

The solar study conducted using Sefaira.

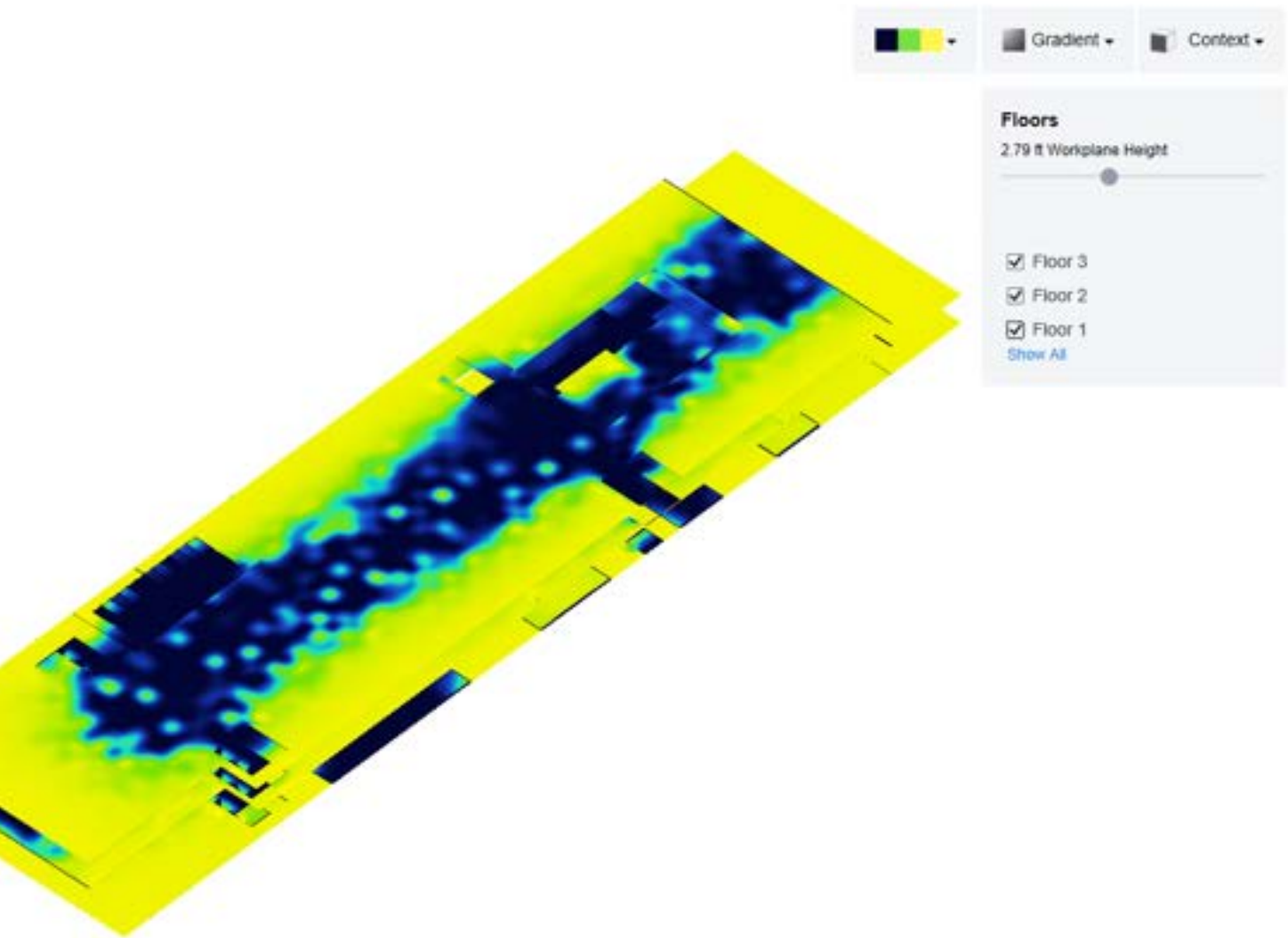
The Daylight Visualisation indicates that most of the spaces are over-lit since there is glazing on both sides. The glare will be disadvantageous to people working in the processing area as well as the greenhouse. The ideal temperature will be in-between 19-25 degrees Celsius for the greenhouse. The shade netting will assist in terms of temperature control.

On the Northern Elevation on the Atrium Space, horizontal shading is used for Sun control and also improves user visual comfort by reducing contrast ratios and controlling glare. This strategy leads to increased productivity in the building. The trees on site also assist in the shading.

Daylighting Visualization



Figure 74: Base Line Case on Sefaira. (Author, 2019)





CONCLUSION

The dissertation investigation showed how architecture and urban agriculture could empower tool informal vendors. Urban agriculture has the potential of alleviating food insecurity and unemployment. The fall of spaza shops in the has been on the decline since the inclusion of large retail chains in the township. That dissertation proposes an alternative of giving the vendors a fighting chance in the capitalist food network.

From the group vision, townships need to become economic nodes so that positive growth can start to occur, which leads to sustainable spaces in the future.



CHAPTER 9



Figure 75: Daycare in Mamelodi. (EBM International, 2018)

The regenerative theory principles in the dissertation seek to create a system of holistic systems thinking. The design can maximise the nested potential in Mamelodi. In the future, townships are economic nodes in their own right.

For sustainability, several different factors have an overall influence on the design. The light became an important design consideration. A central courtyard is a place on the south side of the building for people to view the building or enjoys the produce produced by the structure. Mainly due to the mechanical properties, steel communicated the concept of adaptability.

The dissertation explores how people can integrate with the process and production of certain products.

9.1. RESEARCH (SUB) QUESTIONS

- How can architecture regenerate a site undergoing urban decay? The site by creating a building which integrates with the surrounding context as well as creates a positive impact on the people of Mamelodi.
- How can architecture create an infrastructure to empower the informal vendor and small-scale farmer? The ground floor of the building is for informal vendor market. Customers buy products on that floor which is permeable.
- Can architecture create an industrial typology which can bring benefit to the community?
 - The industrial typology proposed is a multifunctional landscape.

Regenerative theory principles were followed in the dissertation which seek to create a system in which holistic systems thinking is being utilised so that the design can maximise the nested potential in Mamelodi. This is crucial if in the future we see township as their own economic nodes in the future.

The main issues that were outlined in the dissertation are the General Issue: which is food insecurity and unemployment, urban issue: urban decay and the architectural issue of industrial mono-functionality.

The dissertation explores interesting ways in which people can integrate with the process and production of certain produce.

9.2. RECOMMENDATIONS FOR FURTHER RESEARCH

Recommendation for further research includes how can alternative ways of empowerment be facilitated by using architecture (design) as a vehicle.

Contribution

The contribution of the dissertation is namely:

- Creating a new typology in which mixed-use development is implemented in a township environment
- Finding alternative ways of re-industrialising townships in the country.
- It explored the adaptation of space to make spaces that are relevant to the people of Mamelodi.
- An architecture that responds on an Urban Scale
- The relationship between architecture, landscape and interior



Figure 76: Haven: Mothong African Heritage Trust is a Place of Work, Research and Hope. (Nkosi, 2018)

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10.2. APPENDICES

Sectional Model



Figure 77: Section Model of the Design. (Author, 2019)

Final Model





10.3. FINAL MASTERS PRESENTATION

DIJO

DIJO (FOOD) - AN AGRI-PARK (AGRO-PROCESSING PLANT) TO EMPOWER INFORMAL VENDORS VIA URBAN AGRICULTURE TO ELLEVIATE UNEMPLOYMENT AND FOOD INSECURITY IN MAMELODI WEST.

LOCATED IN A TOWNSHIP CALLED MAMELODI THIS PROJECT EXPLORES HOW A DESOLATE SITE CAN BE A SPACE OF REGENERATION WHICH CAN LEAD TO A DECREASE IN FOOD INSECURITY AND UNEMPLOYMENT FOUND IN THE AREA.

IN ORDER TO FULFILL THESE OUTCOMES, RE-INDUSTRIALISATION OF TOWNSHIPS NEEDS TO BE EXPLORED AS THE FOUNDATION OF THE PROJECT. THE PROGRAMS WHICH WAS CHOSEN IS DESIGNING AN AGRI-PARK IN THE INDUSTRIAL EDGE OF MAMELODI. URBAN AGRICULTURE IS EXPLORED IN THE DESIGN.

RESEARCH QUESTION
HOW CAN ARCHITECTURE BY REGENERATING A DESOLATE SITE CHANGE THE CURRENT FOOD NETWORK IN MAMELODI WEST TO ELLEVIATE THE FOOD INSECURITY AND UNEMPLOYMENT?

INFORMAL VENDORS
CONSUMERS
SMALLHOLDER FARMERS

user



UNEMPLOYMENT ISSUE



Unemployment rate per country in 2013. Source: International Labor Organization

ADAPTIVE ARCHITECTURE

concept



AGRI-PARKS

program



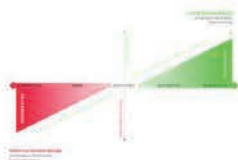
INDUSTRIAL TYPOLOGY ISSUE

architectural issue



REGENERATIVE DESIGN

theory



MAMELODI WEST
(INDUSTRIAL EDGE)

site



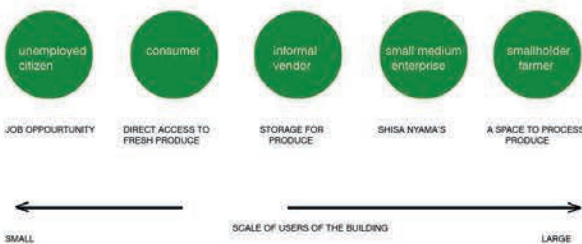
URBAN DECAYING ISSUE

urban issue

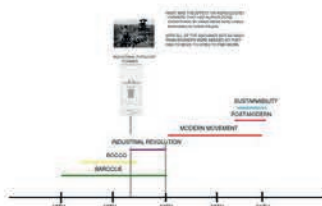
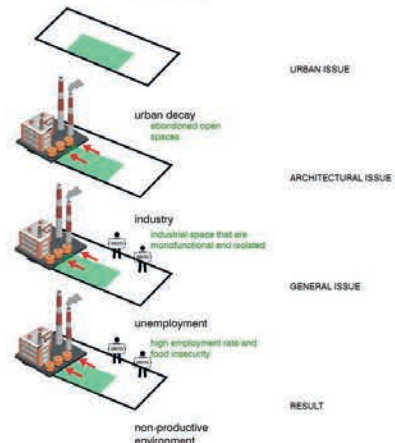


Wang et al. 2018 Regenerative Design, Harvard. 1900 Adaptive Design

users profile



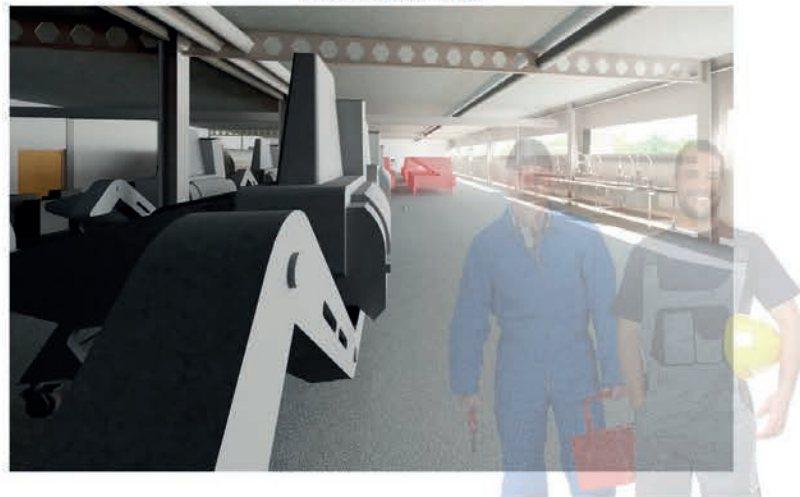
issue diagram



PRODUCTION



PROCESSING

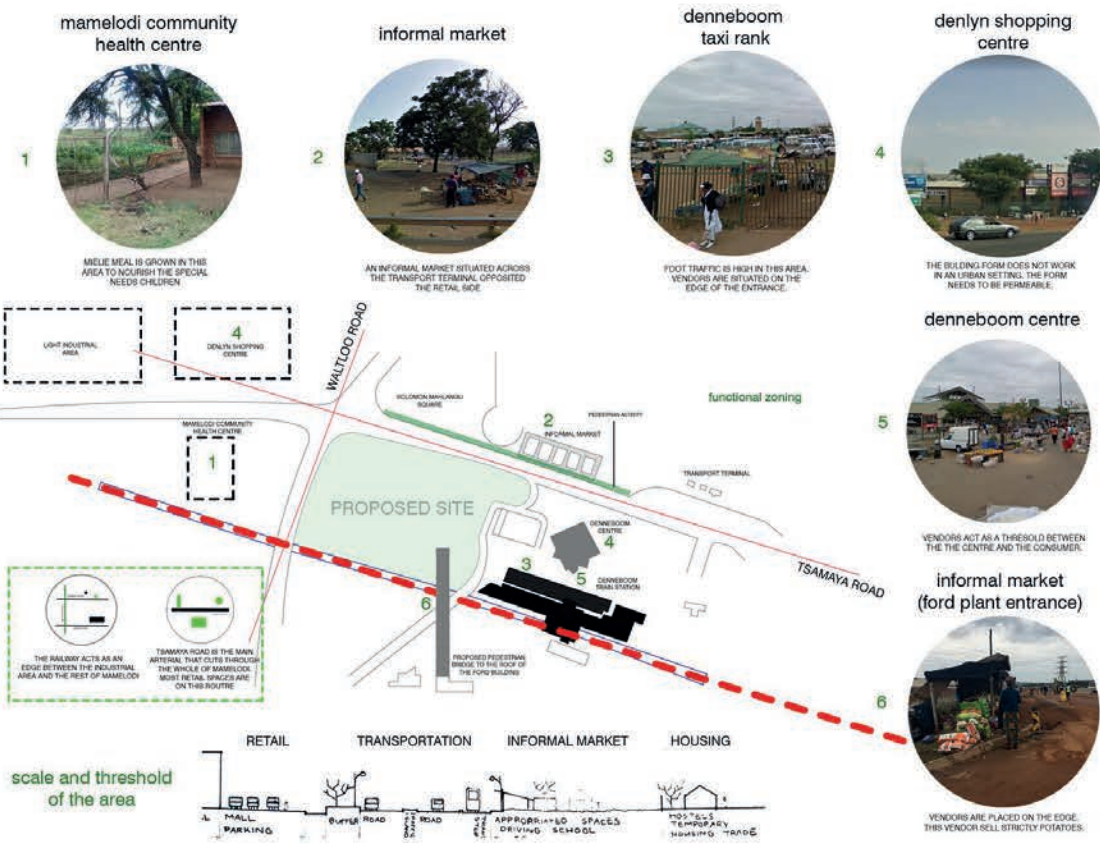


CONSUMPTION





<p>AN ABANDONED UNDERUSED OPEN SPACE</p> <p>URBAN DECAY STARTS TO OCCUR IN THESE DESOLATE SITES</p>	<p>AN EXISTING INDUSTRIAL BASE</p>	<p>PROXIMITY TO A RAILWAY</p> <p>FOR DISTRIBUTION OF THE PRODUCT</p>	<p>MARKET POTENTIAL</p> <p>SERVICES AND PRODUCTS = COMMERCIAL VIABILITY</p>	<p>ACCESS TO COMMERCIAL AND SUPPORT SERVICES</p> <p>FOR THE SERVICES IN THE PARK</p>	<p>FUTURE DEVELOPMENT OF TSAMAYA ROAD</p> <p>BRT, DENSIFICATION, ETC.</p>
---	------------------------------------	--	---	--	---



mamelodi food network



farming
PIENAARS RIVER
URBAN SUSTAINABILITY
URBAN FORESTRY PROJECT
WILL BE PILOTED HERE

distribution
TSHWANE FRESH MARKET
BUYS THE PRODUCE
WHERE INFORMAL VENDORS
BUY THEIR GOODS

farming
SCHOOLS
VEGETABLE FARMING IS BEING
DONE IN SCHOOLS.



farming MAHUBE VALLEY



PARASITIC RELATIONSHIP



The farming network is located because it is close to Mamelodi, the Ebenezer and an informal market.

