

Designing with Uncertainty in South Africa Informal Community

A public facility focusing on local social mechanism and
construction knowledge

Yitian Zhai
Master's Thesis Spring 2026

Chalmers School of Architecture
Department of Architecture & Civil Engineering
Society, Justice, Space

Examiner: Liane Thuvander
Supervisor: Emiline Elangovan,
Jason Oberholster (University of Pretoria)



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**1. Introduction and
Background**

1.1 Introduction

Introduction of Melusi Community

The project is located in Melusi, an informal community in Pretoria, South Africa.

Informal communities refer to residential areas that are not fully incorporated into official planning or regulatory systems, and typically exhibit irregularities in land use, infrastructure provision, and building legality.

Informal communities are a growing global phenomenon, and Melusi is a typical example with active social organization and self-governance, as well as potential for formalization and long-term stabilization.

Problem description:

1. Within informal contexts, there is no clearly defined planning policy.

As a result, the future development of community spaces remains highly uncertain. *How a design proposal can continue to operate effectively over time therefore becomes a critical concern.*

2. The use of materials by local residents is inherently uncertain.

Materials are sometimes sourced as recycled components from nearby factories or racetracks, while at other times they are obtained through donations or sponsorships from companies or individuals.

3. Human behaviour is likewise uncertain due to the absence of conventional spatial frameworks.

Activities such as gatherings, knowledge exchange, and collective practices take place in spaces that are not formally designated, resulting in fluid and unpredictable patterns of use.

4. Self-organized Social Mechanism and the Urban Planning leads to unequal access to various resources

1.2 Purpose and Aim

Traditionally, architects are understood as figures who are able to control and oversee the whole. However, within informal communities, architects are required to reconsider their roles and strategies Krsti, I. (2016)., as conventional architectural approaches are often inapplicable to informal contexts.Koolhaas, R. (2001).

This research aims to investigate how architects can, through analysing uncertainty (construction, social mechanism, etc) within informal environments and drawing upon existing local conditions and knowledge, develop design strategies that are capable of working with uncertainty rather than attempting to eliminate it.

While aiming to demonstrate an alternative process which embraces uncertainty, this study also seeks to encourage architects to critically re-examine and reconfigure their own professional identity across different contextual conditions.

This project focuses on the informal settlement of the Melusi community and explores the potential for design proposals to intervene through informal means under conditions of high uncertainty. By examining material acquisition processes, resident groups, and relevant stakeholders within informal communities, the project brings together multiple uncertain factors to construct different scenarios. These scenarios, in turn, inform and shape corresponding design proposals, enabling an architectural response to uncertainty within informal settlements.

Architect Role in Formal Context



Figure 1.2.1. Traditional Role of Architect Concept Diagram by author



Dance with Uncertainty in Local Context

Figure 1.2.2. New Role of Architect within Informal Community Concept Diagram by author

1.3 Thesis Questions and Main Objectives

VARIOUS UNCERTAINTY
WITHIN INFORMAL COMMUNITY
FROM BEFORE TO AFTER

How can architectural design respond to uncertainties generated by self-organized social mechanism and informal construction processes to form viable public space in informal settlements?

VIABLE INTERACTION
IN INFORMAL SETTLEMENTS

1. Objective: to create a design proposal based on on existing conditions,
- 2.Capable of easy adapting to changing environmental circumstances.
3. Multifunctional and responds to the needs of the community.

PHASE 1
basic knowledge, previous research
and reference

PHASE 2
uncertainty, HSD theory and
proposal draft

PHASE 3
uncertain scenario and theory leads
design proposal

PHASE 4
workshop, demonstration
local material learning
interview of residents
research with
community workers
construction learning
site visit in informal community

PHASE 5
Revision

December 15th - January 20th

Since this project is based on informal communities in Africa, it explores a context I had not previously worked with. I contacted the University of Pretoria and reviewed their research over the past three years. Their mapping provided a macro understanding of Melusi's infrastructure, zoning, development status, and formation process.

At the same time, Chalmers University's Reality Studio has conducted fieldwork in the area. Their documentation helped me understand MYDO and material use at a micro scale, while their workshops revealed residents' daily life and needs.

In addition, research by Rem Koolhaas and others on African informal cities, such as Nairobi, clarified the logic of urban development in these contexts. Reviewing previous architectural approaches also provided theoretical guidance for my design proposal.

In such informal environments, the absence of strong governance and structured planning generates multiple uncertainties in development, including crime, economy, employment, investment, policy, education, and climate. The HSD theory is particularly suited to addressing these conditions, enabling development while coexisting with uncertainty.

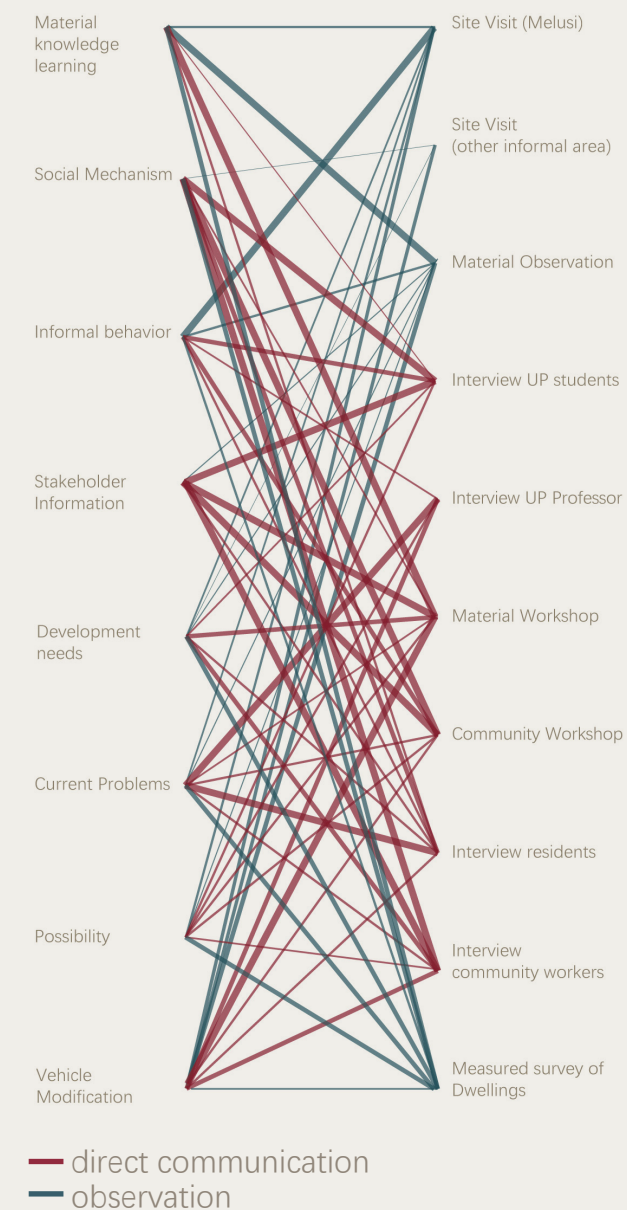
January 10th - February 9th

Based on the previous research from the University of Pretoria and Chalmers Reality Studio, I analyzed the stakeholders and the community's internal self-governance structure. The findings suggest that many of the issues in Melusi stem from unequal resource distribution within an urban planning context.

In response, I propose a design intervention that directly engages with this imbalance, leading to the concept of a modified vehicle system.

Building on a stakeholder matrix, I further developed different scenarios driven by uncertainty. Guided by the community's self-organized structure and HSD theory, the design adapts to these scenarios through the deployment of modified vehicles as a flexible infrastructural response.

February 9th - March 13th



March 13th - End

During fieldwork in Melusi, I validated the proposed scenarios through workshops and interviews with MYDO and other stakeholders. Based on the feedback and research findings, the design will be further refined and developed. At the same time, insights from on-site workshops, local construction knowledge, and interviews will inform adjustments to the vehicle modification strategy.

Ultimately, the different scenarios will be integrated through the community's self-governance logic among stakeholders, forming a consolidated design proposal. The final outcome will be presented through vehicle modification drawings, operational strategies, and a clear articulation of how the design responds to uncertainties within the community. This will be communicated through models, renderings, plans, elevations, and sections.

Figure 1.4.1. Research Relationship Diagram Drawn by author based on Personal Site Visit in Melusi and Pretoria.

1.4 Methodology

1.5 Delimitations

This research focuses on informal contexts in South Africa and their public spaces, and more specifically investigates how informal public spaces can be constructed through the application of Human-centred Sustainable Development (HSD) theory in order to respond to multiple forms of uncertainty inherent in informal environments.

The proposed methodology involves the adaptation of existing vehicles belonging to community learning and service centres. These vehicles are intended to address certain existing issues within the community—such as unequal distribution of basic resources, child safety concerns, and the lack of spaces for public interaction—while remaining easily adaptable by local residents under varying contextual conditions.

Furthermore, the proposal aims to support the gradual development of more mature community spaces (spaces have stable and close connection with local context) and to coexist with future contextual transformations. The research examines different types of uncertainty present within informal contexts and investigates how these uncertainties influence the possibilities of architectural design.

By analysing factors such as stakeholders, climate, residents' lifestyles, investment actors, materials, and construction processes, the study develops multiple scenarios and discusses how the design responds under each condition. Through this process, the research seeks to validate the strong correlation between architectural design and uncertainty

While aiming to encourage architects to critically re-examine those conditions within informal communities which used to be ignored or treated as negative elements and reconfigure their own professional identity across different contextual conditions.

This project does not seek to address the broader socio-economic challenges faced by informal settlements. Instead, it focuses on design strategies related to spatial organization and construction logic, investigating how a spatial framework can effectively respond to uncertainty by drawing on the community's existing knowledge of materials, construction experience, and relevant stakeholders, while also defining the scope and limits of architectural design capacity.

Although I will engage with the community in Melusi to test and validate the design proposal, the project does not involve co-creating or constructing spaces together with community members. The vehicle adaptations proposed in this project are intended only as a means to offer the community a potential approach for addressing current conditions and future uncertainties, rather than as a technically rigorous exploration of professional vehicle modification(automotive structure, mechanics, etc) .

All aspects related to adaptation therefore focus on responding to systems of social self-organization, uncertainty, and local material knowledge, rather than on in-depth technical development.



Figure 1.5.1. The delimitations and included contents in the thesis Drawn by author

1.6 Background

South Africa has experienced sustained and rapid urbanisation, with large numbers of people migrating from rural areas or small towns to cities and their peripheral zones.

These migrants, largely from low-income or informally employed groups, encounter significant barriers to accessing the formal housing market upon arrival in urban areas.

As a result, they either attach themselves to existing communities or construct self-built dwelling units on vacant land.

Melusi emerged gradually through this process.