Shwarandala Cooperative 0.1 open field and 2 shade nets

Muboko Cooperative 0.2 open field and 3 shade nets

Pilo Cooperative 0.2 open field and 3 shade nets

Brakley Cooperative 0.2 open field and 3 shade nets

Kopengang Cooperative 0.2 open field

macro



MAMELODI GATEWAY (GROUP BLOCK VISION)

- retail
INFORMAL MARKETS
- MALL
- distribution
WAREHOUSES
- consumption
RESTAURANTS
- waste recycling
COMPOST



relationship between the stages



meso

DENNY'S SHOPPING CENTRE



BRT SYSTEM THAT WILL BE IMPLEMENTED IN TSAMAVA ROAD



1. TSHANE REGIONAL MALL (NEW)



"INFORMAL TRADE, INCLUDING FOOD AND CRAFTS TO BE SET UP AT DENNEBOOM STATION" (GAPP, 2011)

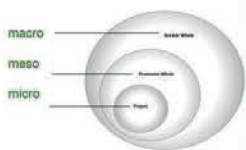


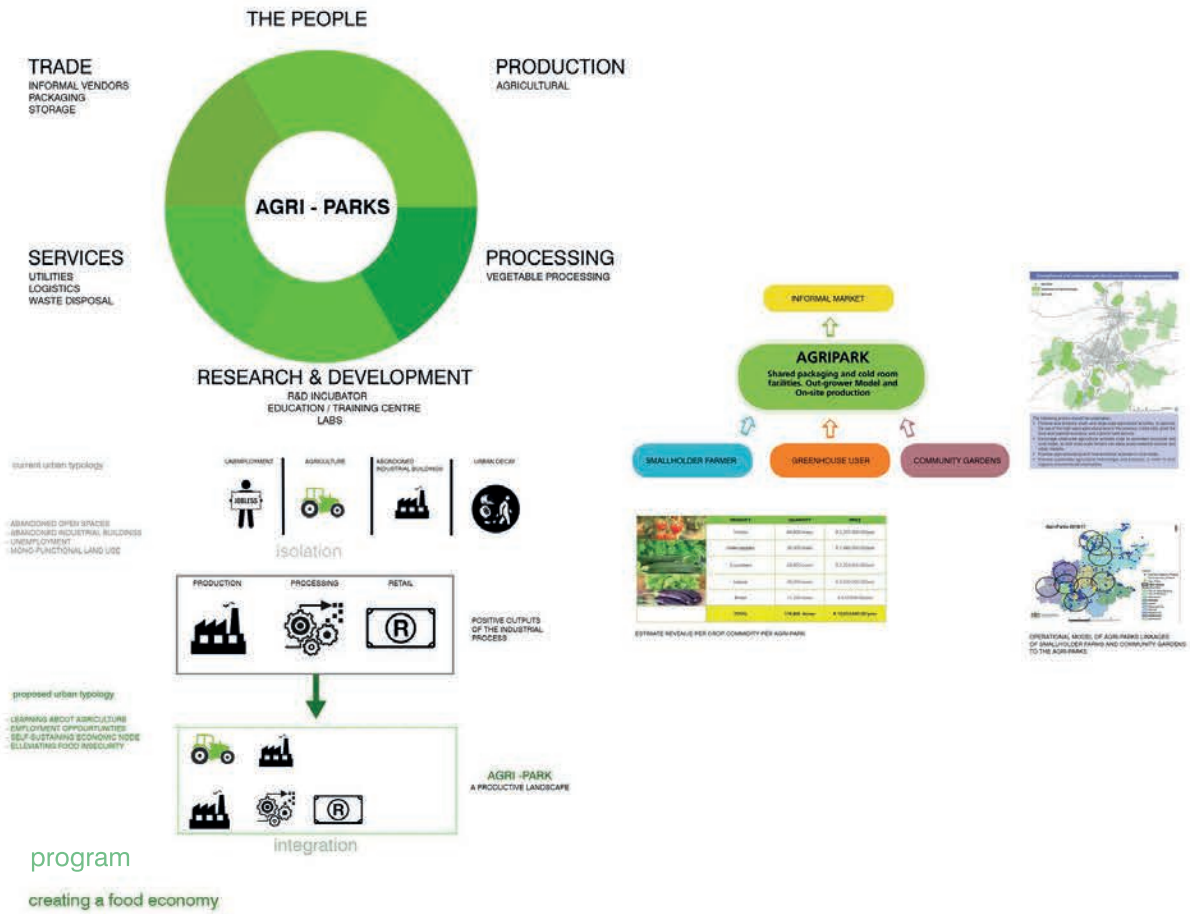
INFORMAL MARKET EDGE

micro

ZONED FOR RETAIL

regenerative theory principle

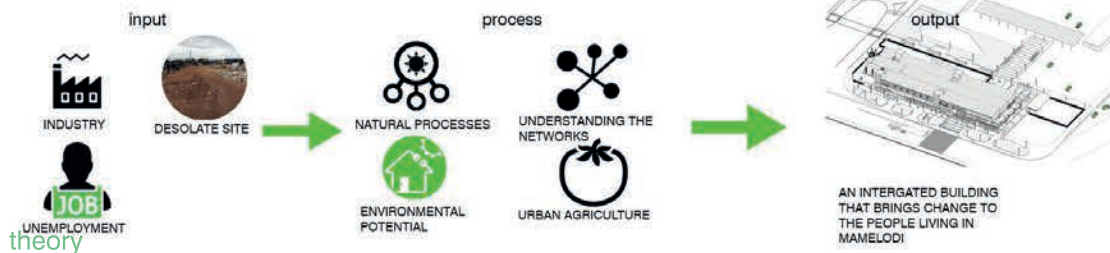




bi-product from the tomato processing unit



REGENERATIVE DESIGN STRATEGY

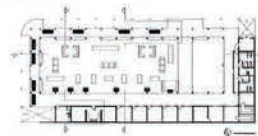


GUGULETHU MEAT MARKET

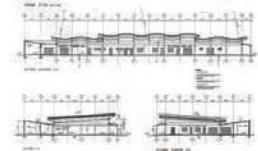
CARIN SMUTS ARCHITECTS



Akin to the Baragwanath Transport Interchange, the Gugulethu Meat Market underwent an early workshop, meetings with local stakeholders and negotiations. "Due to the active involvement of all the traders in the design discussion, the initial 'Environment' market proposal was transformed into a more appropriate local and culturally expressive solution," said CS Architects. "Traders requested an L-shaped building which would form a boundary wall on the south and west sides, cutting off the prevailing winds. This thickened 'wall' accommodates the spaza shop, public toilets, offices, etc."



Gugulethu Meat Market ground floor plan



DESIGN APPLICATION



SCALE OF USER



ROOF STRUCTURE



MATERIAL USE



INFORMAL MARKET DESIGN



CONCEPT APPLICATION



MULTI-FUNCTIONAL USE



STRUCTURE

ROOF CANOPY



SYSTEMS DESIGN

BARAGWANATH TRANSPORT INTERCHANGE

URBAN SOLUTIONS ARCHITECTS



"The Baragwanath Transport Interchange and Market is a strong example of a public catalyst for the development of new urban spaces and fabric in a formerly underdeveloped and marginalized context" (Dokler et al, 2005:68). The success of the project comes from the fact that it is always busy whenever you pass. There is a symbiotic relationship between the different types of programmes. "It is planned so as to accommodate 500 street traders, with associated storage facilities, management offices and support infrastructure."

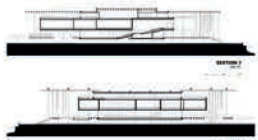


PEREZ ART MUSEUM

HERZOG AND DE MEURON



The building roof is supported by concrete columns. Underneath the canopy is a public space for the people of Miami. This public space acts as a threshold between the building and the street. The space welcomes people into the building. "Due to its proximity to the water, the museum is lifted off the ground for the art to be placed above storm surge level" (Archdaily, 2019). "Roof and plants combined will create an overall microclimate reducing the extreme temperature gaps between outside and inside in the hot weather" (Archdaily, 2019).



RESEARCH CENTRE ICT-P

H. ARCHITECTES



"In accordance with the research fields of the building users, they choose, from the beginning, a building prepared to give an ambitious response to the challenges of sustainability." (Archdaily, 2019). This design theory can start to inform the regenerative design theory. Structure: "Low point concrete structure with a lot of inertia has been chosen as the main structure, contributing directly to the passive comfort of the building." (Archdaily, 2019).



precedent study

productive landscapes in the future

PUBLIC OPEN SPACES



SMALL PARKS

ECOLOGICAL LANDSCAPE



PLANTS

SOCIAL INFRASTRUCTURE



INFORMAL MARKET

WORK + RESEARCH INFRASTRUCTURE



PRODUCTION AREAS
LEARNING INCUBATORS
TECHNOLOGICAL CENTRE

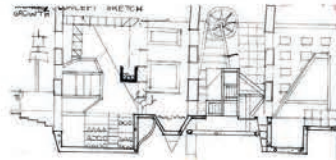
PRODUCTIVE LANDSCAPES



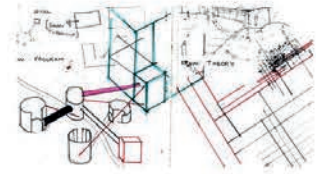
GREENHOUSES



concept 1
intergration



concept 2
production and procesing



concept 3
informal market pods

concept

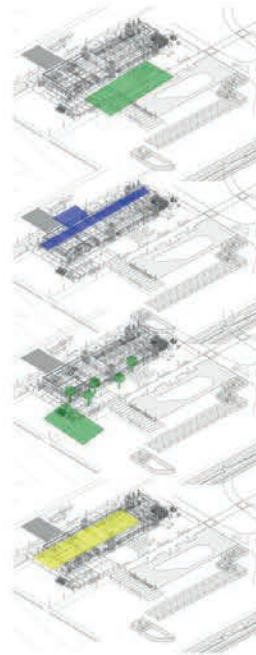
ISSUES

ENVIRONMENTAL
- WATER SCARCITY

SOCIAL
- LACK OF SOCIAL INFRASTRUCTURE
- UNEMPLOYMENT

ECOLOGICAL
- URBAN DECAY

ECONOMICAL
- ACCESS TO FRESH PRODUCE
- LOW TO NO INCOME STUDY AREA



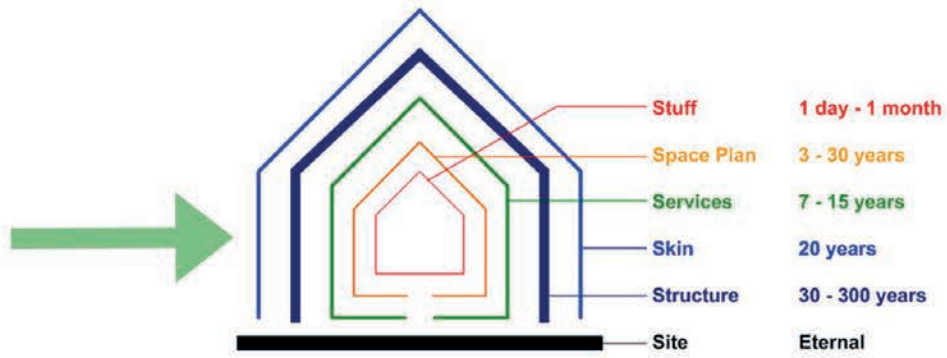
ADAPTIVE STRATEGY

- IRRIGATION
- MORE GREENHOUSES
- DIFFERENT CROPS

- MORE SOCIAL INFRASTRUCTURE
- PUBLIC OPEN SPACE

- MORE TREES
- GREEN ROOFS

- RETAIL EDGE FOR INFORMAL VENDOR EMPOWERMENT



Stewart Brand's 6 S's from *How Buildings Learn*

TSAMAYA ROAD

PEDESTRIAN FRIENDLY ENVIRONMENT

OVERHEAD ST

TRUNK STAT

PEDESTRIAN CROSSING TO SOLOMON MAHLANGU SQUARE

FLEXIBLE INFORMAL VENDORS

PUBLIC SEATING

WATER FALLS TO THE LANDSCAPE BUFFER

PUBLIC S

WALTLOO ROAD

INFORMAL VENDORS EDGE

MAIN ENTRANCE

ENTRANCE 3 UP

LARGE STAIRCASE THAT CAN ACT AS PUBLIC SEATING

EXISTING PRAYER SPACE

WATER GARDEN

MARKET / CONCERT SPACE SPACE FOR FESTIVALS

COMMUNITY GARDEN

WALKWAY ABOVE

PERIMETER SEATING

INFORMAL TAXI RANK - CHANGE STATION

STAIRS

STALL & INFORMAL VENDOR STORAGE

ENTRANCE 4

ENTRANCE TO THE BUILDING

GREENWALL FACADE

WATER FALLS INTO PRODUCTIVE LANDSCAPE

VIBURNUM PLANTS TO GUIDE PEDESTRIAN TO THE MALL

BOULEVARD PLANT

PERGOLA STRUCTURE ABOVE

PRODUCTIVE LANDSCAPE

CAR PORT STRUCTURE OVERHEAD

TAXI WASH BAYS

HOLDING BAYS

STALLS

STALLS

CENTRAL AXIS TO SOLOMON MAHLANGU SQUARE

TAXI RANK

INFORMAL

Figure 83: Ground Floor Plan. (Author, 2019)