Melusi 1

- the earliest-established core area
- the longest period of settlement and relatively stable spatial structure
- the earliest contact with government agencies, NGOs, and infrastructural provision

Melusi 2

- an outward expansion following the saturation of Melusi 1
- still reliant on existing social networks situated in a semi-recognised condition

Melusi3

- the most recent, peripheral, and unstable area
- often serving as a point of arrival for displaced or later-coming populations
- the weakest infrastructural provision (lack of access to clean water, electricity, and waste management systems)

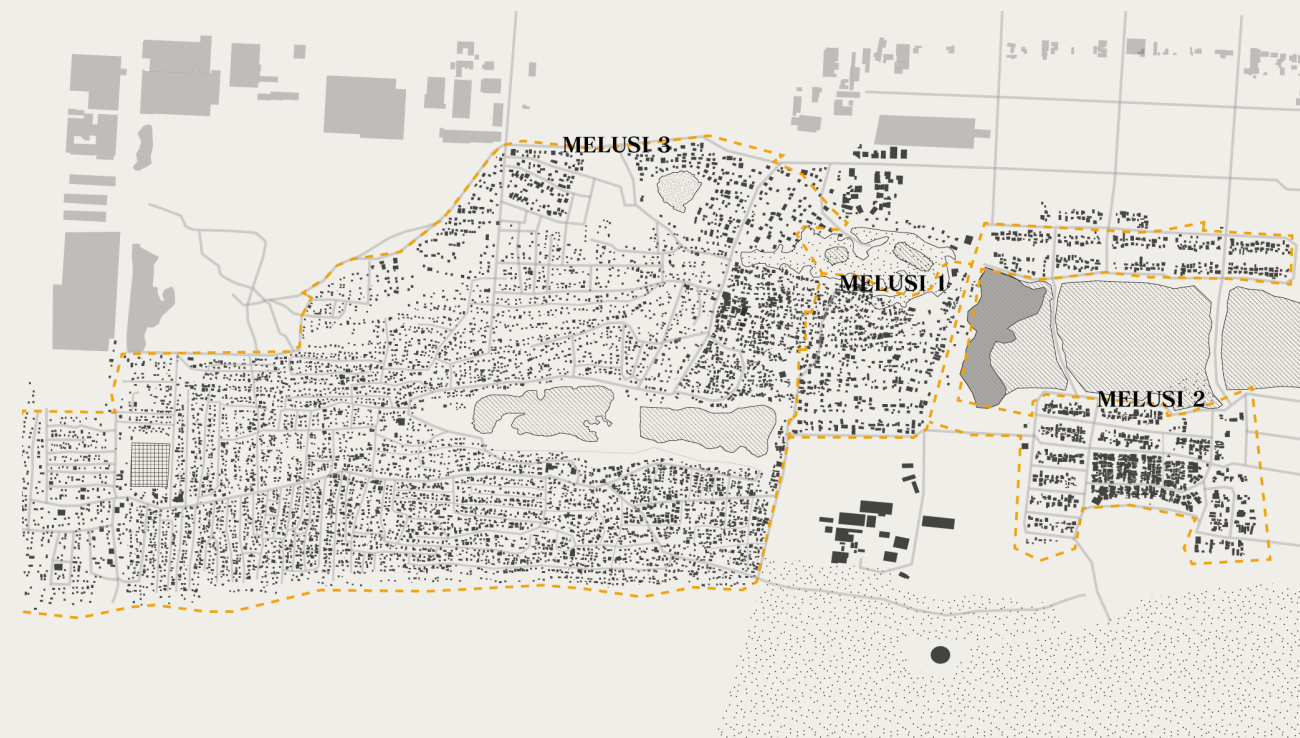


Figure 1.6.1. Site Plan of Melusi 1:1000. Adapted by author from [source].

From the diagram, we can observe that informal settlements are a widespread global phenomenon, particularly in countries in Sub-Saharan Africa. Moreover, the proportion of populations living in informal settlements has been steadily increasing since 1950. With ongoing urbanization, this mode of settlement is likely to become a living choice for nearly half of the world's population.

Due to their socially self-organized nature, informal settlements generate and confront a set of shared and recurring challenges. Therefore, this thesis—through its investigation of uncertainty in the development process of the Melusi informal settlement in South Africa, along with its analytical framework and corresponding design proposals—offers insights that are applicable to other informal settlements.

This is especially relevant for those in Africa, where contextual conditions tend to be more comparable.

The selection of the Melusi settlement in South Africa is based on its ongoing self-built spatial development, integration with urban systems, active social organization and self-governance, potential for formalization and long-term stabilization

Informal communities represent a localised strategy that goes beyond mere subsistence needs and the Western binary of power relations. (formal against informal, order against uncertainty, planner against user)

Through this strategy, social practices and activities are actively contributing to the formation of new, sustainable urban forms.

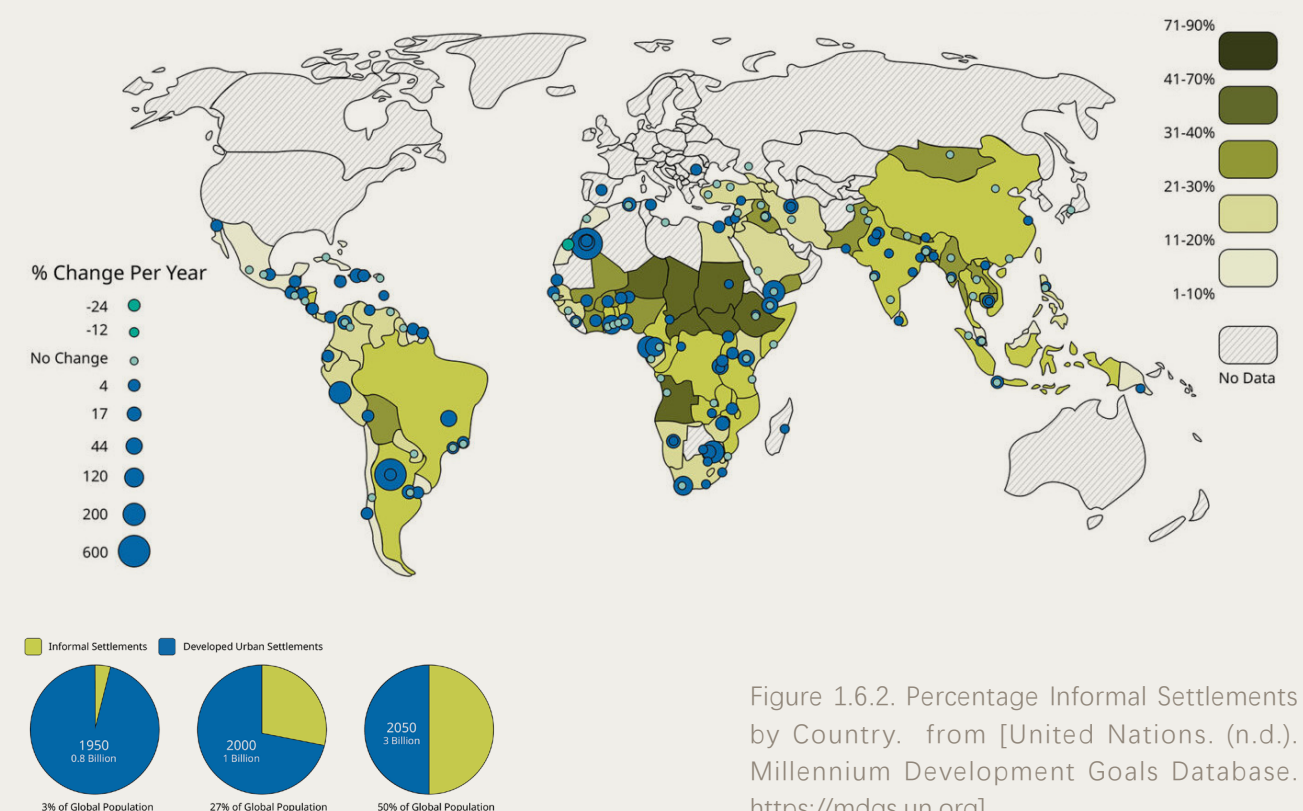


Figure 1.6.2. Percentage Informal Settlements by Country. from [United Nations. (n.d.). Millennium Development Goals Database. <https://mdgs.un.org>].

History of South Africa Informal Community

19th - 1910 Apartheid Spatial Planning

Background:

The promulgation of the Native (Urban Areas) Act enforced the segregation of Black populations into designated areas, restricting their access to cities and permitting their presence only insofar as it served white labour demands.

Spatial consequences:

- Cities were explicitly divided into:
- “permanent white residential areas”
 - “temporary Black labour areas”



Figure 1.6.3. Spatial urban segregation between 1913-1936: the ‘reserves’ for the native Africans (Vestbro and Emer, 1999)

Informal shack settlements proliferated along the urban peripheries.

1948–1970 High Apartheid: The Spatial Machine of Racial Segregation

Background:

Following the enforcement of the Native (Urban Areas) Act and the promulgation of the Group Areas Act of 1950, the apartheid system intensified and became fully institutionalised.

Spatial consequences:

Populations were subjected to forced removals and large-scale relocations into racially segregated zones. Non-white populations were resettled in low-density townships on the urban periphery, characterised by limited public facilities and long commuting distances.

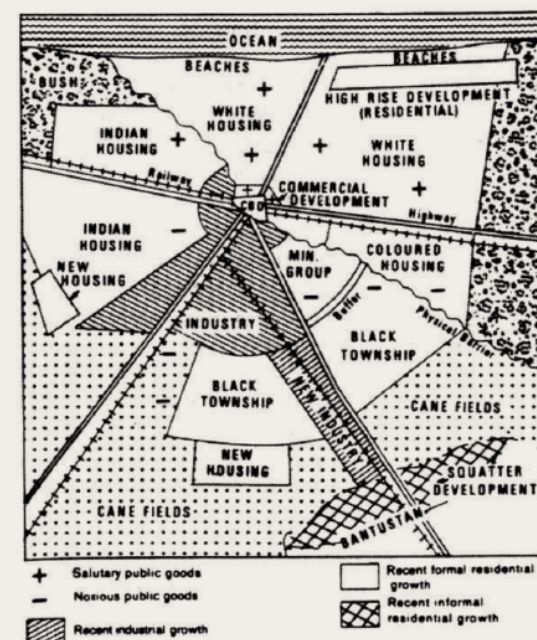


Figure 1.6.4. Racial urban spatial segregation and the ‘Bantu Townships’ created by the Group Areas Act (Vestbro and Emer, 1999)

Informal settlements continued to expand as a response to the spatial and social problems generated by apartheid-era urban planning.

1970–1990 Late Apartheid Crisis

Background:

The acceleration of industrialisation intensified cities’ dependence on Black labour, while the expansion of capitalist production gradually weakened the state’s capacity to maintain strict spatial control.

Spatial consequences:

Informal settlements began to consolidate, expanding in scale and acquiring a more permanent character. Governmental attitudes shifted from policies of total eradication toward a pragmatic stance of selective tolerance.

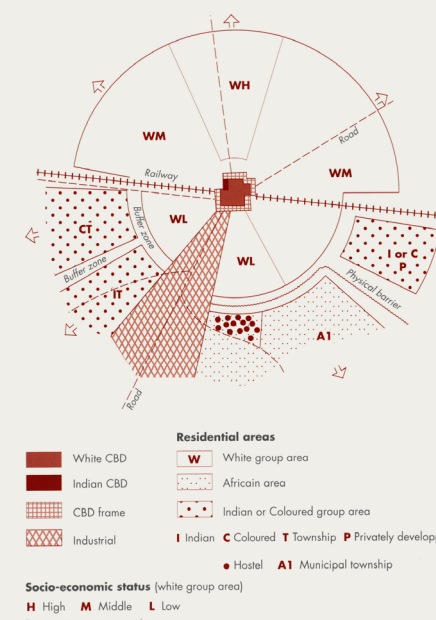


Figure 1.6.5. Adapted from the Apartheid City Model (Davies, 1981; Christopher, 1984)

The spatial forms of informal settlements became increasingly defined, emerging as an indispensable component of urban functioning.