(PROPOSED BRT IN THE FUTURE)







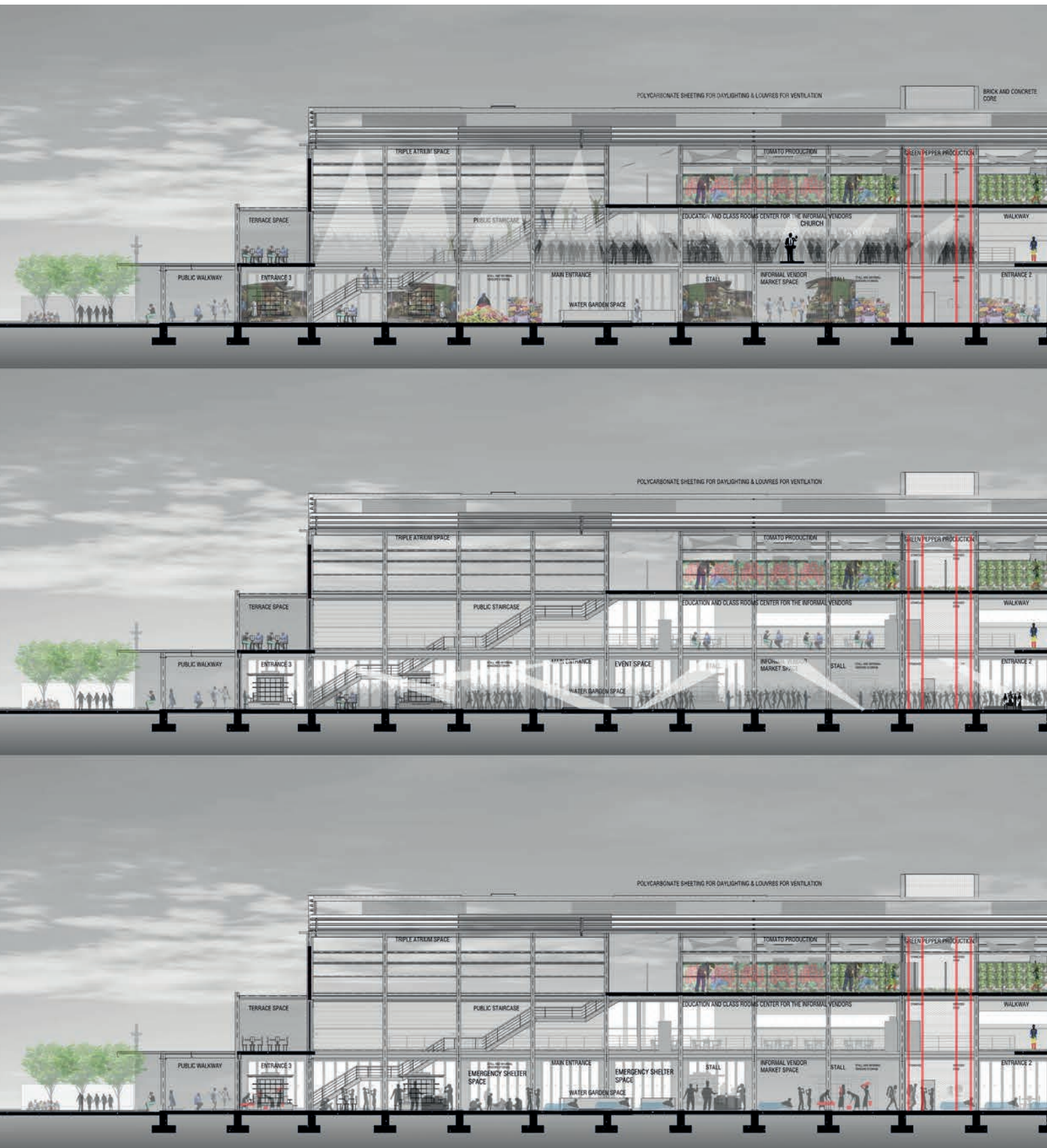
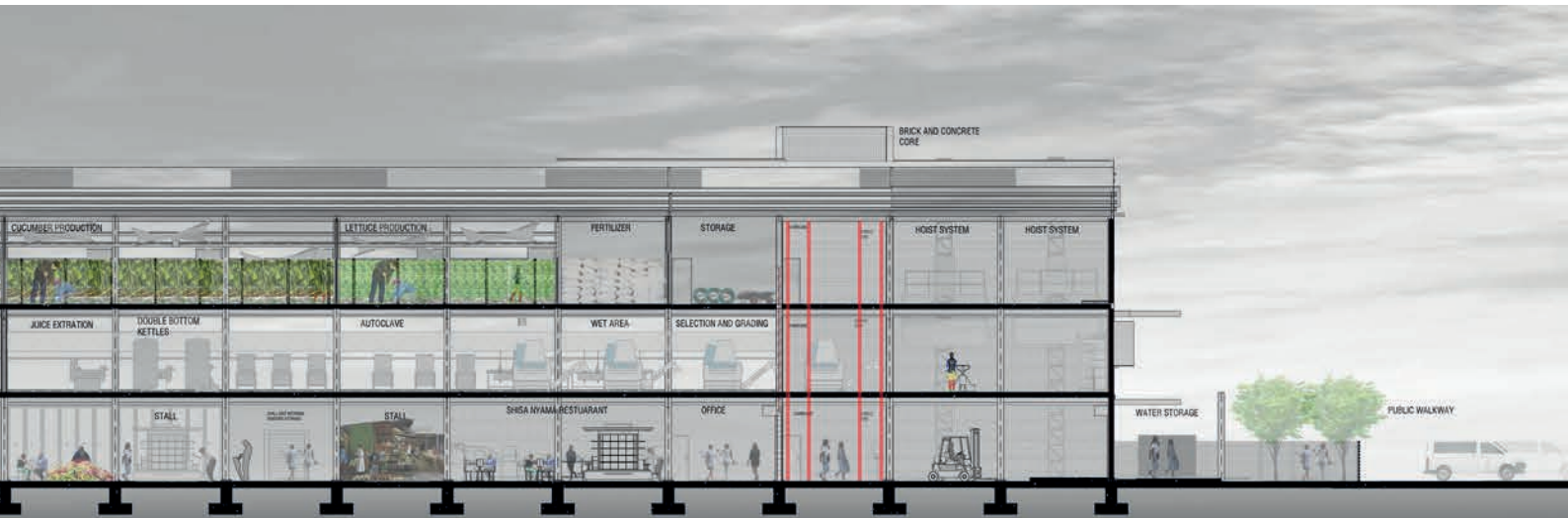
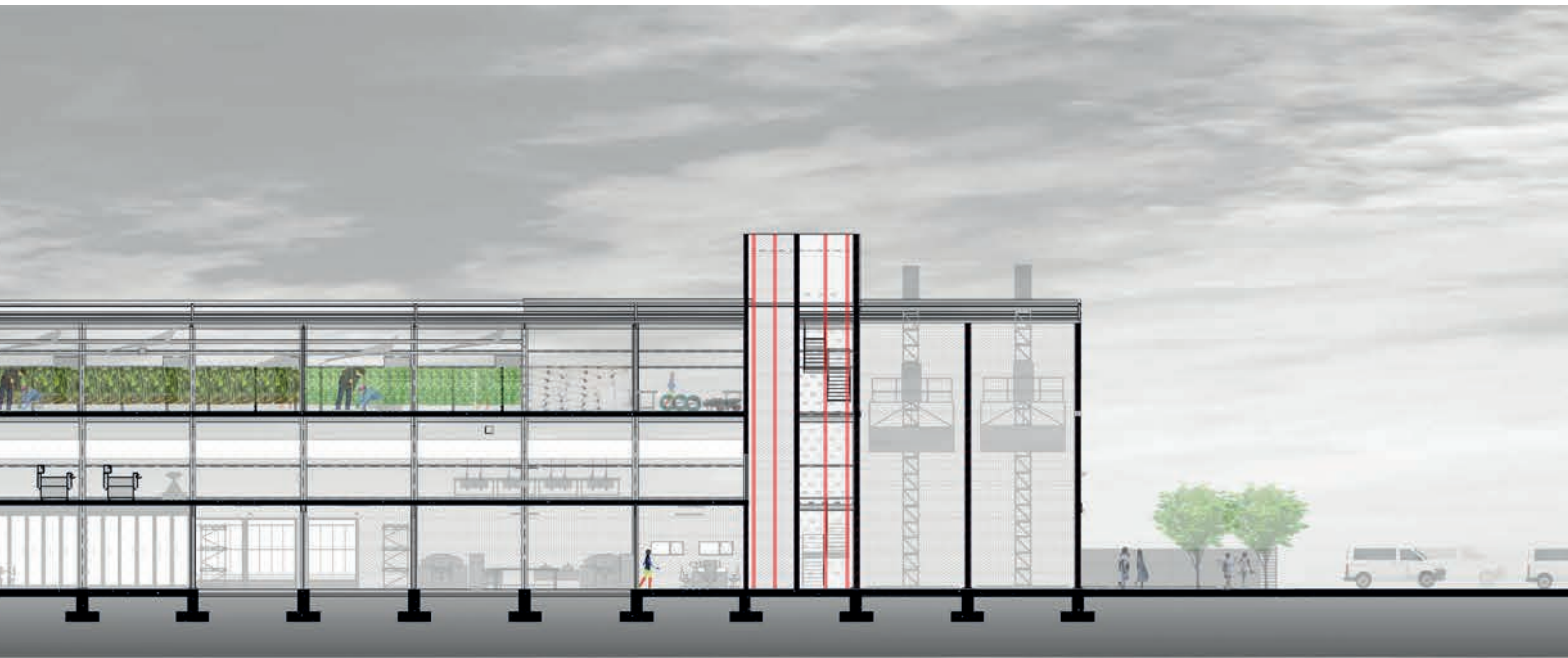


Figure 85: Section of Adaptation of Different Programmes in the Building. (Author, 2019)







COURTYARD SPACE

WALKWAY

TAXI RANK

RAIL











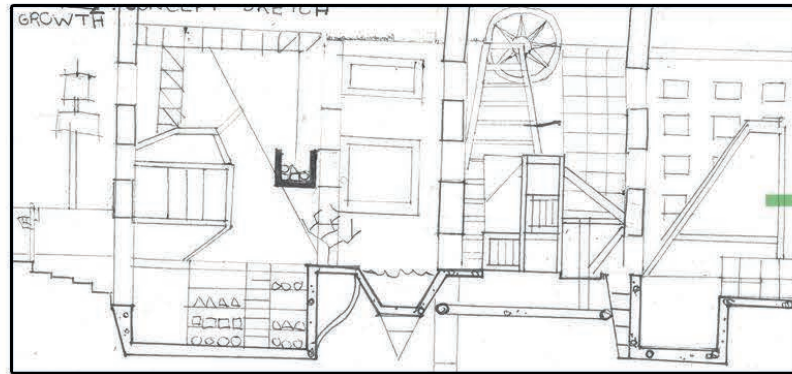




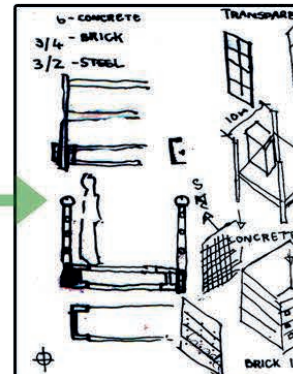


DIJO (FOOD) - AN AGRI-PARK (AGRO-PROCESSING PLANT) TO ALLEVIATE UNEMPLOYMENT AND FOOD INSECURITY IN MAHLANGU

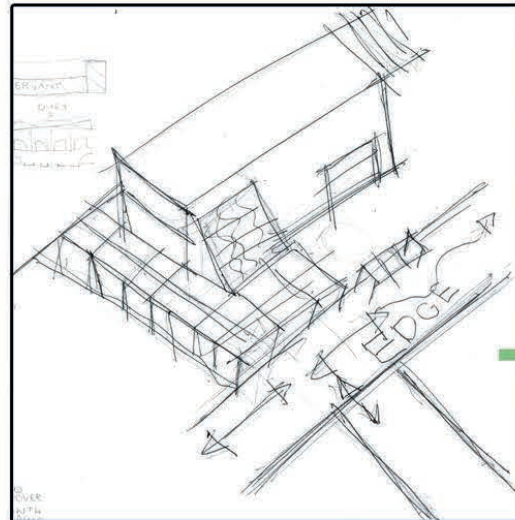
conceptual drawings



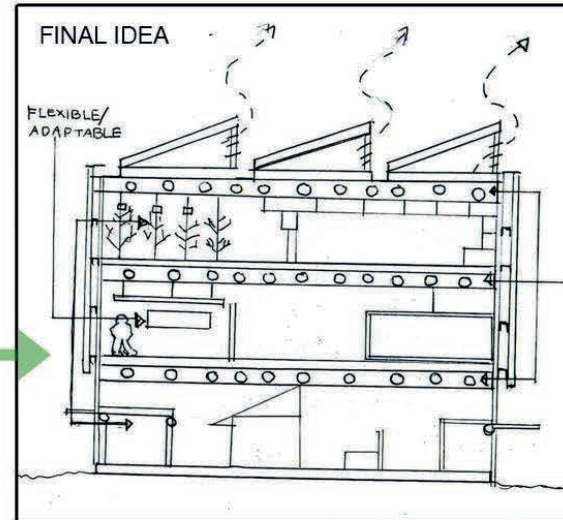
EARLY CONCEPTUAL SKETCH - AN INDUSTRIAL MACHINE OR CREATING FOOD



TECHNICAL CONCEPT OF THE DESIGN

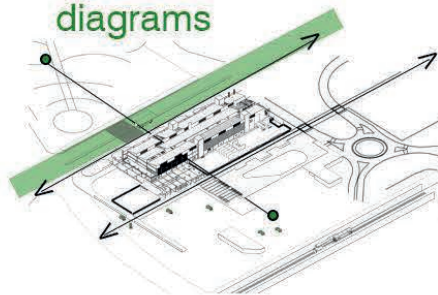


FORM - A BUILDING WHICH RESPONDS TO DIFFERENT EDGE CONDITIONS



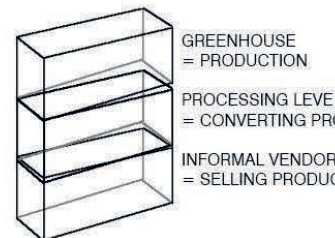
STEWARDS BRAND'S - ADAPTABILITY CONCEPT APPLIED

diagrams



CONTEXTUAL RESPONSE

THE NEEDS OF THE COMMUNITY | LINKING SOLOMON MAHLANGU AND THE PROPOSED TAXI RANK | THE NEEDS OF THE INFORMAL VENDOR | PEDESTRIAN ORIENTED DEVELOPMENT | MATERIALITY OF SURROUNDING BUILDINGS | EXISTING EDGES AND FUNCTIONS