1990–1994 A Period of Spatial Vacuum

Background:

With the collapse of the apartheid regime, restrictions on residential mobility were lifted and freedom of settlement was restored.

Spatial consequences:

Large populations rapidly migrated into urban areas, leading to the swift occupation of land and the explosive emergence and growth of new informal settlements.

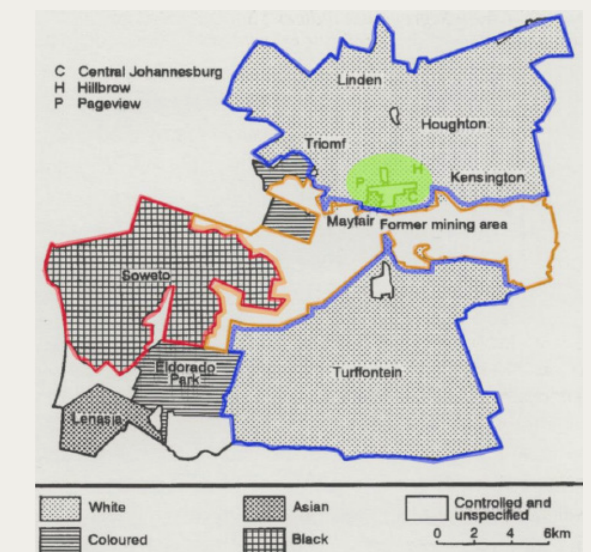


Figure 1.6.6. Johannesburg racial zoning of the population (1991) (Adapted from(Christopher ,1999:302))

Informal settlements functioned as a spatial response to a moment of suspended or reconstituting power.

History of South Africa Informal Community

1994–2004 Early Post-Apartheid Period

Background:
The introduction of the RDP housing programme marked the state's primary response to the housing crisis. However, RDP-provided public housing was often located far from urban centres and disconnected from employment opportunities, with limited consideration given to existing community networks.

Spatial consequences:
Rather than declining, informal settlements continued to expand. Many residents, despite having access to legally recognised formal housing, chose to remain in informal settlements.

2004–2010 From Eradication to Upgrading

Background:
The Breaking New Ground (BNG) policy marked a strategic shift toward the provision of higher levels of municipal infrastructure, implemented across entire townships. The policy also promoted the inclusion of supporting facilities such as schools, clinics, and commercial opportunities.

Spatial consequences:
Internal differentiation emerged within informal settlements as earlier-established areas received infrastructural interventions. However, as informal settlements continued to expand, later-formed areas were left without adequate supporting infrastructure.

2010–Present Informal Settlements as a “Long-Term Urban Condition”

Background:
Informal settlements are now recognised within urban planning documents and risk management frameworks; however, they still lack formal property rights and remain highly vulnerable to various uncertainties.

Spatial consequences:
Informality is understood as a system of urban production and adaptive practice, constituting a persistent and enduring form of the city.

Although lacking legal status, informal settlements exhibited a strong degree of urbanity.

The differentiated infrastructural conditions observed across Melusi 1, Melusi 2, and Melusi 3 are products of this period.

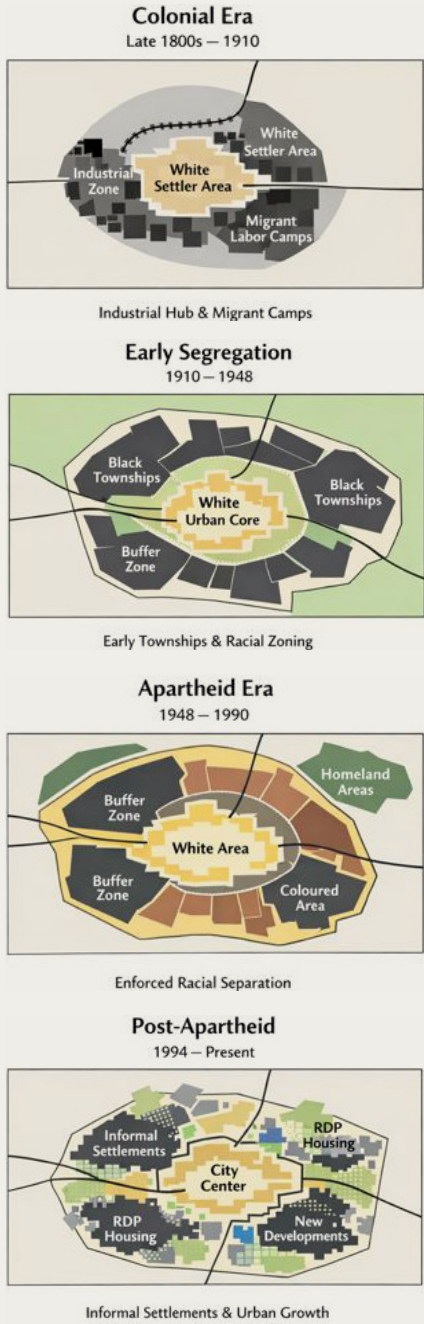


Figure 1.6.7. History of urban planning in South Africa Diagram Adapted by author (Porto, 2022)

1.7 South Africa Context External Institutional and Internal Mechanism

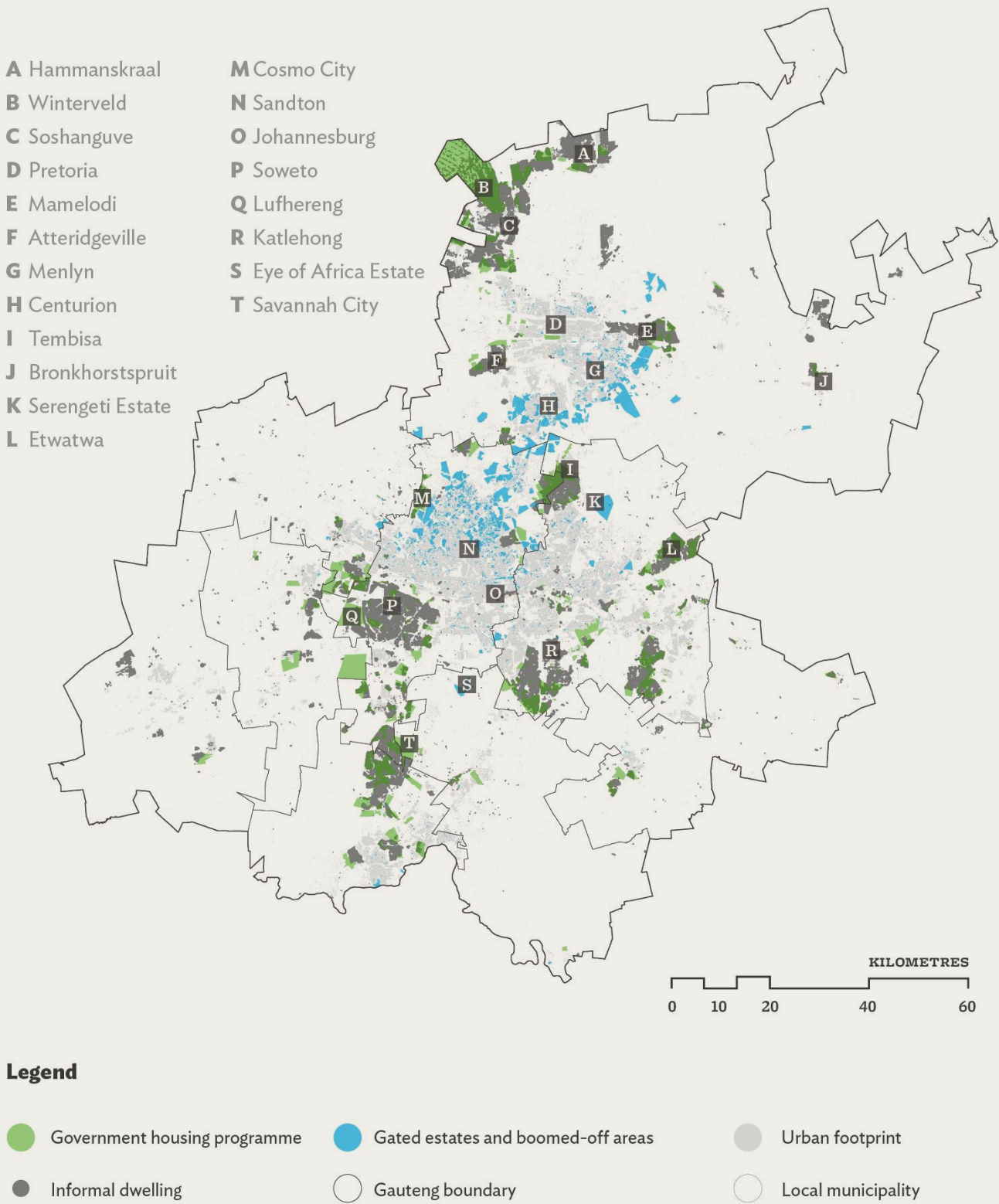


Figure 1.7.1 Current External Influence on Urban Planning Adapted by author from [AfriGIS Gated communities(2012), Gauteng Department of Human Settlements(2014), GTI building based landuse(2016/17), ESA Land cover(2016)].

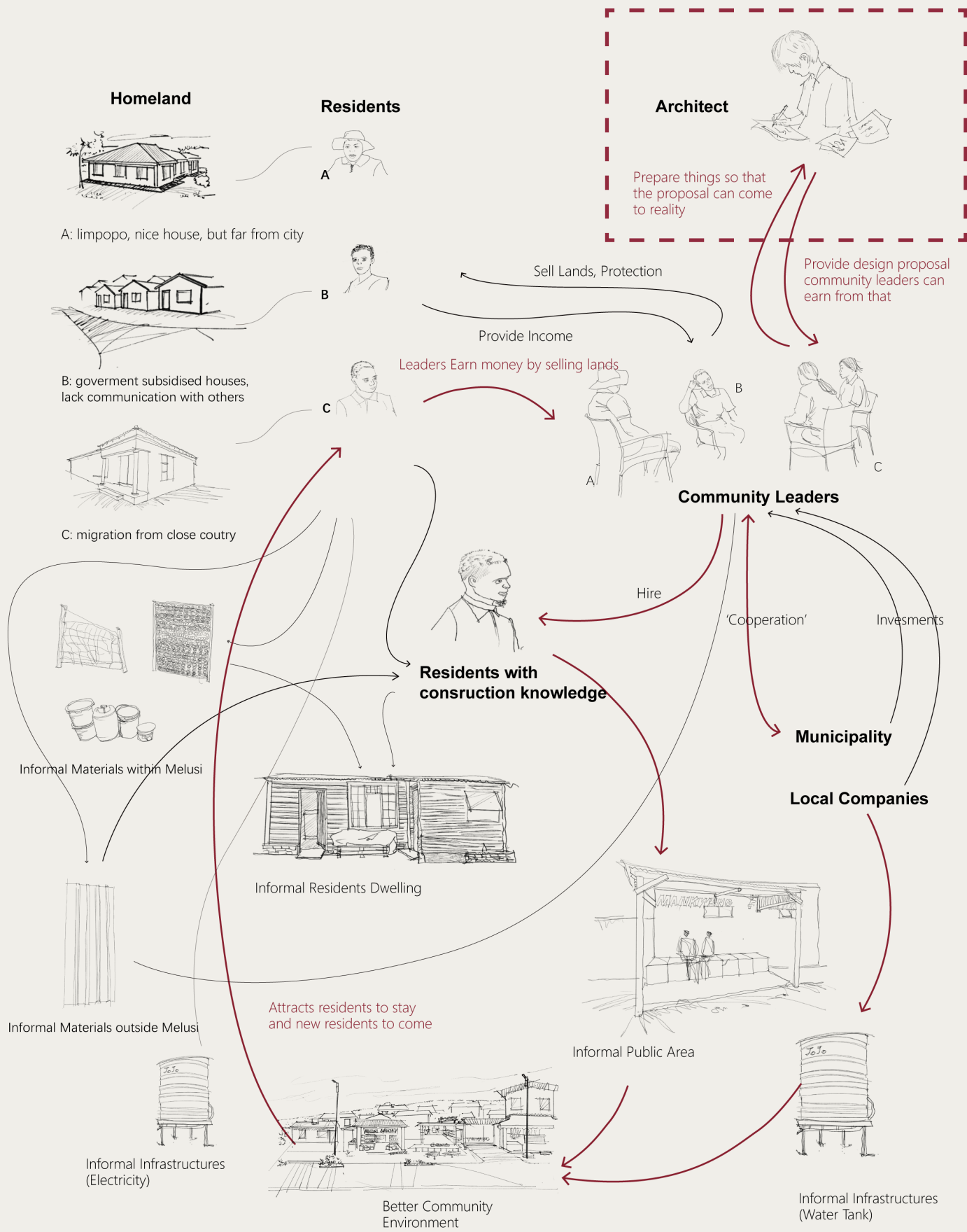


Figure 1.7.2. Social Mechanism Diagram. Adapted by author from [site visit, workshop and interview in Melusi].

Relationship between External and Internal

Numerous challenges and uncertainties exist within the community, emerging as by-products of the self-organized governance model characteristic of informal settlements. Taking into account the community's operational mechanisms and power structures, this project proposes to address inequalities in resource distribution through the modification of the widely used Toyota HiAce.



Figure 1.7.4. Location of Melusi. Adapted by author from openstreetmap.

External urban planning processes have led residents to settle informally near city centers and other economically active areas. As people continue to gather, large-scale informal settlements gradually emerge. Due to the illegality of land occupation and the lack of internal

planning, significant uncertainties arise—such as unclear land tenure, fluctuating population mobility and the uncertainty of accessibility. These uncertainties exist not only within the internal system but are also highly susceptible to changes in external systems.

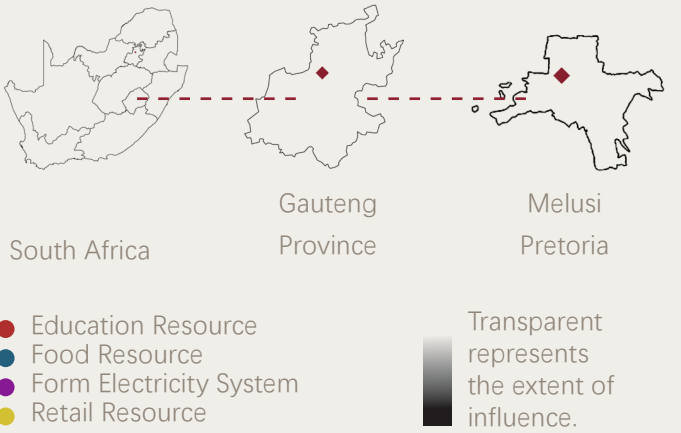


Figure 1.7.3. Location of Melusi. Adapted by author from openstreetmap.

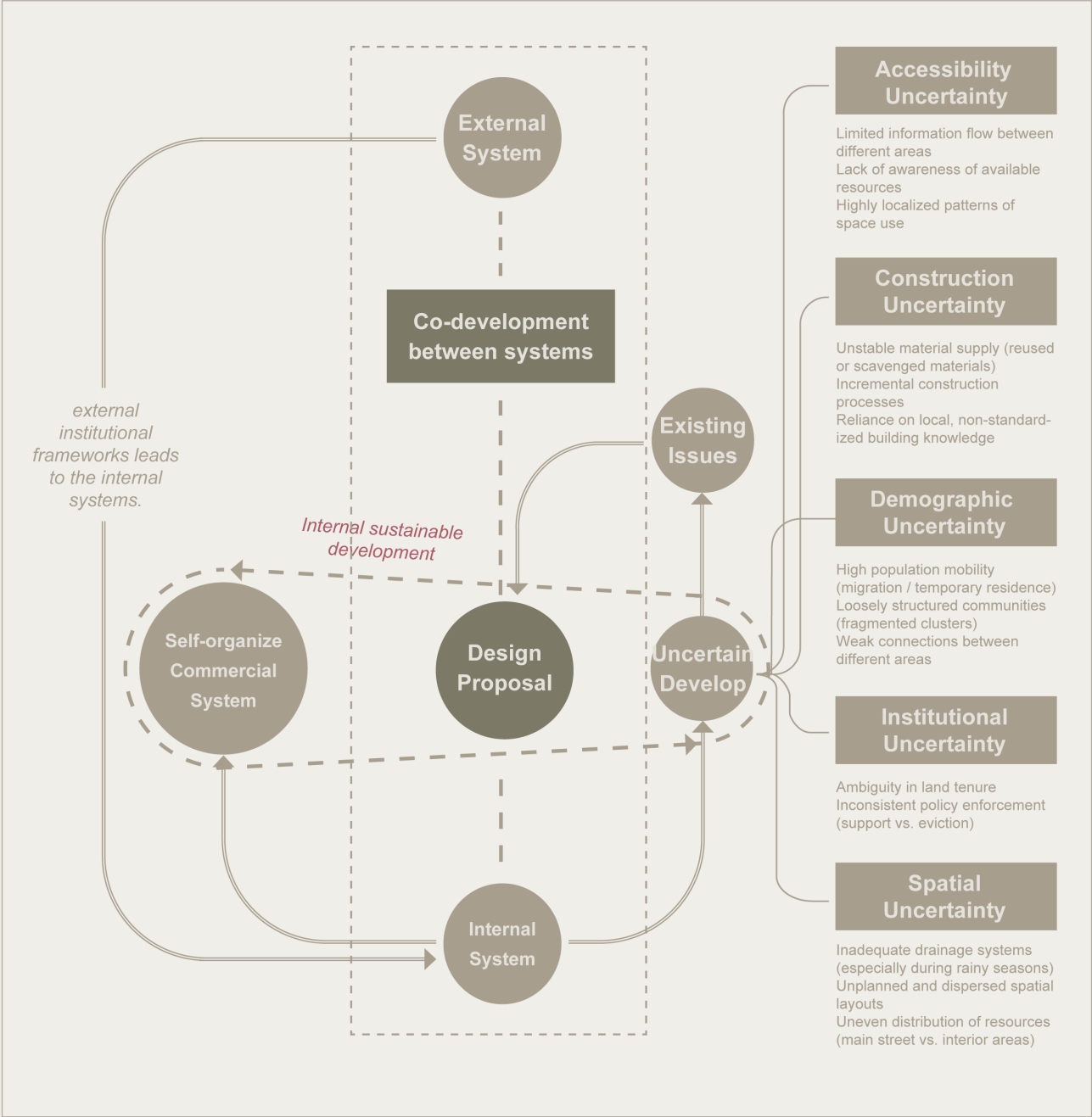


Figure 1.7.5. Social Mechanism Diagram. Adapted by author from site visit, workshop and interview in Melusi.

Responding to the uncertainties and issues generated by the internal system, thereby enabling its sustainable development.

enabling co-development with external institutional systems.

The persistent presence of external institutions shapes and reinforces the formation of internal systems. These internal systems, in turn, generate uncertainty, which gives rise to a range of challenges. At the same time, they foster socially self-organized economic models.

By addressing these challenges, the system is able to coexist with uncertainty, thereby sustaining the internal structures over time. Ultimately, this process enables the co-evolution of external and internal institutional frameworks

2. Theory and Literature

2.1 Inroduction of Theory

To gain a deeper understanding of how architects intervene in informal living environments, I examined several relevant reference projects and literary texts. These projects and references are all grounded in the context of informal communities or urban conditions in Africa, and they operate at different scales.

In the references, I focus on and extract theories that can deconstruct and reflect on the role of architects from the perspective of social systems, and use them as tools to both drive design development and evaluate and continuously examine the current situation.

The Human Scale Development Theory is used to reinterpret community needs beyond purely economic terms, identifying fundamental human needs such as subsistence, protection, participation, and identity. These needs are translated into spatial and programmatic components within the design.

The concept of uncertainty derived from the urban status of informal settlements is used as a framework to identify key instabilities within institutional, spatial, and socio-economic systems. These uncertainties inform the development of adaptive and non-permanent design strategies.

Theories on public space are used to challenge conventional, fixed definitions of public space, reframing it as a dynamic and negotiated condition shaped by everyday practices in informal communities.

Together, these theories construct a multi-layered framework in which human needs define what should be provided, uncertainty defines how it should be delivered, and public space theory redefines where and in what form these interventions can take place.

Main Theory Supports the Program

Human Scale Development Theory

Human Scale Development (HSD), proposed by the Chilean economist Manfred Max-Neef in the 1980s–1990s, posits that fundamental human needs are finite, universal, and invariant across cultures; what varies are the ways in which these needs are satisfied (satisfiers).

Nine Pointes of HSD

Subsistence, Protection, Affection, Understanding, Participation, Leisue, Creation, Identity, Freedom

(Max-Neef, M. A. 1991)

Sub Theory 1

Uncertainty from City Status in Informal Coummunity

In line with the theory articulated in Rem Koolhaas’s Lagos: How It Works, architectural infrastructure and public space are not conceived as final or fixed forms, but as frameworks that can be occupied, modified, and bypassed.

The informal condition is understood as a highly adaptive urban state, characterised by continuous negotiation.

Sub Theory 2

How Architects View Public Space in Informal Communities

In informal communities such as those in South Africa, public space functions as a connective tissue that binds everyday life together. As discussed in Spatial Agency: Other Ways of Doing Architecture, meaningful community participation in practice enables agency, while the attribution of a sense of ownership grants communities subjectivity in the development of space.

The common interest of informal communities lies in confronting various forms of security-related uncertainty. As discussed in Nairobi: Migration Shapes the City, the functioning of the city is explored through observations of how people live, work, and move in Nairobi, with a focus on the synchronicity of participation and relations of interdependence. The study traces fundamental human activities and analyses the spaces in which they take place.