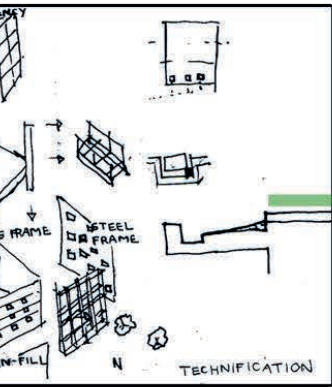
FUNCTIONAL ORGANISATION

STACKING THE RESPECTIVE FUNCTIONS

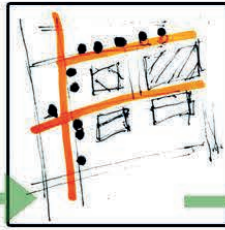
TO EMPOWER INFORMAL VENDORS VIA URBAN AGRICULTURE

MELODI WEST

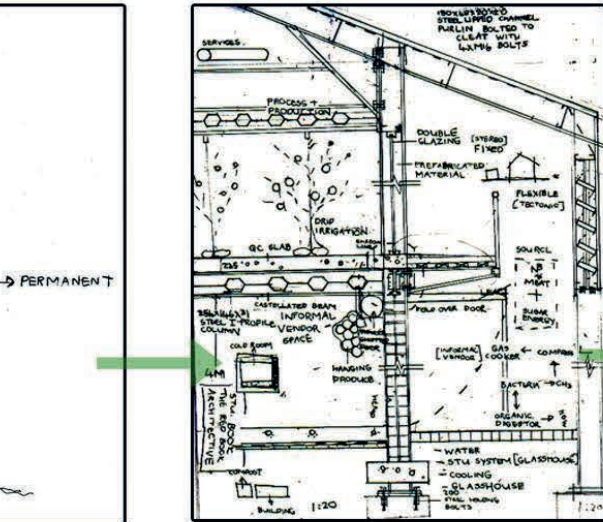
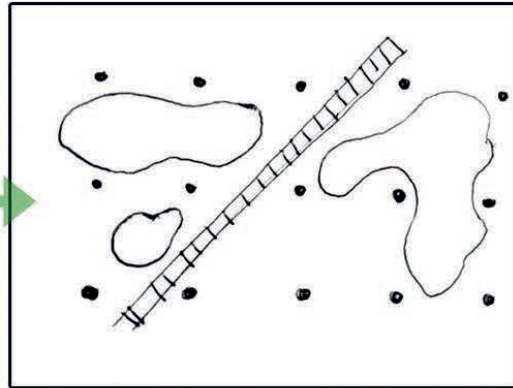
MANGALISO MTETWA
12029280



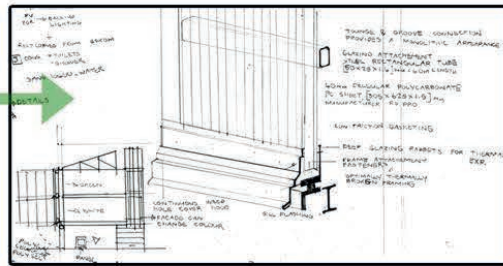
DESIGN - STEEL FRAMES AND BRICK INFILL



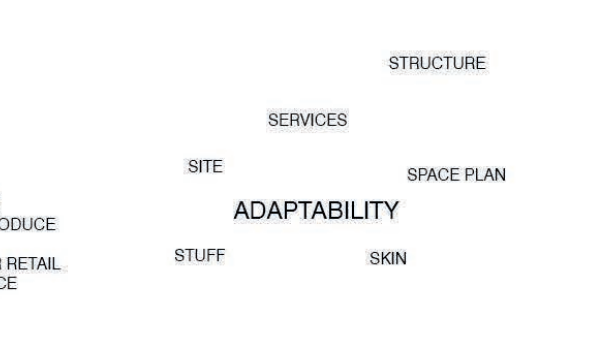
OPEN AND PERMEABLE - SPACES CREATED IN A RIGID GRID WITH A CENTRAL AISLE



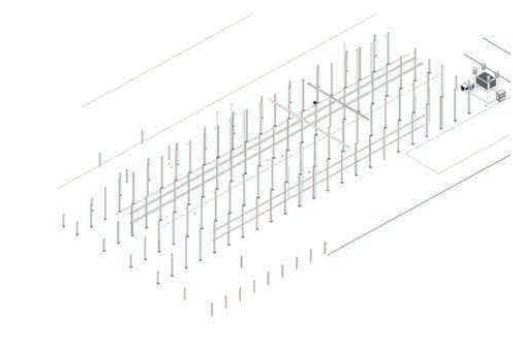
TECHNICAL RESOLUTION DETAIL - EXPLORATION



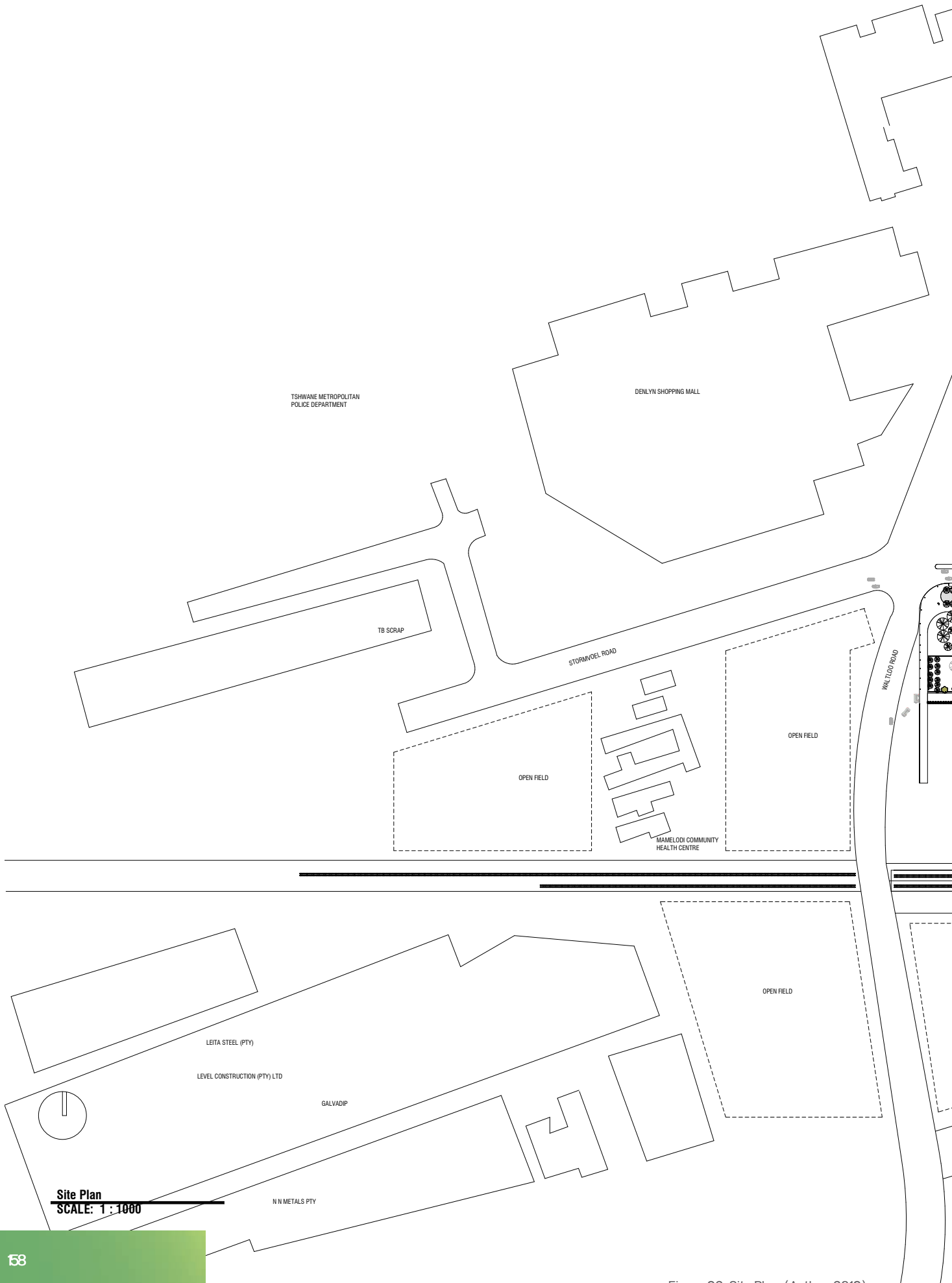
DETAIL AND FACADE TREATMENT - EXPLORATION OF THE DETAILS

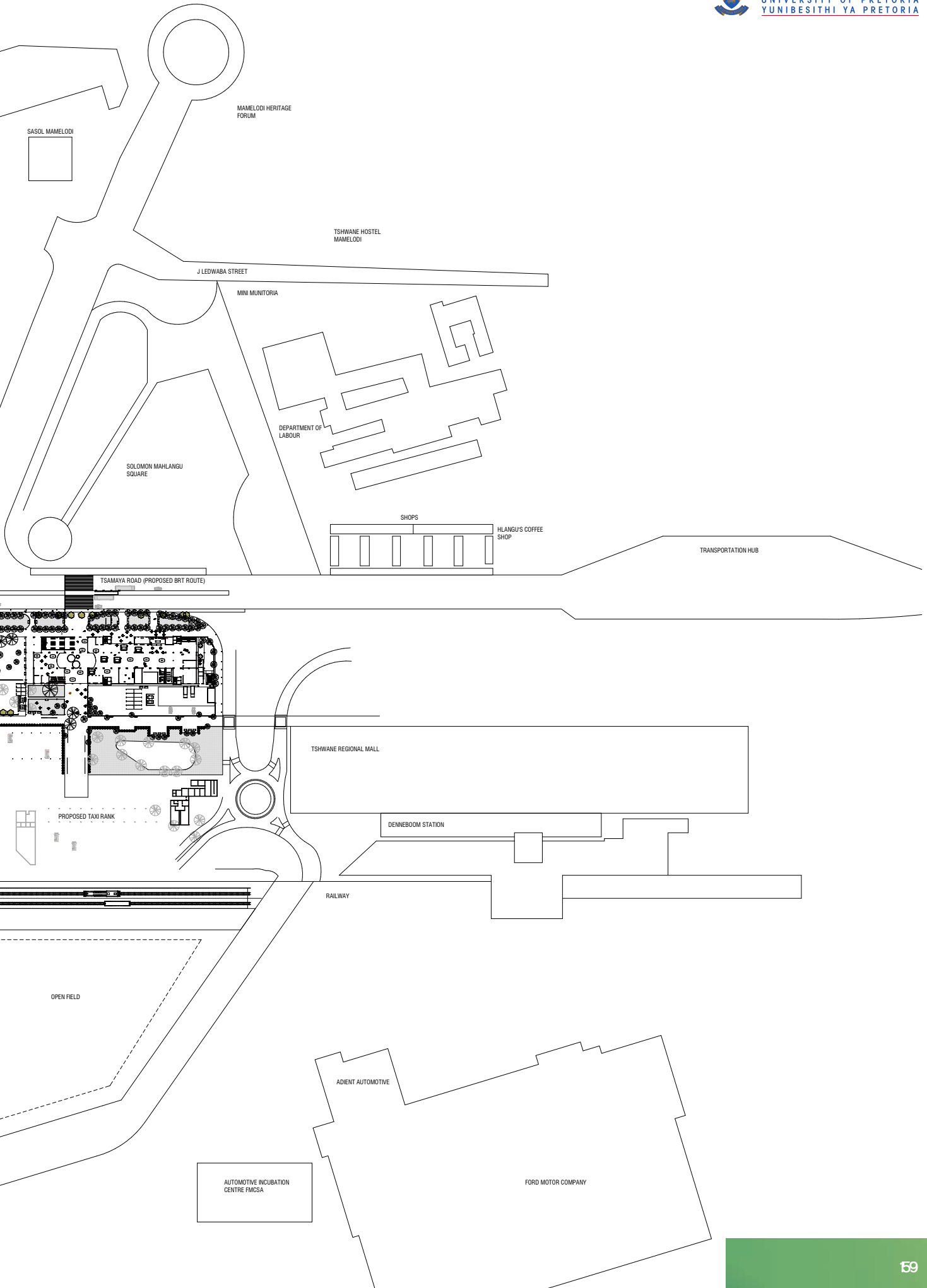


FORMAL IDEAS
STEWART BRANDS IDEAS OF THE ADAPTILITY



TECHNOLOGICAL INTENTIONS
A PERMANENT STEEL STRUCTURE THAT ALLOWS FOR ADAPTABILITY ESPECIALLY USE







DIJO PROPOSED BUILDING
PALETTE

EXISTING MATERIAL PALETTE
AROUND THE SITE

materiality

BRICK (COROBRIK)

POLYCARBONATE SHEETING



STREET VENDORS STRATEGICALLY
PLACE THEMSELVES AROUND THE
STATION

GOOD LIGHT



DENNEOOM STATION



STEEL



CONCRETE



LANDSCAPE



KLIP-LOK SHEETING



DRYWALLING SYSTEM



DESOLATE SITE



TSHWANE MALL



SITE



INFORMAL VENDOR

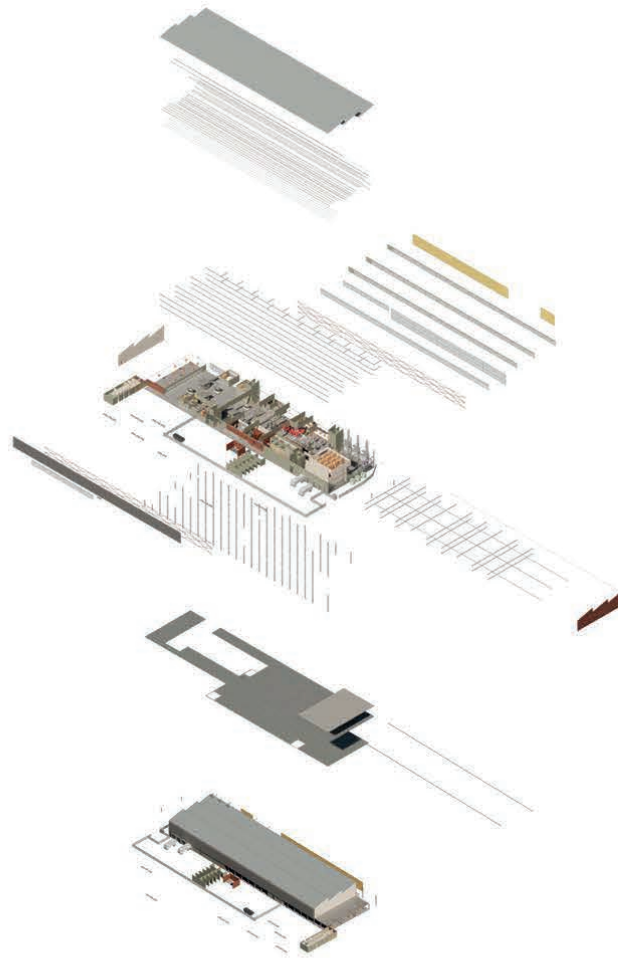


ROOFING
IBR ROOF ON C-CHANNELS

STRUCTURE
- H-COLUMNS
- CASTELATTED BEAMS

FLOORING
- COMPOSITE DECKING

COMPLETED FORM
- TECTONIC



ADAPTABILITY CONCEPT
(STEWART BRAND)

SKIN
KLIP LOK 700 & POLYCARBONATE SHEETING

STRUCTURE
STEEL STRUCTURE

SPACE PLAN
FLEXIBLE SPACE

SERVICES
- SERVANT AND SERVED SPACES
- CANTILEVER BEAM CHANNEL

SITE
- MAMELODI

SOCIAL
- BUILDING SPACE THAT FILTERS
TO THE COURTYARD (URBAN SPACE)

SURROUNDINGS
- IN BETWEEN TWO MALLS

structural system

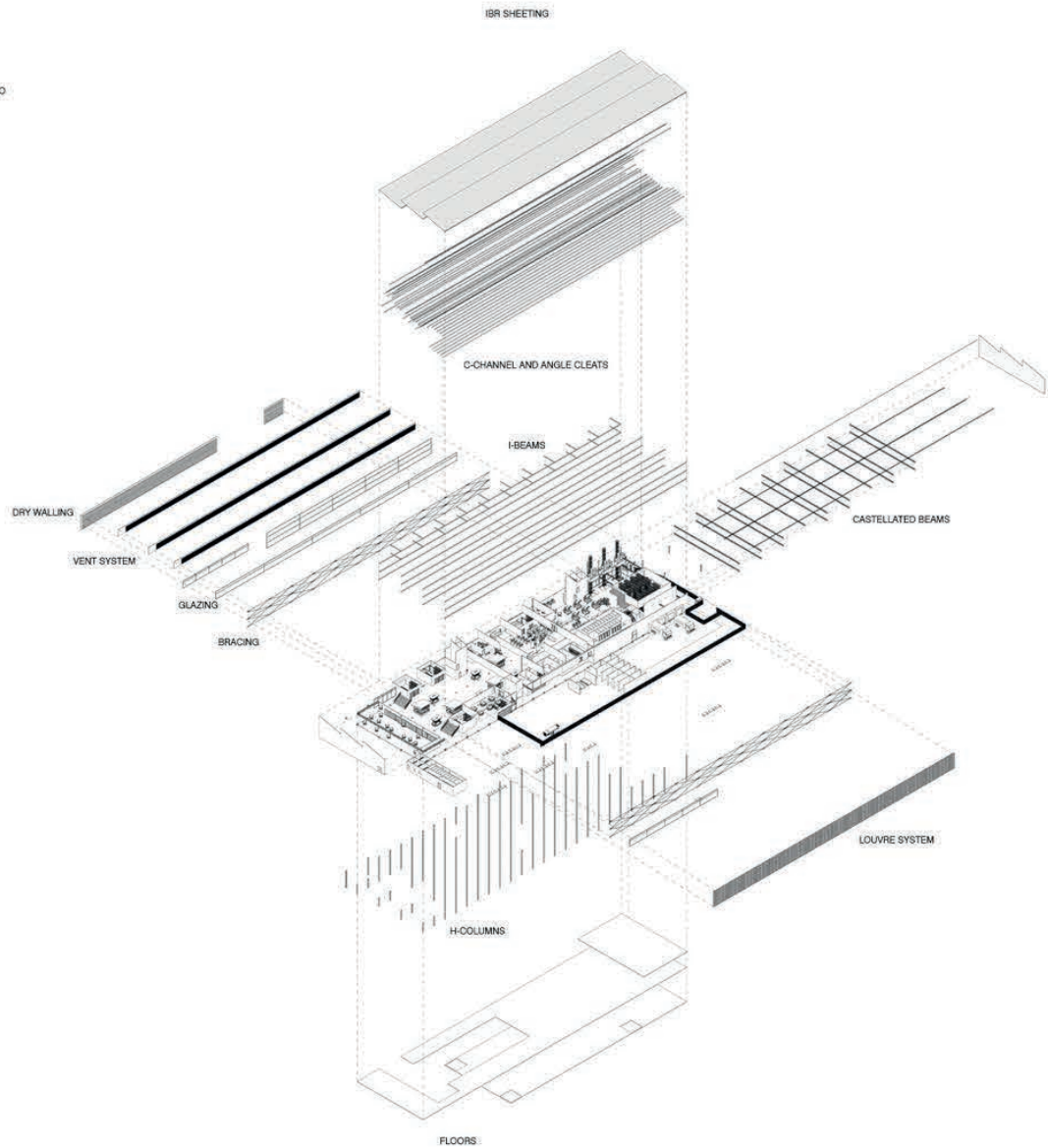
ROOF:
1200mm x 1200mm IBR ROOF SHEETING FIXED TO C-SECTION
150 X 65 X 20 X 20 STEEL LIPPED CHANNEL PURLIN BOLTED TO
CLEAT WIT 4 X M16 BOLTS

JOIST:
254 x 146 x 31 STEEL I-BEAM PROFILE SPACED 10 M.
BOLTED WITH 4 M8 BOLTS.

BEAMS:
CASTELLATED BEAMS SPACED IN 5M INTERVALS.
FOR THE STRUCTURE AND DERVICES.

COLUMNS:
305 X 3025 X 97 STEEL H-PROFILE COLUMN TO
STEEL BASE PLATE

GROUND FLOOR:
COMPOSITE FLOORING STRUTURE
STEEL = TENSILE
CONCRETE = COMPRESSION



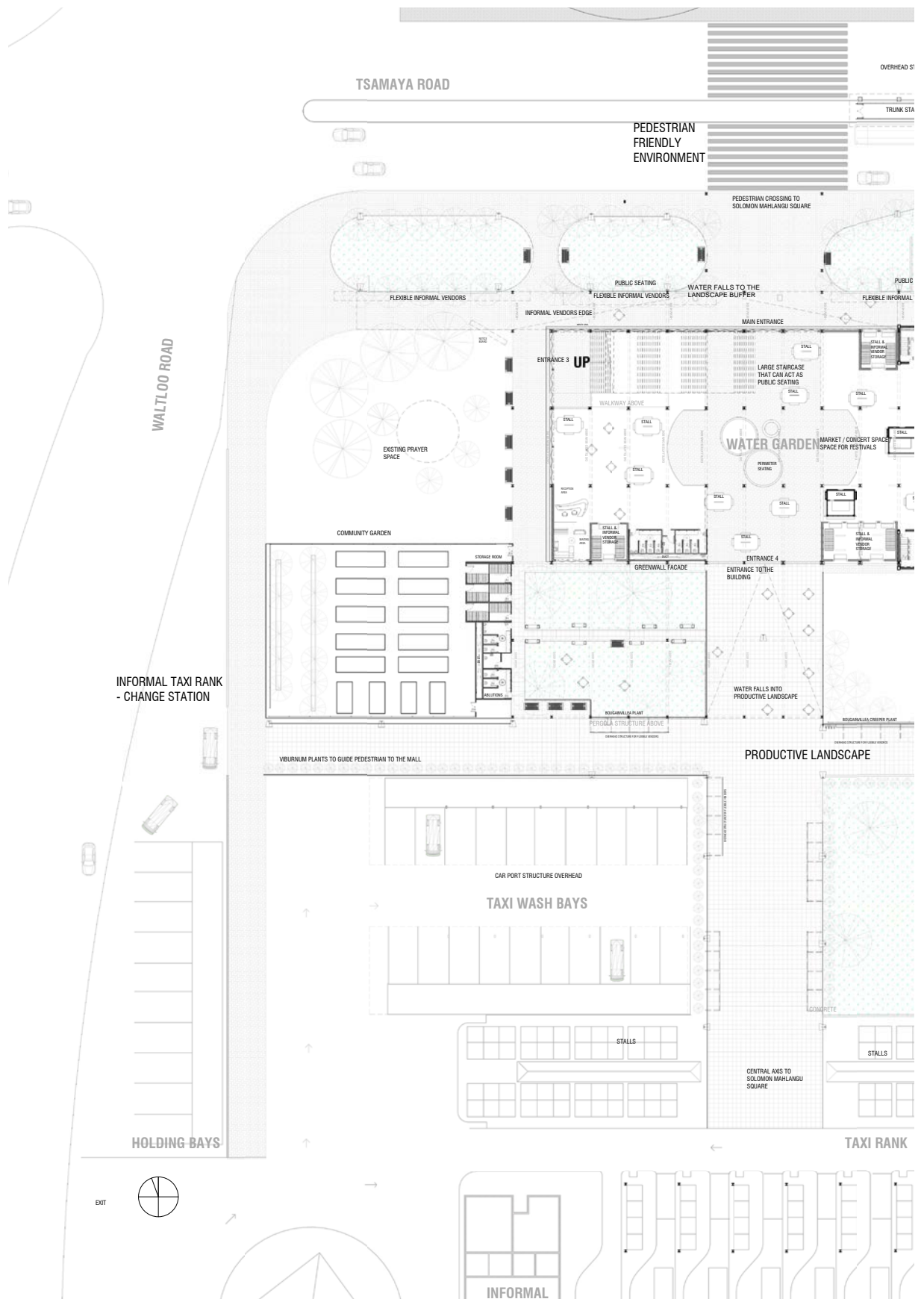
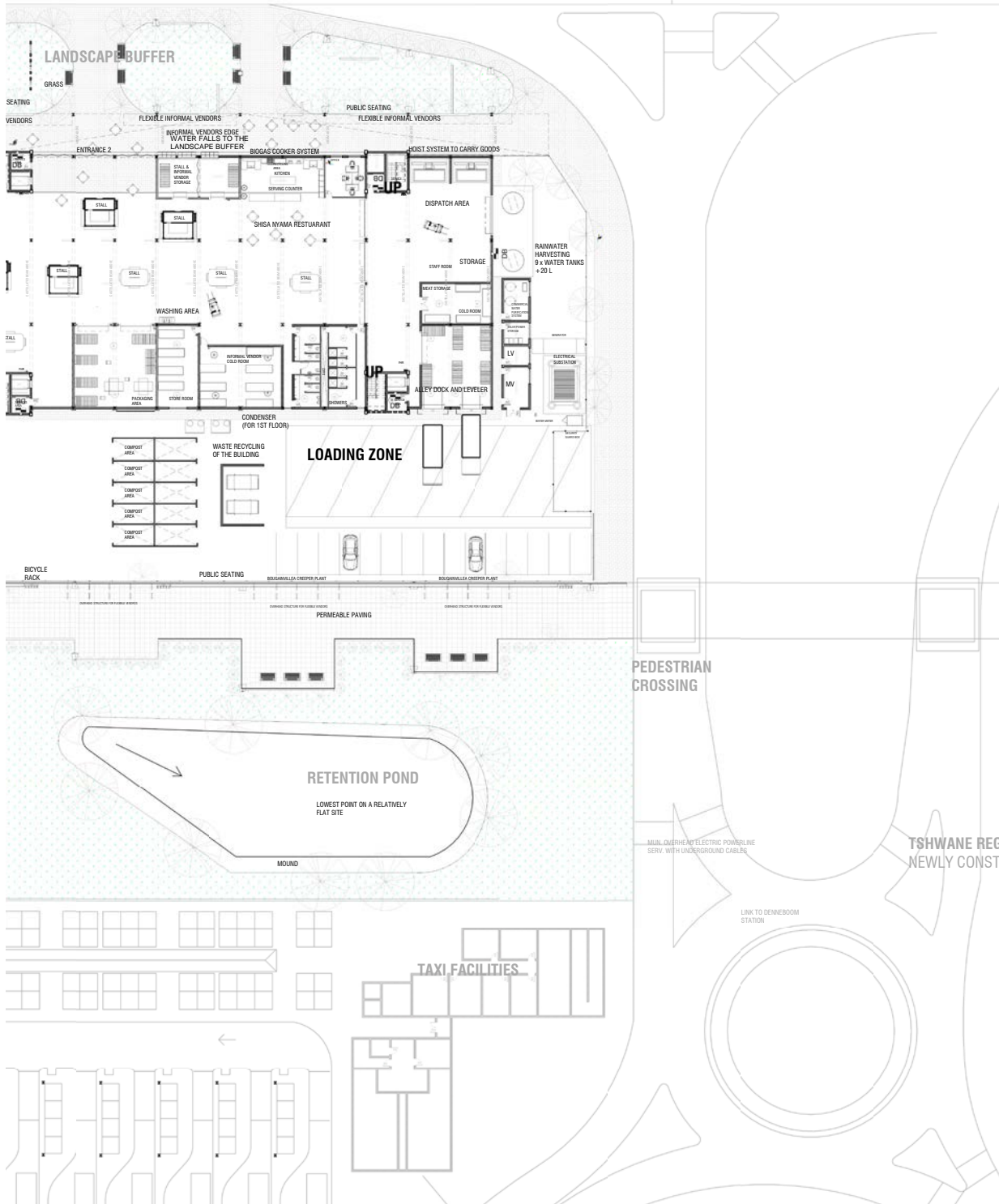
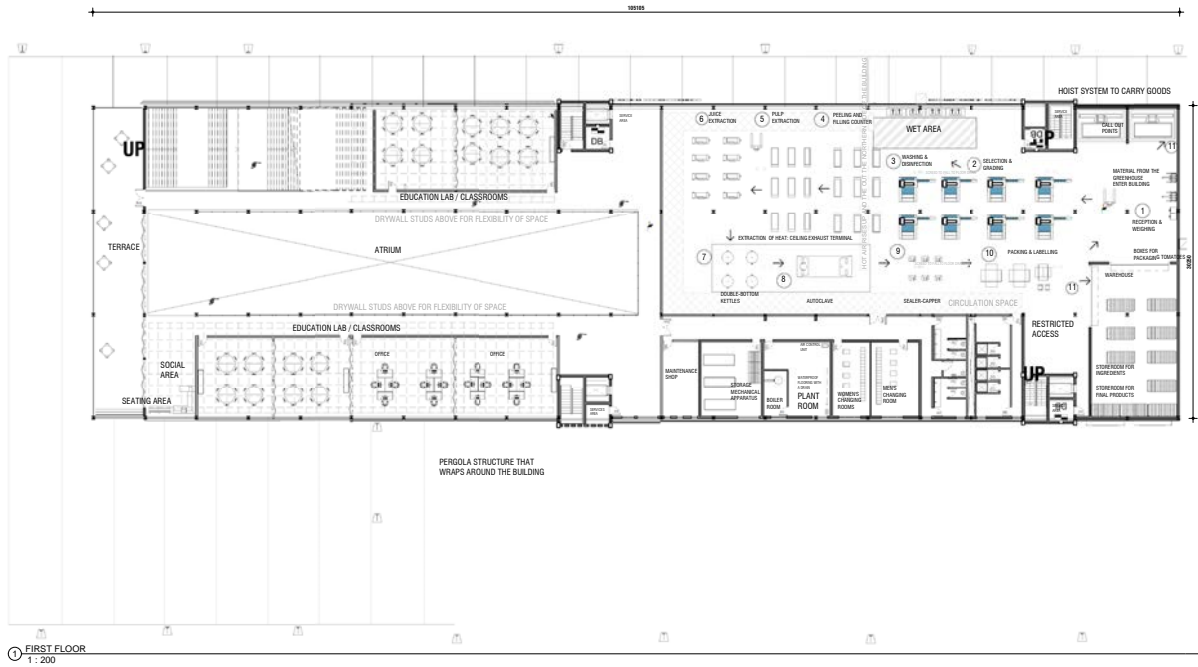