(Rahbaran, S. (Ed.). 2014)

Human Scale Development Theory

Human Scale Development Theory classifies human needs into cross-cultural fundamental dimensions, such as subsistence, protection, participation, identity, leisure, and creation. This shifts design thinking away from conventional functional categories (e.g., housing, commercial, public space) toward an understanding of whether these underlying human needs are being fulfilled.

HSD theory leads design: Transforms “spatial typologies” into “need-based carriers”, Allows a single space to simultaneously respond to multiple human needs, Shifts the design focus from “what kind of space is this?” to “what human conditions does it enable?”

HSD further expands the scope of design beyond purely material spatial production by incorporating: social relations, patterns of use and behaviour, self-organisational capacity modes of resource access

As a result, the design object is no longer limited to architecture itself, but is understood as a composite system of: *space + behaviour + flows*

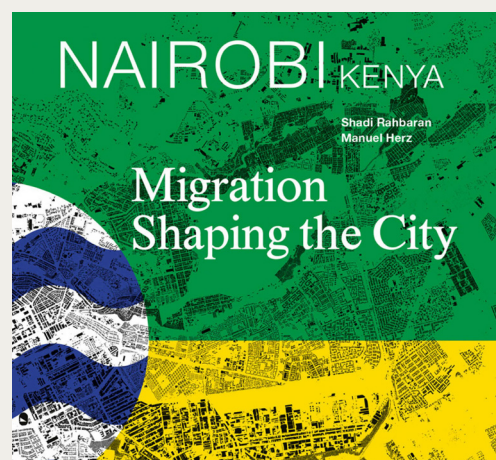
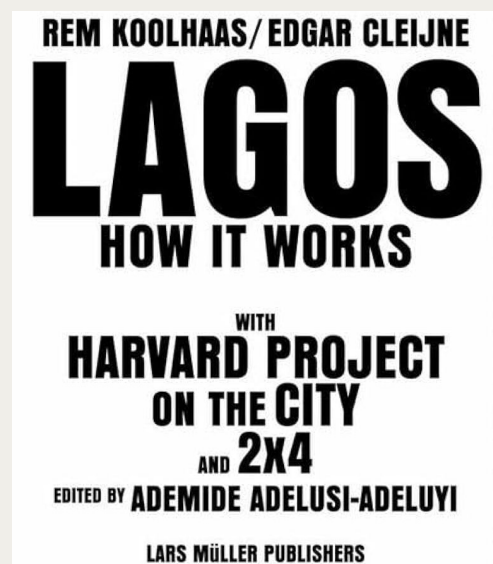
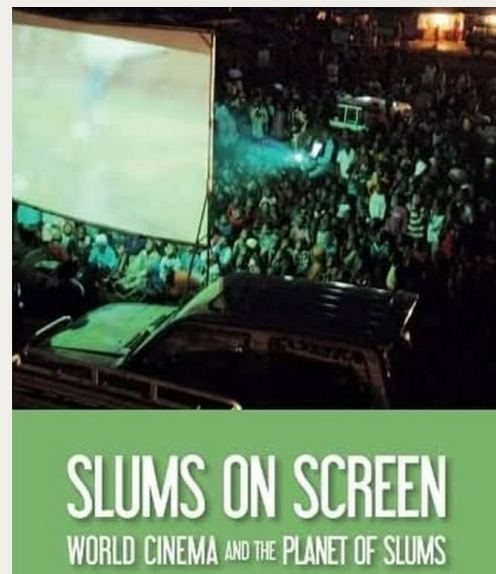
Use HSD to analyze the problems embedded within the existing social mechanisms, and after the intervention of the proposal, evaluate whether the corresponding issues are addressed through the lens of the social operational system.

Human Development Scale

	Being	Having	Doing	Interacting
Subsistence	Physical & Mental Health, Adaptability, Humor	Food Shelter and Work	Feed, Procreate, Rest, Work	Living Environment, Social Setting
Protection	Care, Adaptability, Autonomy, Solidarity	Insurance, Savings, Social Security, Health Systems	Cooperate, Prevent, Plan, Take care, Cure	Living Space, Social Environment
Affection	Self Esteem, Solidarity, Respect	Friendships, Family, Relationships with Nature	Lovemaking, Caress, Express emotion, Share	Privacy, Intimacy, Space of togetherness
Understanding	Conscience, Curiosity, Intuition, Discipline	Literature, Educational Policy, Teachers	Investigation, Experimentation	Schools, Academies, Universities
Participation	Dedication, Respect, Passion, Determination	Rights, Responsibilities, Duties, Work	Affiliations, Opiniate, Propose Ideas	Settings for Interaction, Communities, Churches
Idleness	Imagination, Tranquility, Sensuality	Games, Spectacles, Clubs, Peace of mind	Daydreaming, Recollection, Relaxation	Spaces of closeness, Free time, Landscapes
Creation	Intuition, Rationality, Curiosity, Inventiveness	Skills, Abilities, Work	Work, Invent, Interpret, Design, Compose, Build	Productive/Feedback settings, Workshops
Identity	Sense of belonging, Differentiation, Assertive	Symbols, Language, Work, Habits, Customs, Values	Commit oneself, Confront, Integrate oneself, Grow	Social rhythms, Everyday settings
Freedom	Autonomy, Self-esteem, determination, passion	Equal rights	Dissent, Choose, Develop awareness, Disobey	Temporal / Spatial plasticity

Figure 2.1.1. HSD Theory Form Adapted by author from (Max-Neef, M. A. 1991).

2.2 Literature and References



Slums on Screen articulates the *internal operational logic of informal settlements* and calls for architects to rethink their role. Architecture, infrastructure, and public space are not final, fixed forms, but can be appropriated, modified, and bypassed. *Informal settlements represent a localized strategy that emerges in the absence of formal institutional frameworks.*

Koolhaas argues that in highly self-organized systems, excessive external intervention may in fact disrupt their internal logic of operation. *Therefore, understanding this operational logic is the primary task.* This thesis begins with an analysis of the operational logic of Melusi, followed by a synthesis and categorization of stakeholders. On this basis, it then develops proposals for architectural interventions.

Through the urban studies case of Nairobi, we understand how economic and social activities in Africa themselves generate new forms of sustainable urbanism. *It also clarifies the interdependent relationships among different groups within informal settlements*, tracing fundamental human activities and analyzing the spatial conditions in which they take place.



An informal community in Dhaka, capital of Bangladesh, showed unique community self-rescue capabilities during the flood risk. A risk monitoring network made up of unemployed youths, religious leaders and local merchants was formed here. Using existing commercial channels and religious gathering spaces, the network finished counting and initially resettling affected people within 72 hours.



Kowloon Walled City:

Due to being in an anarchic state, Kowloon Walled City is filled with gangs and low-priced illegal business models, with clear internal divisions and its own set of rules. Residents spontaneously established an autonomous institution to seek changes in basic living conditions.



Mobile Market in Rural China:

Due to the dispersed distribution of rural areas in China, fixed spaces cannot operate for a long time. People will gather in some towns on a regular basis, where products from the land, industrial products from the city, and some service industries engage in commercial activities.



In informal settlements, due to urban planning conditions, *the community is often widely dispersed*.

Resources within one area are frequently unknown to and inaccessible by residents in other areas. In this context, *the limitations of permanent architecture become evident*.



Inside Retail Asia. (2013, August 27). FamilyMart goes mobile.



The Wayward Home. (n.d.). Toyota Hiace camper. <https://www.thewaywardhome.com/toyota-hiace-camper>



A movable public facility in rural China.

Due to the vast land and sparse population of farmland, some spatial needs of local residents cannot be met by permanent fixed spaces. This simple, low-cost, and easy to maintain mobile space can change according to different space requirements

3.Methodology,Workshop and Design Proposal

3.1 Stakeholder Matrix

A stakeholder map is a tool used to visually represent key actors and their relationships within a project (Hanington & Martin, 2012).

In the diagram on the right, the horizontal axis indicates the degree of each stakeholder's involvement in the project, while the vertical axis represents their authority to influence or drive the project forward. These dimensions are evaluated based on fieldwork, including interviews with local residents and discussions with students from the University of Pretoria who have previously engaged with Melusi.

Within the matrix, company investment, external action plans, and community leadership emerge as highly influential stakeholders.

They play a critical role in initiating and sustaining the project. Therefore, these three stakeholder groups are selected as the primary drivers for constructing the project scenarios.

Three Main Stakeholders

Investments of Related Companies

There are three main doner companies, which ocaasional support MYDO(Melusi Youth Development Organization).

Cocacola
financial support
public activity support

SUZ food brands
food donatation

PPC Cement Ltd.
cement donation
material class in MYDO

Pretoria University Students

Landscape design along the main road,which connectes Melusi 1 and 3

Community Leaders

MYDO 2 location change
build more MYDO in Melusi 3
nursery design proposal

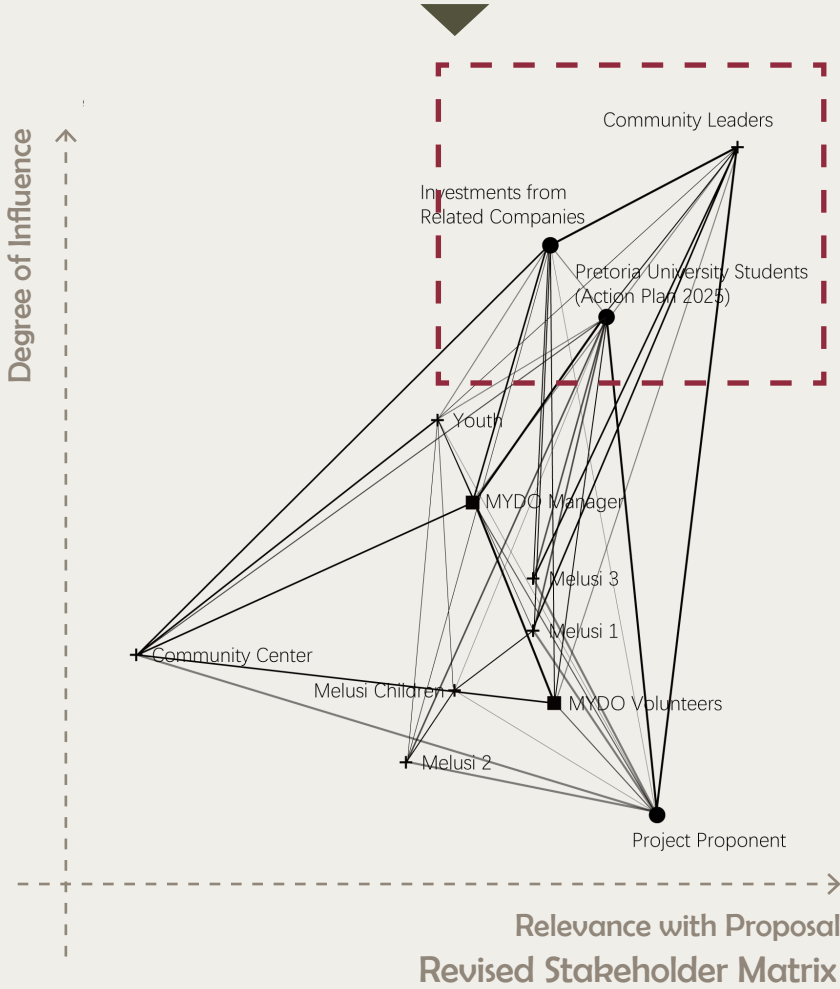
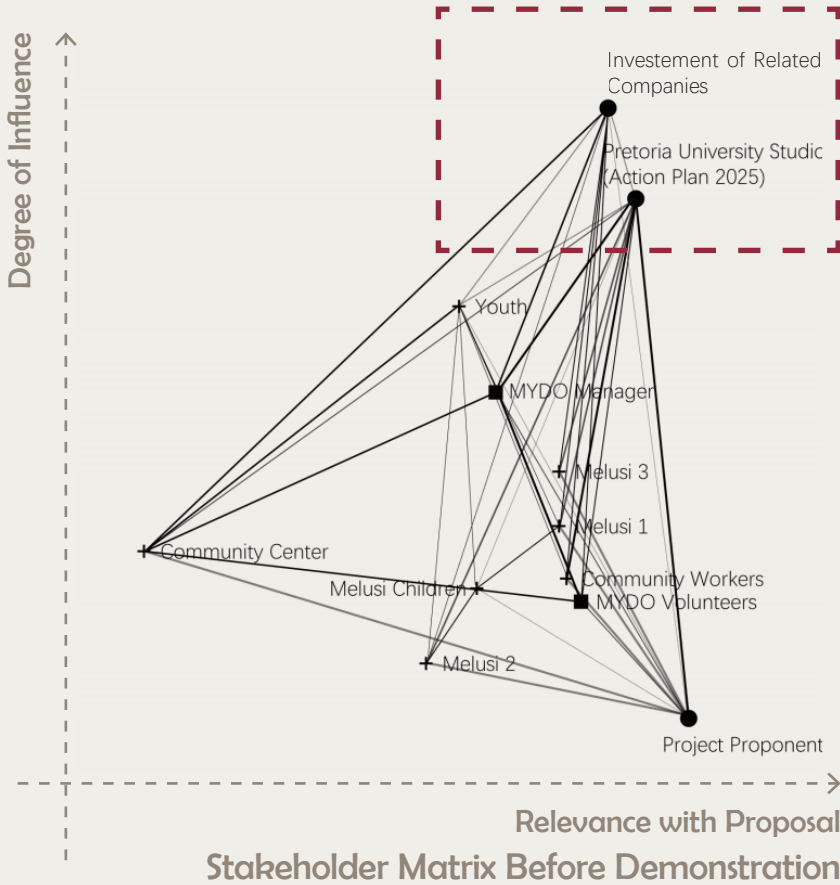


Figure 3.1.1. Stakeholder Matrix Adapted by author from (Chalmers Reality Studio Xi Xifeng,2024)

3.2 Uncertain Scenario Build

Scenario Creation Uncertain Investments

If.....?

Local community leaders aim to improve the area to attract more residents, enabling them to profit from land sales. They seek to develop various infrastructures and public buildings, while improving local education and living conditions.

To achieve this, community leaders organise meetings and actively pursue investment from the government and private companies.

Local companies have been investing Melusi for many years. Public space investment becomes a low-risk entry point through which companies can engage with high-density communities while positioning themselves for future development.

Then.....

1. Investments on Community Buildings

A local business supports a community initiative by organising activities around a public building. Limited information flow prevents many residents from participating. Vehicles with event advertisements act as mobile communication tools, extending outreach across the wider area.

After the event, materials are left on site due to cost constraints and can be reclaimed by residents. Vehicles are also adapted as mobile collection and redistribution units, delivering materials to those able to reuse them.

2. Public Lecture Investments

A local building materials supplier invests in and organises a public lecture on construction materials. As many young people work or study outside the community during the day, they have limited opportunities to attend or learn about the event. In response, vehicles operate in the early morning and evening, promoting the lecture and engaging directly with young people through mobile outreach.

3. Investments on Infrastructure

A part of Melusi 3 receives infrastructure investment but lacks electricity and internet access, and extending permanent networks is too costly.

Vehicles are therefore retrofitted with retractable power and network systems, operating from serviced areas to provide temporary electricity and internet to the site.

4. Food Donation from NGO

An NGO donates food to the community, but limited storage in southern Melusi restricts access for distant residents. Vehicles are converted into mobile food trucks to distribute food across different areas.

At each stop, locally made tables and benches create temporary gathering spaces. As residents collect and share meals, informal public activities emerge, turning distribution into social interaction and collective life.

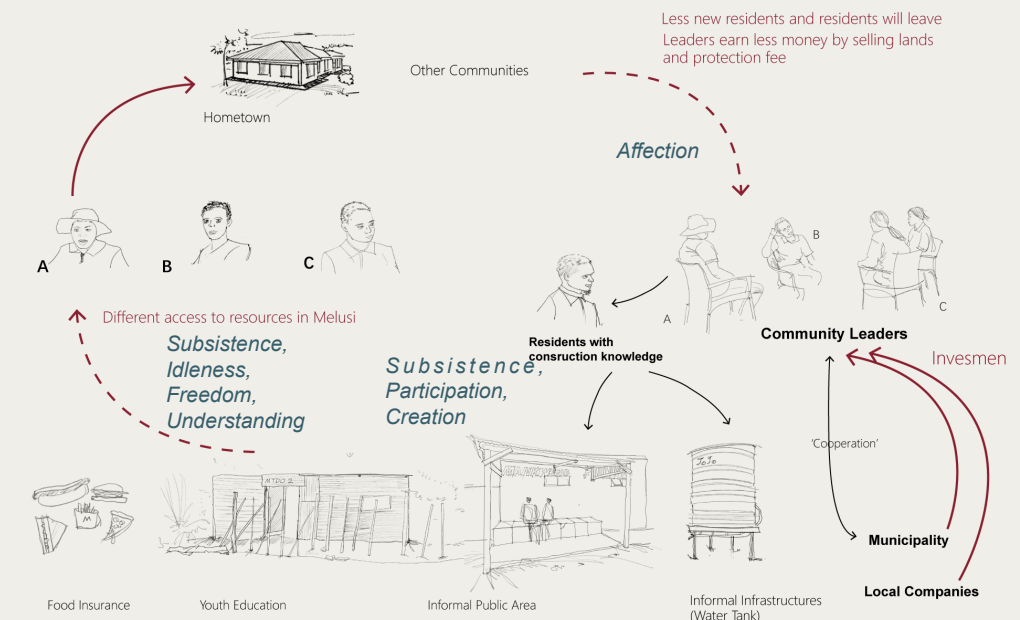


Figure 3.2.1. Social Mechanism of 'Investments happen scenario' before Interaction Diagram and HSD demands Drawn by author

Before Design Interaction: Community leaders propose development plans for specific areas and attract investment from local companies. However, these developments are often limited in scope, meaning not all residents benefit equally. Those who do not perceive improvements may leave.

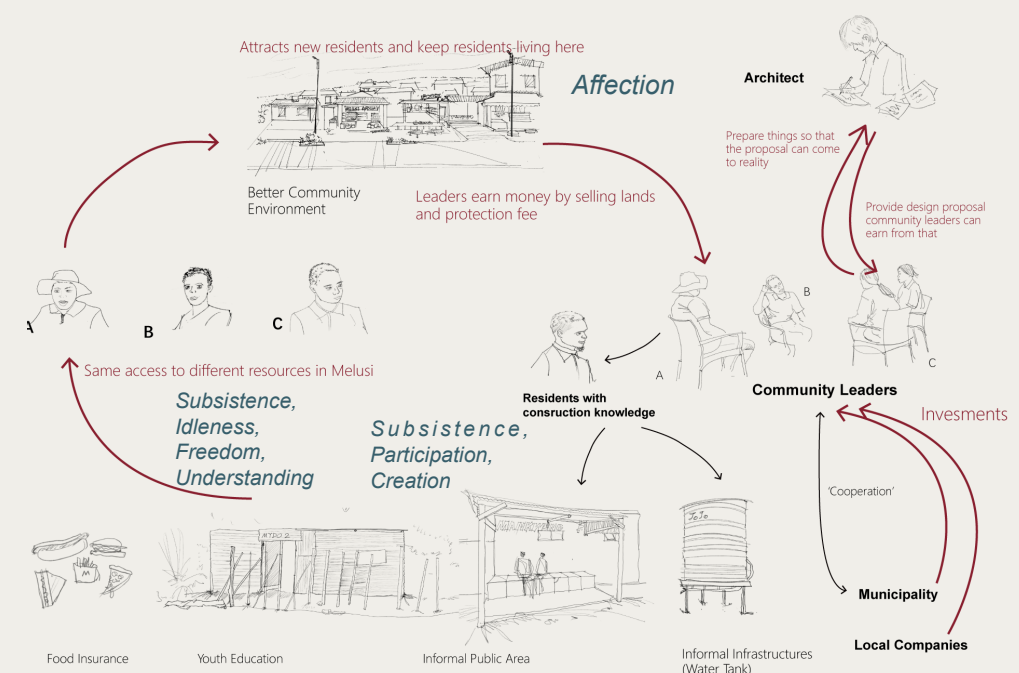


Figure 3.2.2. Social Mechanism of 'Investments happen scenario' before Interaction Diagram and HSD demands Drawn by author

After Design Interaction: The design proposal extends the impact of localized development to a wider group of residents, enabling more efficient use of investment and increasing potential rental income for community leaders.

In Melusi, recycled materials generated from the investment and construction of a specific building can be accessed equally by residents across different areas through the design proposal, thereby fulfilling the “Idleness and Freedom” concept in HSD theory.

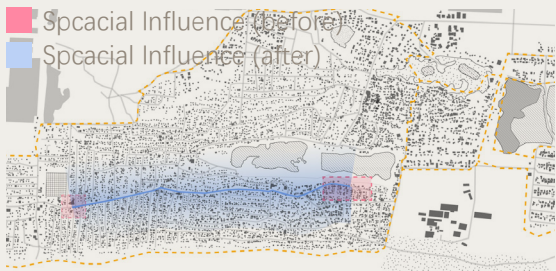


Figure 3.2.4. Spatial Influence Mapping (before and after interaction)

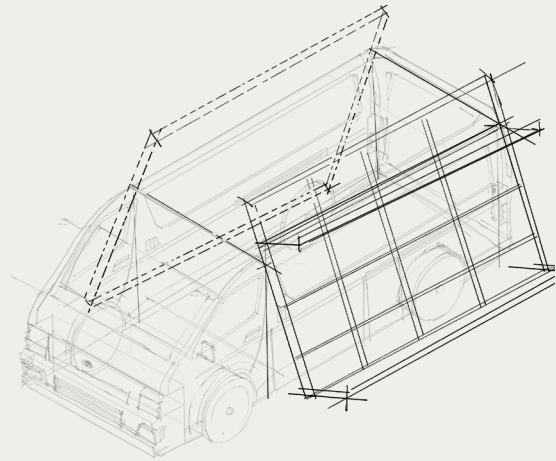


Figure 3.2.5. Design Proposal: Sketch of Movable Material Storage

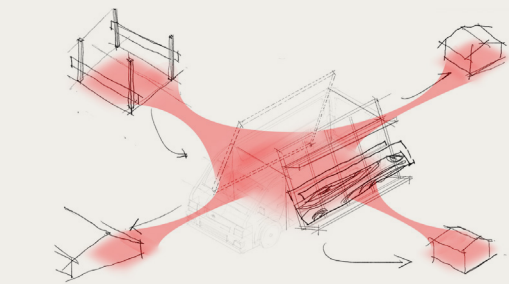


Figure 3.2.6. Spatial Influence of Movable Material Storage Diagram

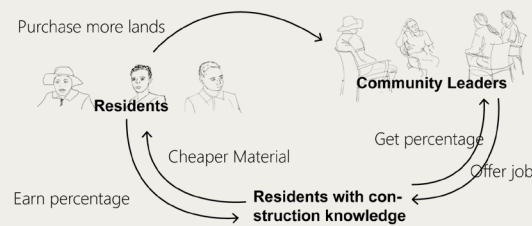


Figure 3.2.7. Mechanism Diagram

Residents in remote areas are unable to access lectures taking place on the central main street. The design proposal breaks this information asymmetry, bringing education to residents while also providing exposure and potential benefits for investors.