Figure 95: Ground Floor Plan. (Author, 2019)

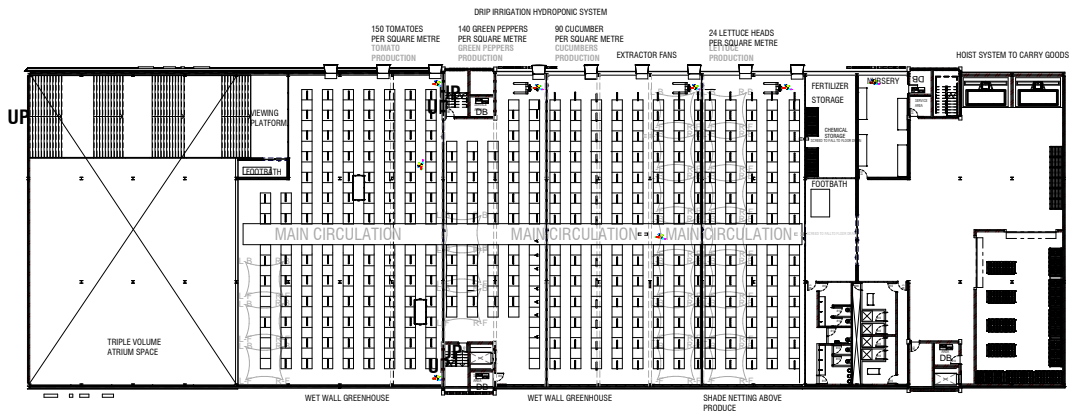
STRUCTURE



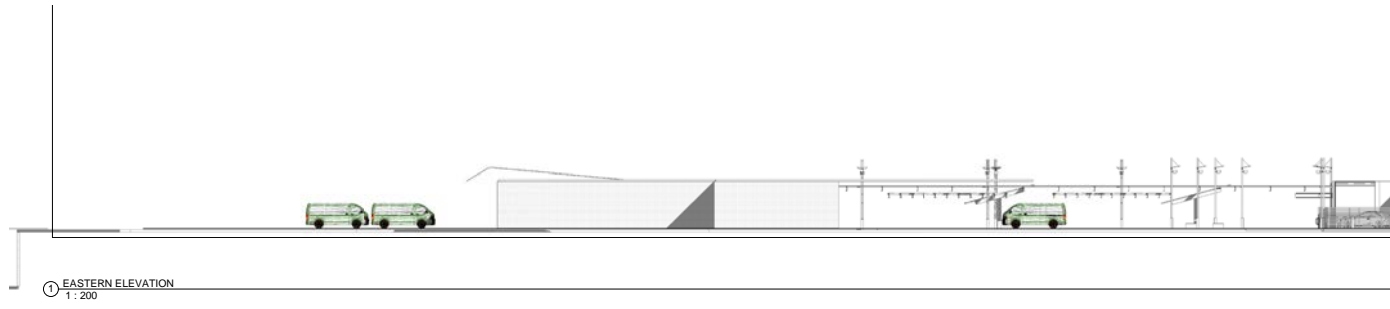


ROOF PLAN
1:200

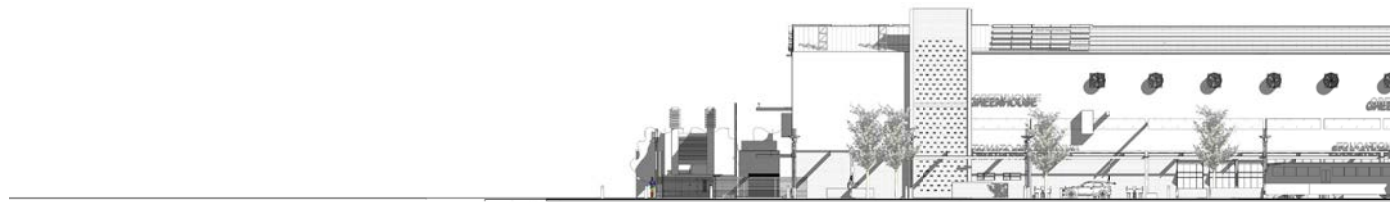




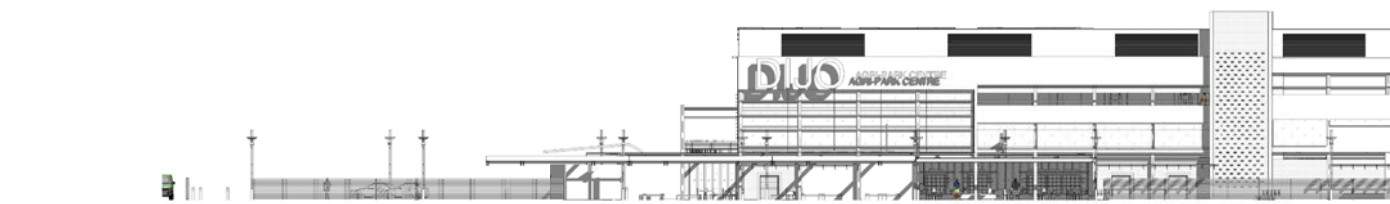
② SECOND FLOOR
1 : 200



① EASTERN ELEVATION
1: 200



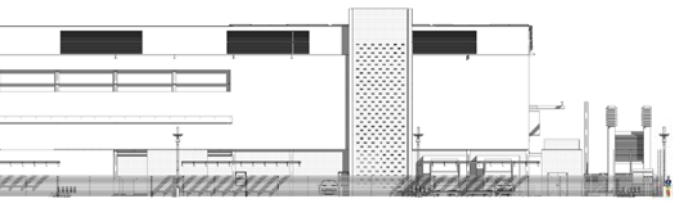
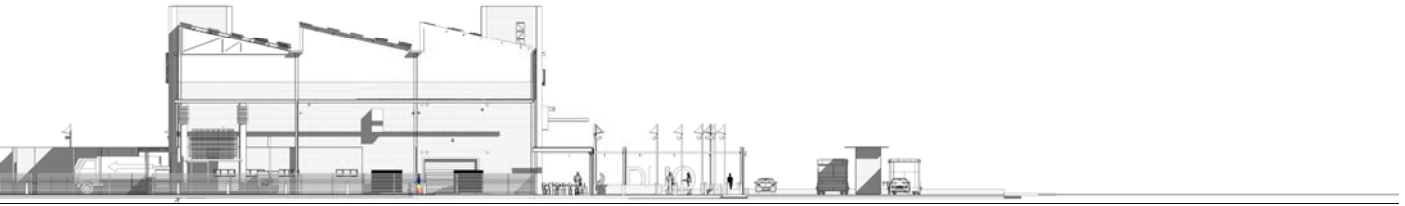
② NORTHERN ELEVATION
1: 200



③ SOUTHERN ELEVATION
1: 200

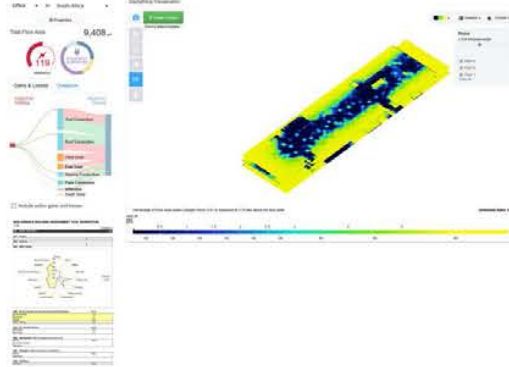


④ WESTERN ELEVATION
1: 200

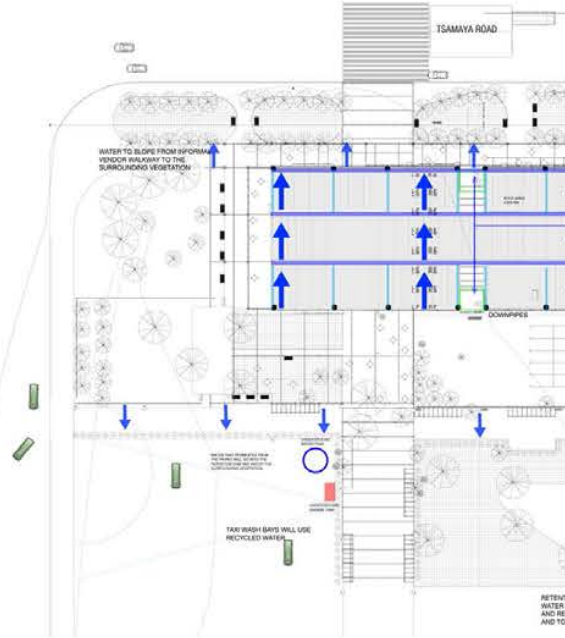


environmental strategies

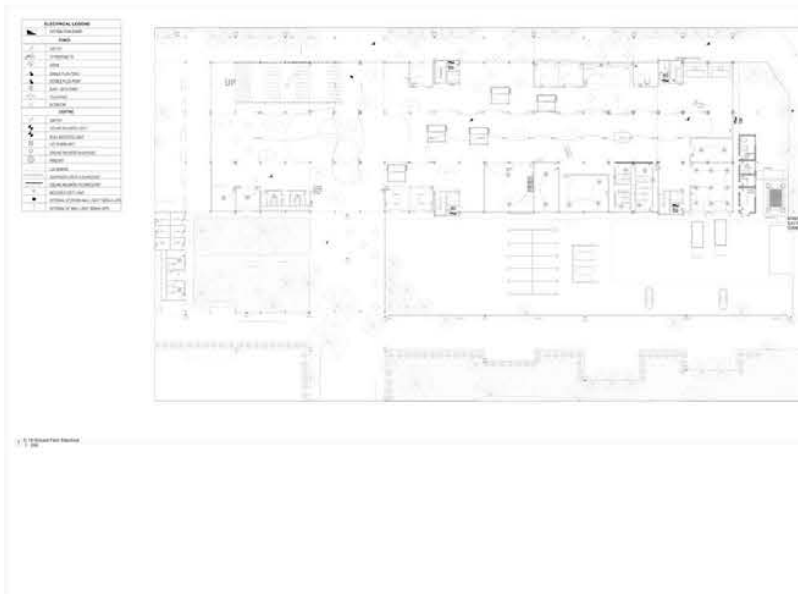
BASE CASE (SEFAIRA)