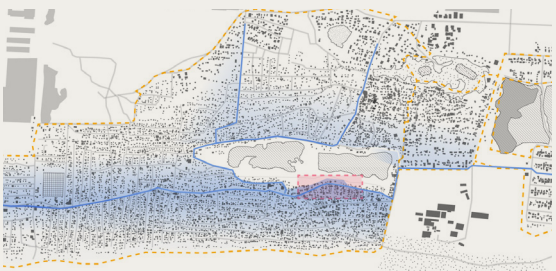


Figure 3.2.8. Spatial Influence Mapping (before and after interaction)

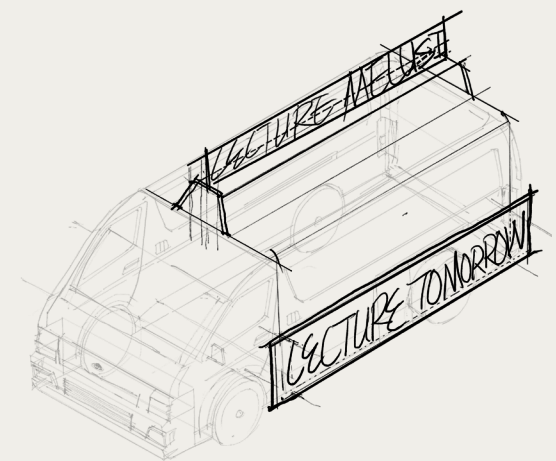


Figure 3.2.9. Design Proposal: Sketch of Movable Billboard

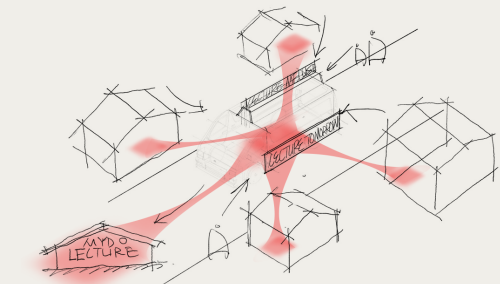


Figure 3.2.10. Spatial Influence of Movable Billboard Diagram

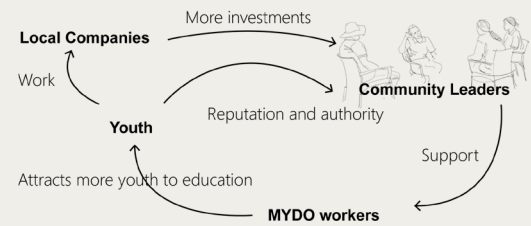


Figure 3.2.11. Mechanism Diagram

In areas without formal electricity and water supply, when constructing signal towers, the design proposal functions as a temporary power grid, addressing the “Freedom” and “Subsistence” concepts in HSD theory.

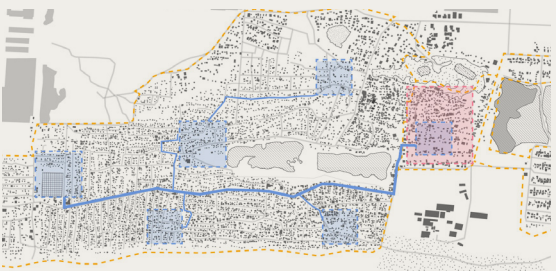


Figure 3.2.12. Spatial Influence Mapping (before and after interaction)

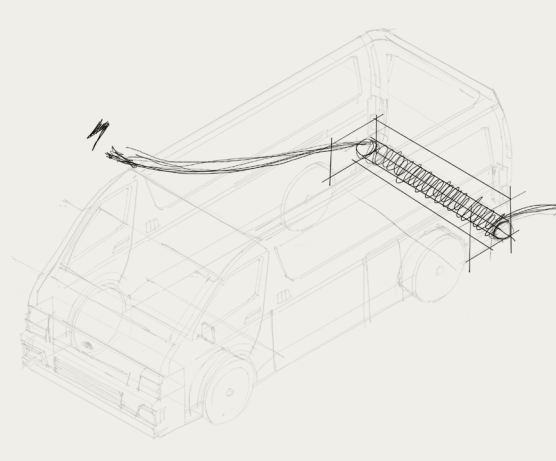


Figure 3.2.13. Design Proposal: Sketch of Temporary Power

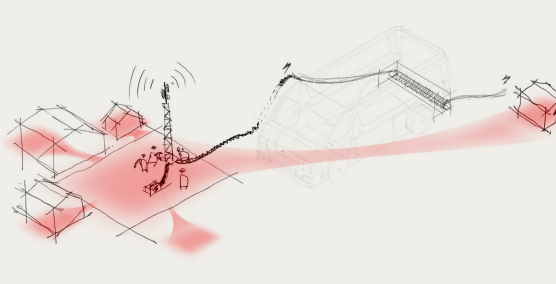


Figure 3.2.14. Spatial Influence of Temporary Power Diagram

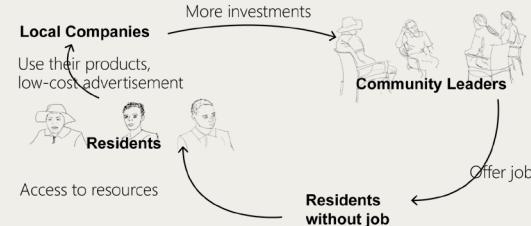


Figure 3.2.15. Mechanism Diagram

The design proposal transforms the spatial distribution of food resources from a point-to-point model into a multi-point network, making resource allocation more equitable and addressing the concepts of Freedom and Subsistence.

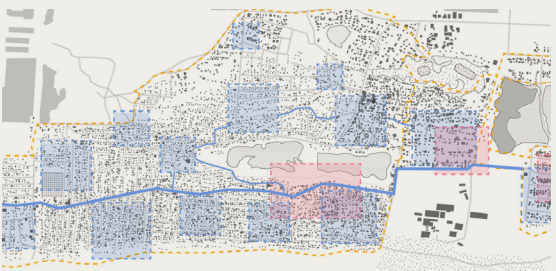


Figure 3.2.16. Spatial Influence Mapping (before and after interaction)

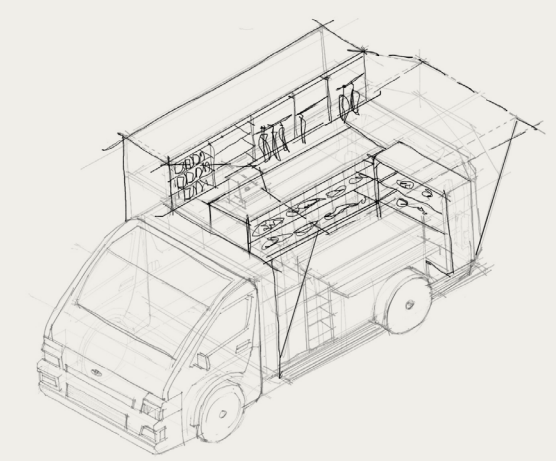


Figure 3.2.17. Design Proposal: Sketch of Food Truck

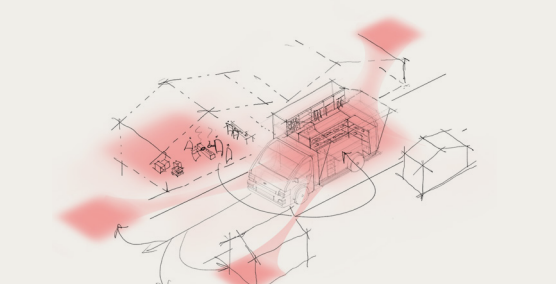


Figure 3.2.18. Spatial Influence of Food Truck Diagram



Figure 3.2.19. Mechanism Diagram

Scenario Creation Uncertain Investments

If not?

“if” scenario based on existing occurrences: since there are no formal contracts or regulatory frameworks, the emergence of these “ifs” is also highly uncertain. So, if not.....

Many proposals from community leaders fail to convince investors, resulting in a significant loss of investment in Melusi. High-quality timber and construction materials are no longer available, and the frequency and number of public lectures have decreased substantially. NGOs lack sufficient funding, and it has been a long time since the last food donation.

Then

1. Less Investments on Community Buildings

The community leader's proposal fails to secure further investment from the company. The vehicle is therefore adapted to carry community workers and residents with construction experience, while the remaining space is used as a mobile storage unit for various materials. External rack-like structures are added to carry items that cannot be stored inside.

The vehicle travels to nearby factories or racetracks to collect discarded materials, which are then reused through local construction knowledge. These materials are not limited to conventional building supplies and may include used tires, steel pipes, and other industrial waste.

2. Decrease of Food Donation from NGO

At this stage, the vehicle took on the role of facilitating the sharing of knowledge and food resources. The food truck carried meals prepared according to the recipes developed by these women. As in the past, when donated food was distributed, the food truck travelled to different areas of Melusi to distribute meals. People gathered around the food truck, where informal exchanges took place, and community members supported one another in getting through difficult times.

3. Less Public Lectures

Local businesses that had previously invested in hosting lectures in Melusi reduced their funding. The youth of Melusi were eager for knowledge and wanted to use it to improve their material conditions, but the channels through which they could access that knowledge were cut off.

At this point, the vehicle functioned as a mobile library and classroom. Most areas of Melusi lacked internet access, so the vehicle was equipped with a mobile network, allowing young people to engage in online learning on their way to work or study outside the community.

Onboard, there happened to be a young person who had previously attended a materials lecture and another who had studied Swedish. Both were eager for the knowledge the other possessed. They quickly started exchanging ideas and helped each other learn.



Figure 3.2.20. Social Mechanism of 'Investments do not Happen' before Interaction
Diagram Drawn by author

Before Design Interaction: When investment decreases, construction and food resources become scarce, and self-governed distribution systems often lead to unequal allocation, which makes the situation worse. It would cause some residents to leave.