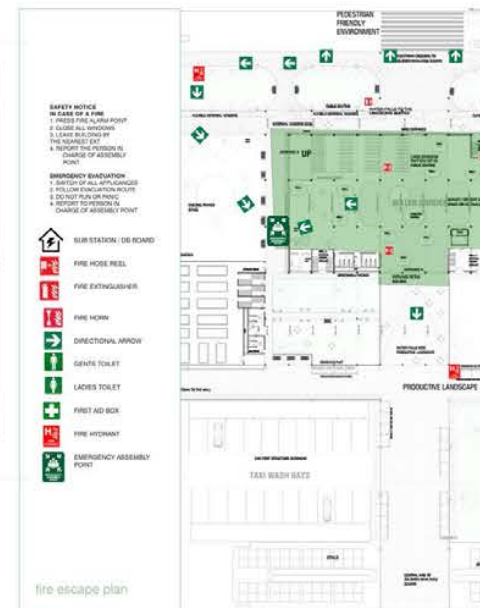
WATER STRATEGY



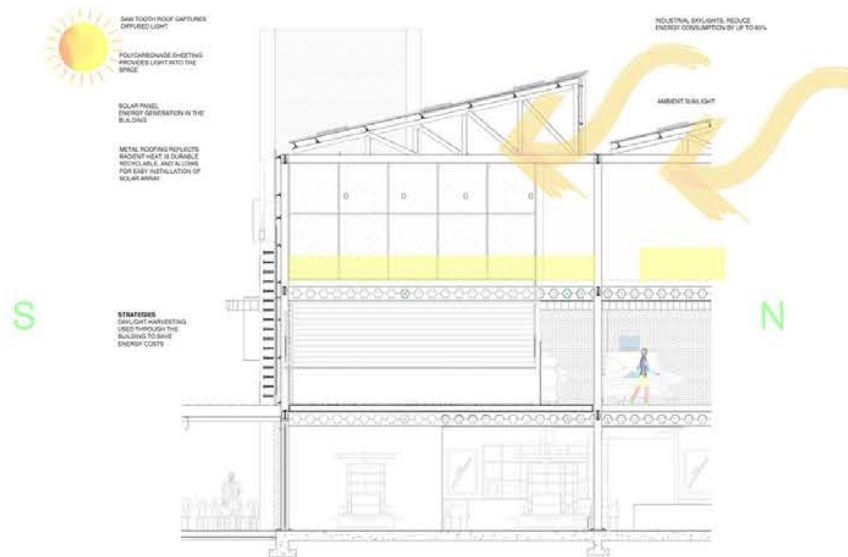
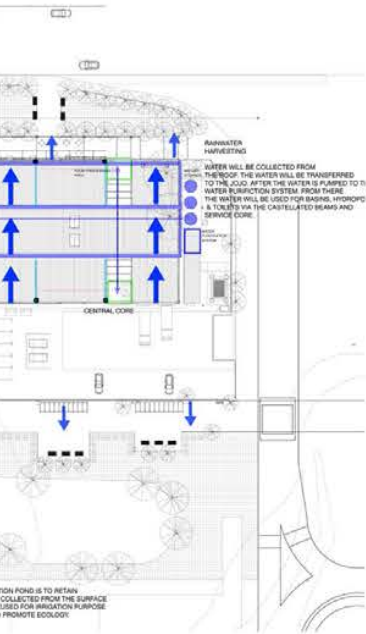
ELECTRICAL STRATEGY



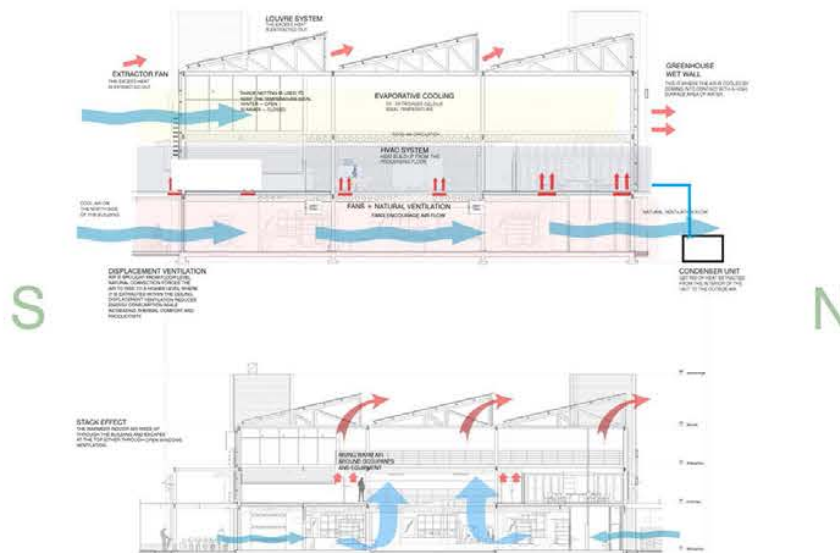
FIRE PLAN STRATEGY



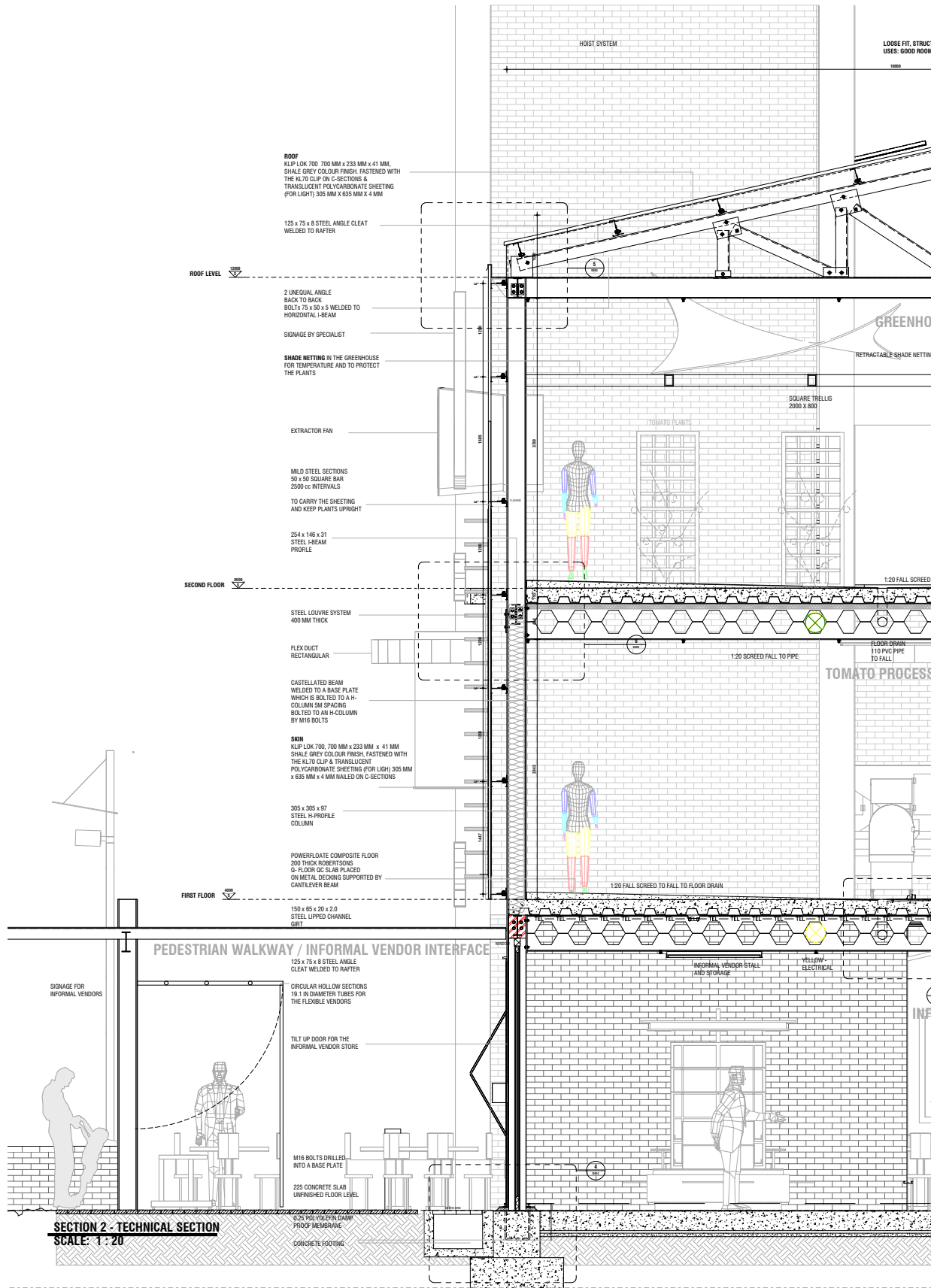
DAYLIGHTING STRATEGY



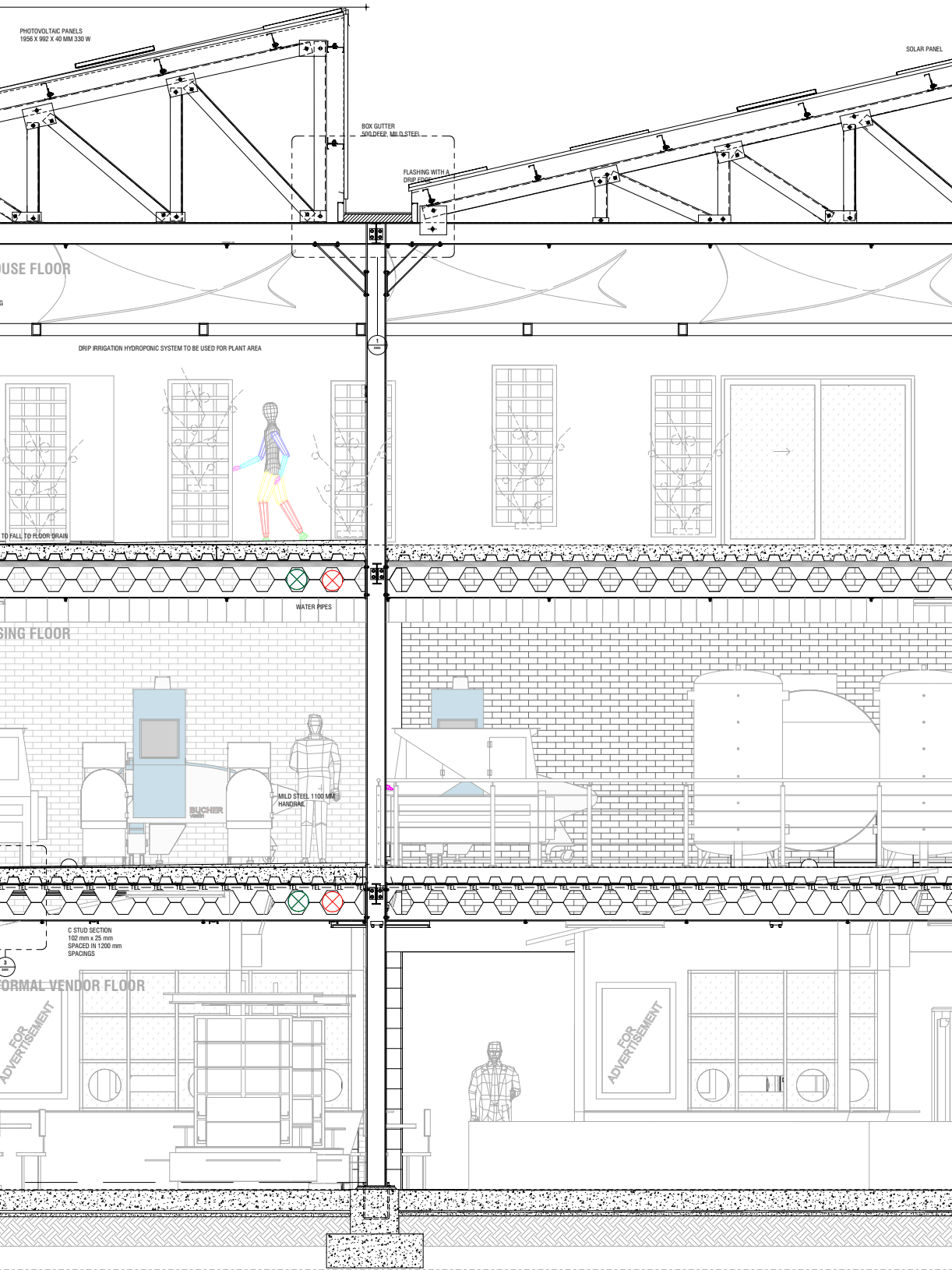
VENTILATION STRATEGY

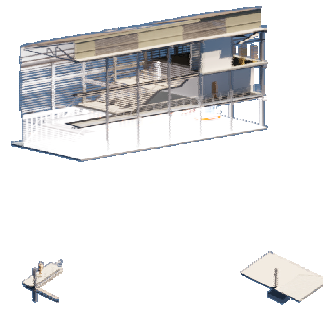
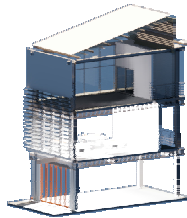
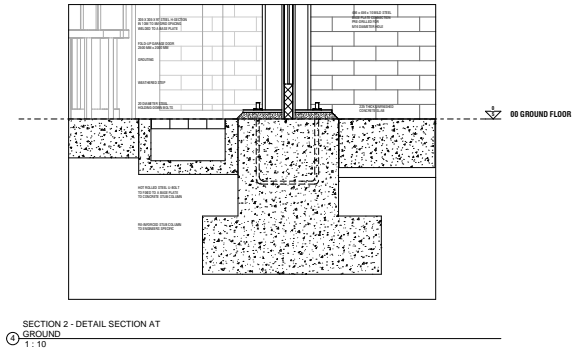
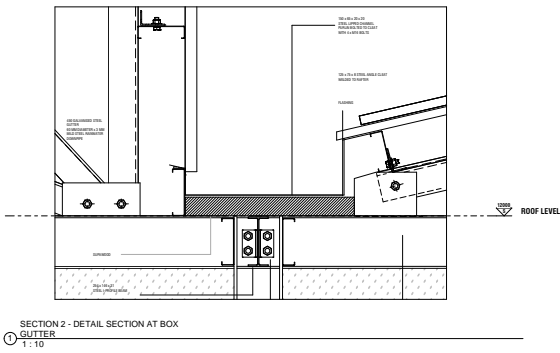
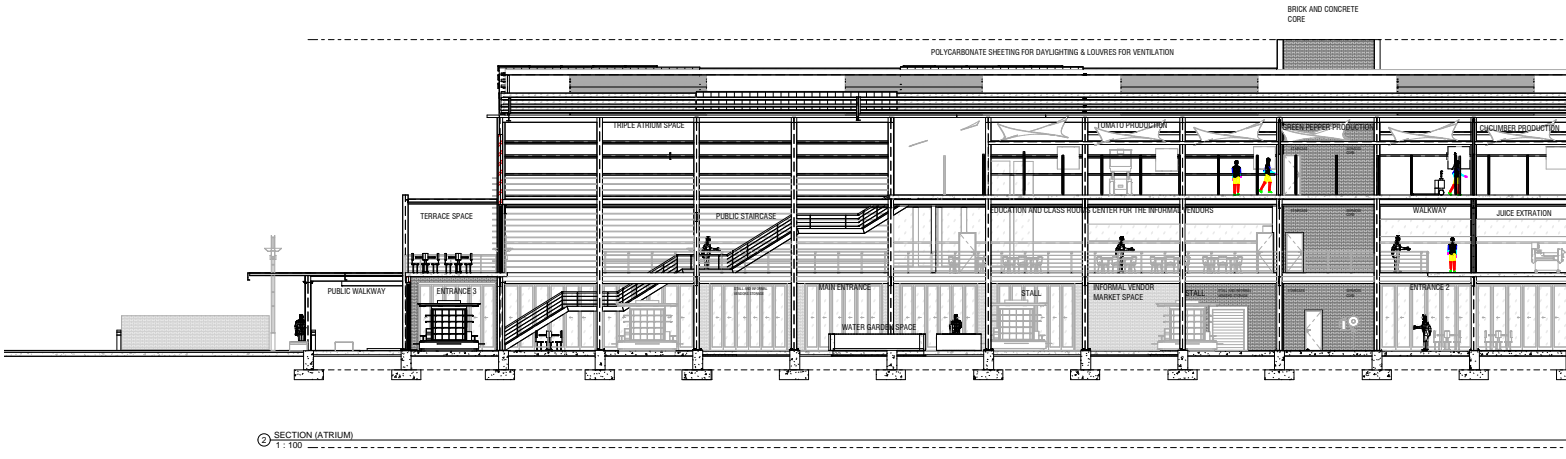


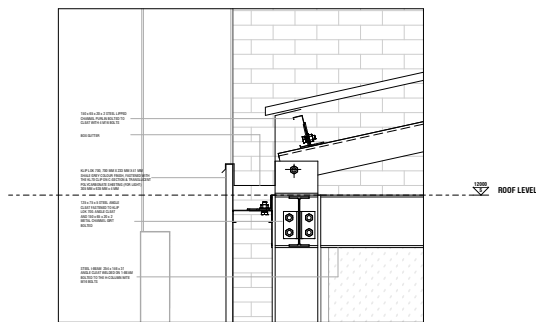
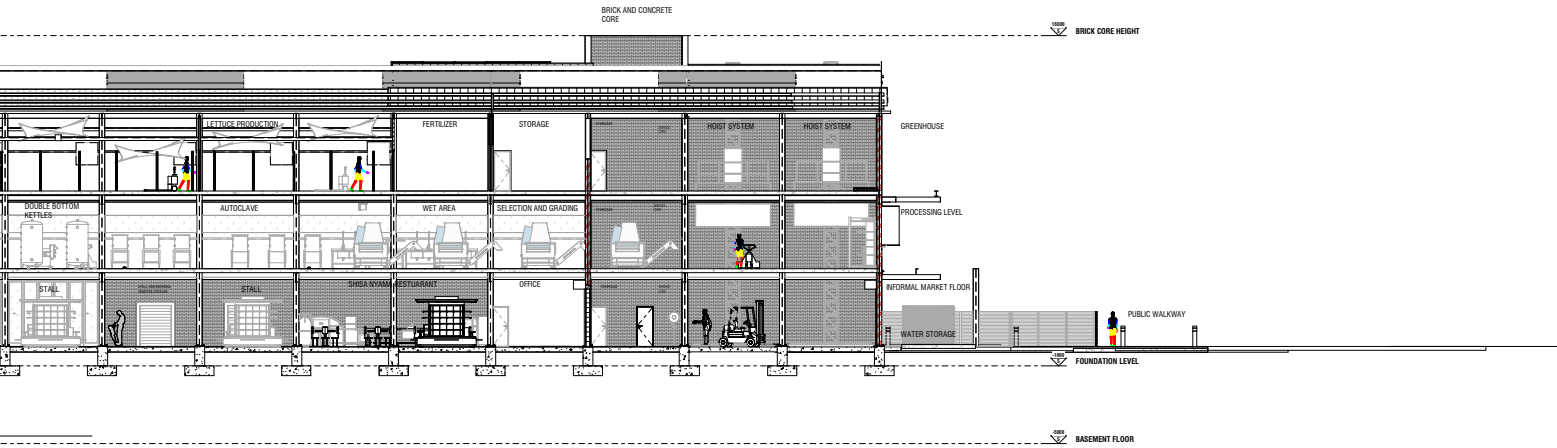
ventilation systems



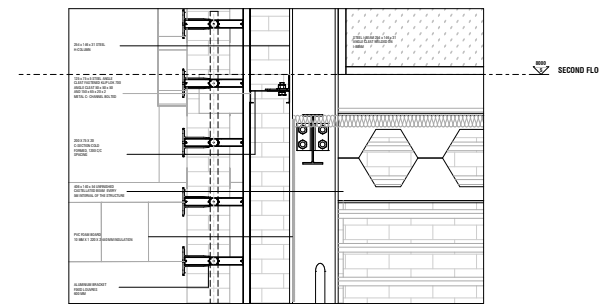
STRUCTURE CAPABLE OF LATER ADAPTION FOR DIFFERENT
SIZES, FLOOR TO CEILING HEIGHTS AND LOADING CAPACITY



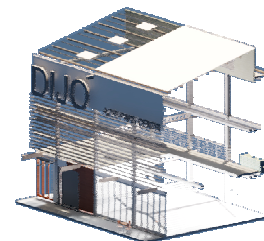
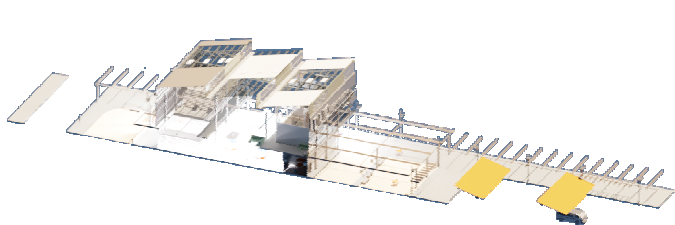


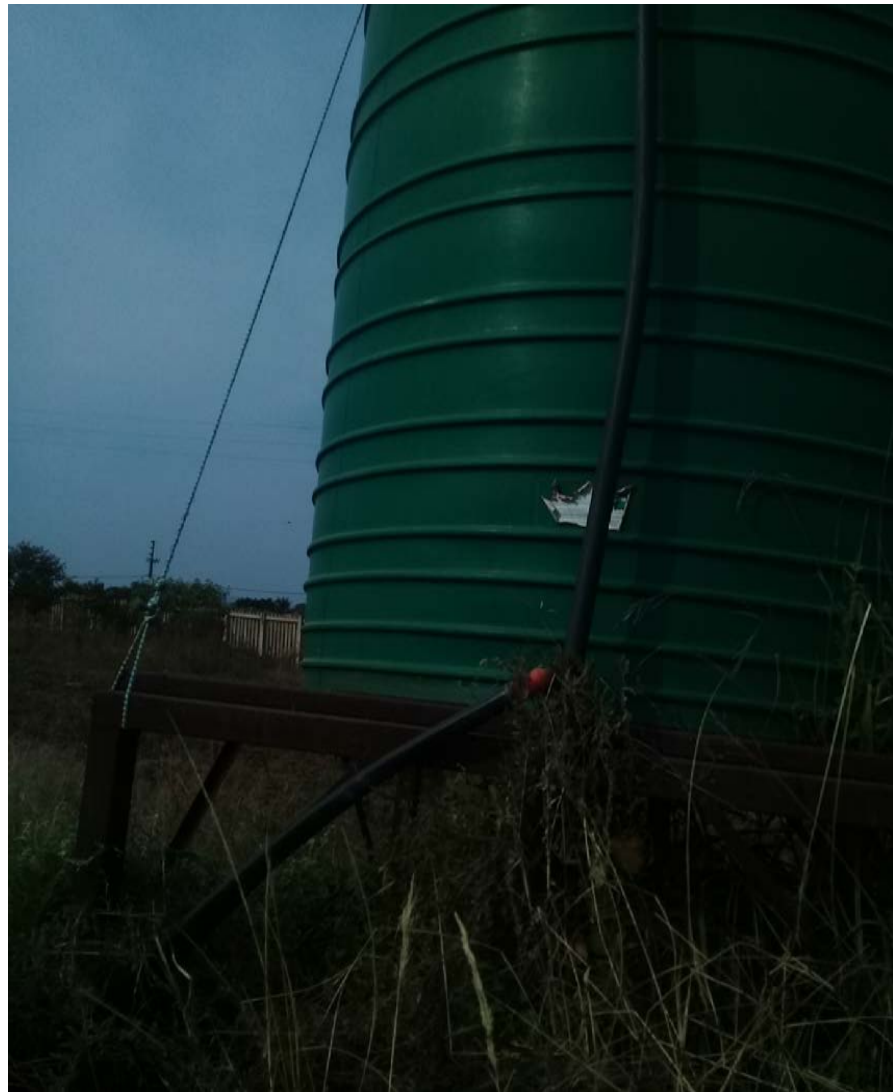


SECTION 2 - DETAIL SECTION AT ROOF
I-BEAM
1:10



SECTION 2 - DETAIL SECTION AT
SECOND FLOOR SLAB
1:10





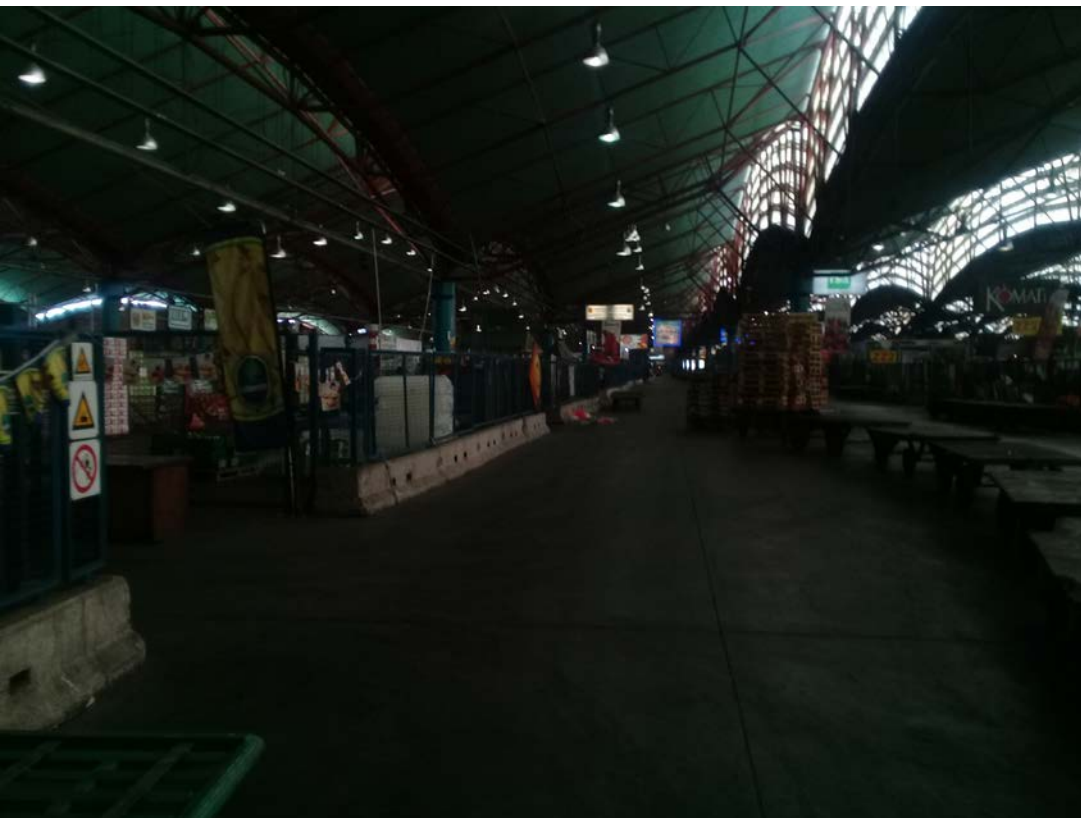


Figure 101: Walk Around Mamelodi Experience. (Author, 2019)







Faculty of Engineering, Built Environment and Information Technology

Fakulteit Ingenieurswese, Bou-omgewing en
Inligtingtegnologie / Lefapha la Boetšenere,
Tikologo ya Kago le Theknolotši ya Tshedimošo

Reference number: EBIT/E11/2019

25 April 2019

Prof A Barker, Mr JN Prinsloo & Ms C Karusseit
Department Architecture
University of Pretoria
Pretoria
0028

Dear All

FACULTY COMMITTEE FOR RESEARCH ETHICS AND INTEGRITY

Your recent application to the EBIT Research Ethics Committee refers.

Approval is granted for the application with reference number that appears above.

1. This means that the research project entitled "*Masters professional dissertation in architecture, landscape architecture and interior architecture*" has been approved as submitted. It is important to note what approval implies. This is expanded on in the points that follow.
2. This approval does not imply that the researcher, student or lecturer is relieved of any accountability in terms of the Code of Ethics for Scholarly Activities of the University of Pretoria, or the Policy and Procedures for Responsible Research of the University of Pretoria. These documents are available on the website of the EBIT Research Ethics Committee.
3. If action is taken beyond the approved application, approval is withdrawn automatically.
4. According to the regulations, any relevant problem arising from the study or research methodology as well as any amendments or changes, must be brought to the attention of the EBIT Research Ethics Office.
5. The Committee must be notified on completion of the project.

The Committee wishes you every success with the research project.

Prof JJ Hanekom

Chair: Faculty Committee for Research Ethics and Integrity
FACULTY OF ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY





UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

DIJO

*AN AGRI-PARK (AGRO-PROCESSING PLANT)
TO EMPOWER INFORMAL VENDORS VIA URBAN
AGRICULTURE TO ELLEVIATE UNEMPLOYMENT
AND FOOD INSECURITY IN MAMELODI WEST*

MANGALISO MTETWA
12029280
M(PROF): DISSERTATION