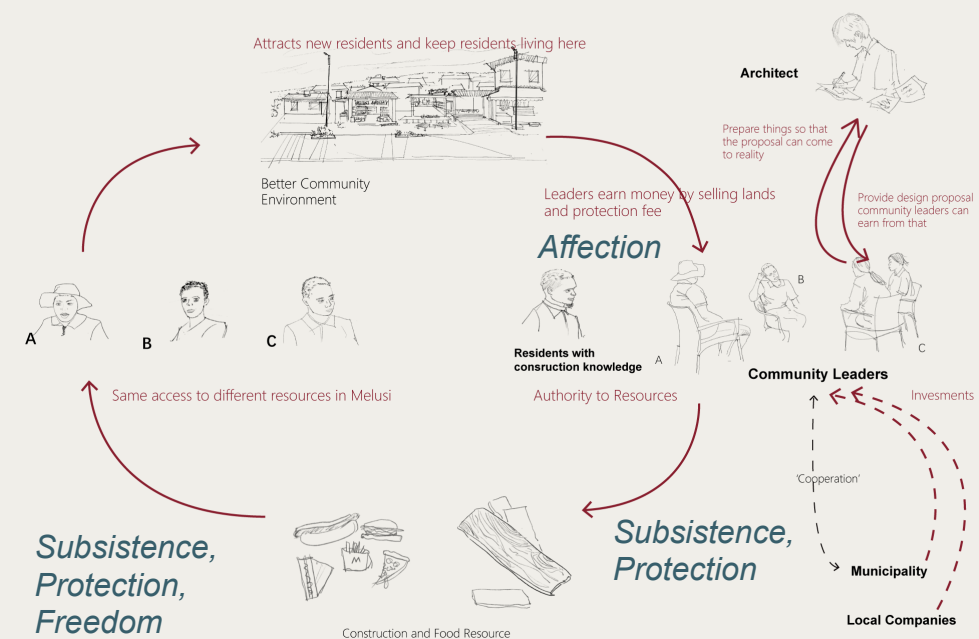


Figure 3.2.21. Social Mechanism of 'Investments do not Happen' after Interaction
Diagram Drawn by author

After Design Interaction: vans enable more efficient and equitable resource distribution within the existing system. This improved fairness can attract new residents and support more cohesive community development.

Similar to the mobile power grid scenario, the design proposal addresses the lack of formal infrastructure across most areas of Melusi 3, fulfilling the concept of Subsistence in HSD theory.

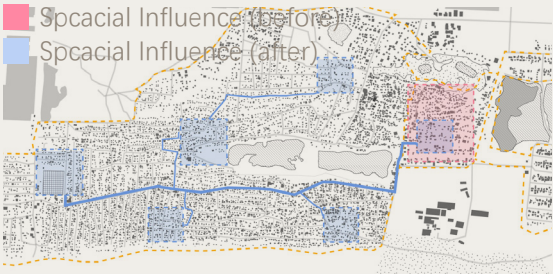


Figure 3.2.22. Spatial Influence Mapping (before and after interaction)

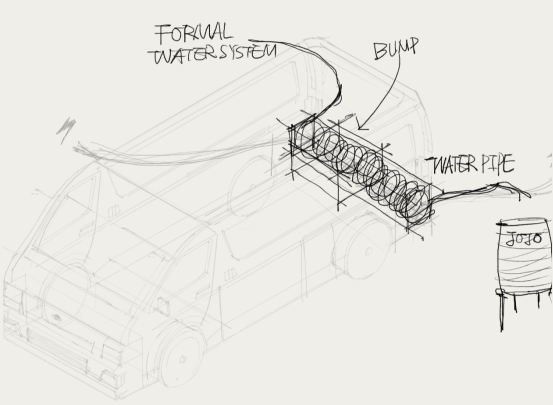


Figure 3.2.23. Design Proposal: Sketch of Temporary Water Supply

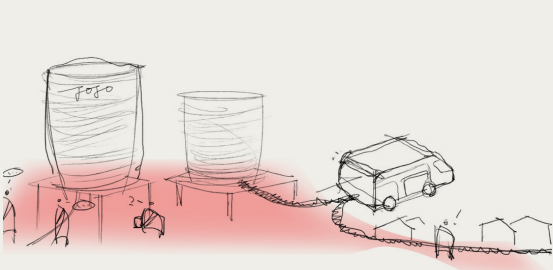


Figure 3.2.24. Spatial Influence of Temporary Water Supply Diagram

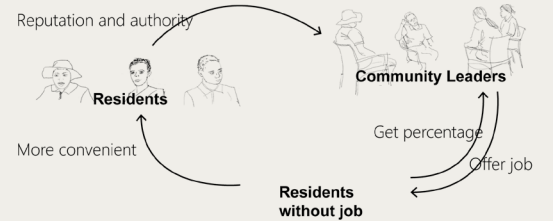


Figure 3.2.25. Mechanism Diagram

Efficient use of reclaimed building materials provides residents with more accessible and affordable housing materials, alleviating both resource pressure and the economic burden on residents.

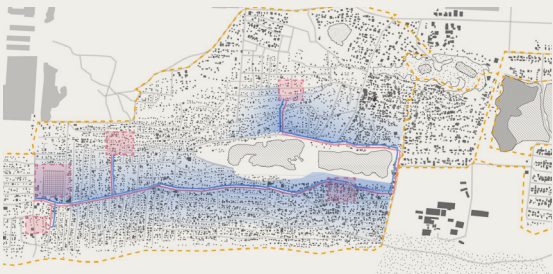


Figure 3.2.26. Spatial Influence Mapping (before and after interaction)

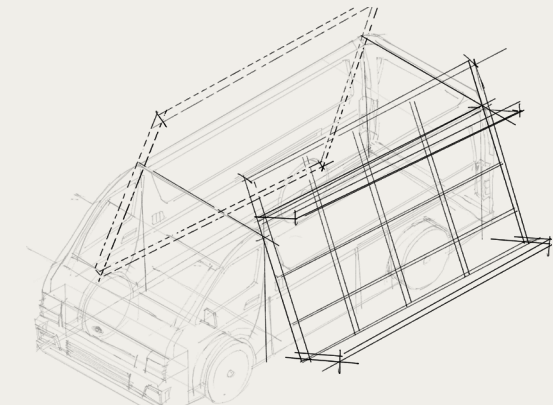


Figure 3.2.27. Design Proposal: Sketch of Movable Material Storage

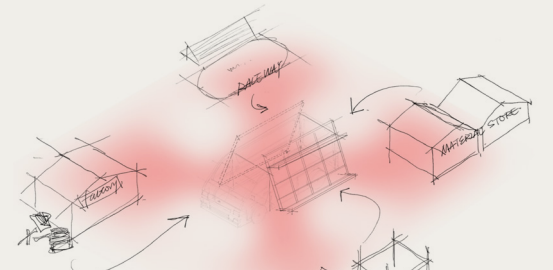


Figure 3.2.28. Spatial Influence of Movable Material Storage Diagram

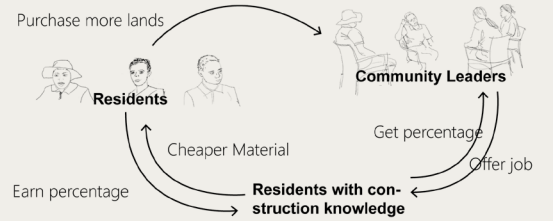


Figure 3.2.29. Mechanism Diagram

The mobile classroom provides children in different areas with equal access to education opportunities. Compared to a fixed classroom, it is better adapted to the context of informal settlements.

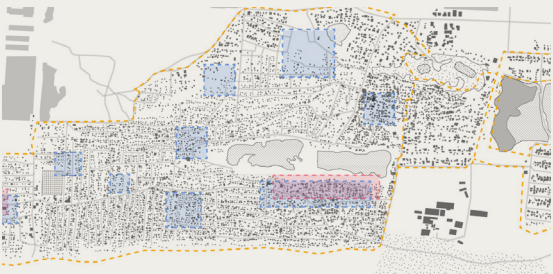


Figure 3.2.30. Spatial Influence Mapping (before and after interaction)

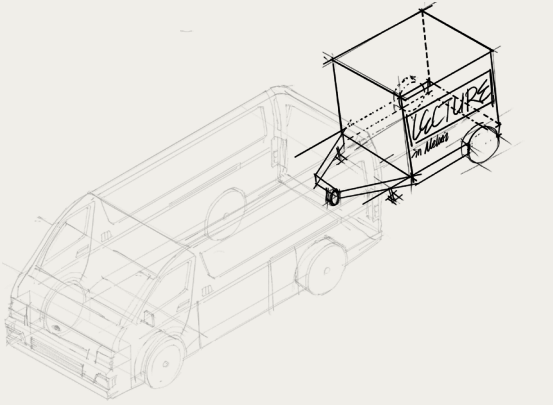


Figure 3.2.31. Design Proposal Sketch of Movable Informal Lecture Room

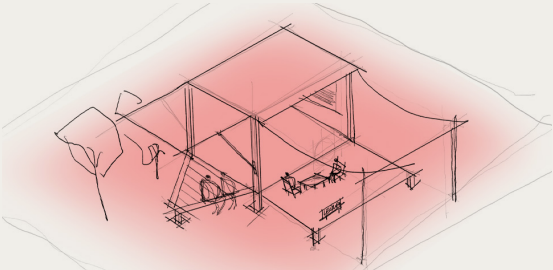


Figure 3.2.32. Spatial Influence of Movable Material Storage Diagram



Figure 3.2.33. Mechanism Diagram

The community's mobile canteen can provide residents who have just moved in or become unemployed with a reason to stay, especially newcomers who often can only live in the peripheral areas of the settlement, thereby giving residents a stronger sense of belonging.

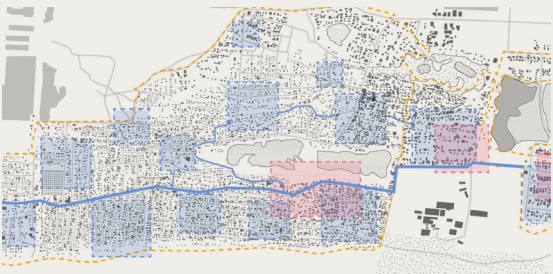


Figure 3.2.34. Spatial Influence Mapping (before and after interaction)

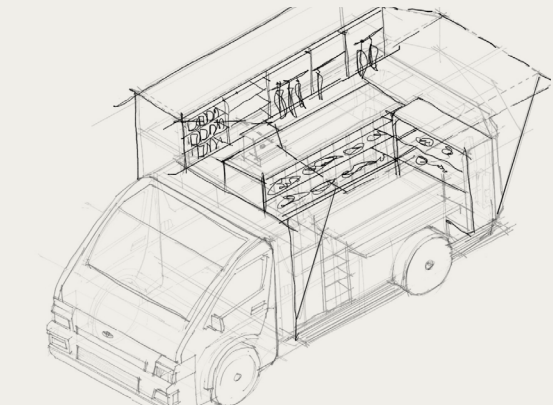


Figure 3.2.35. Design Proposal Sketch of Food Truck

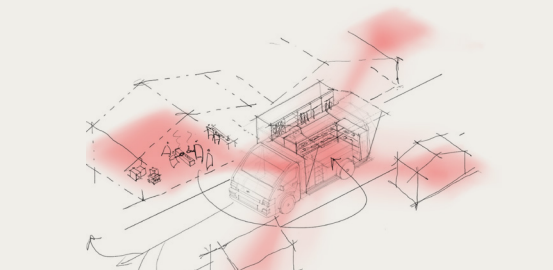


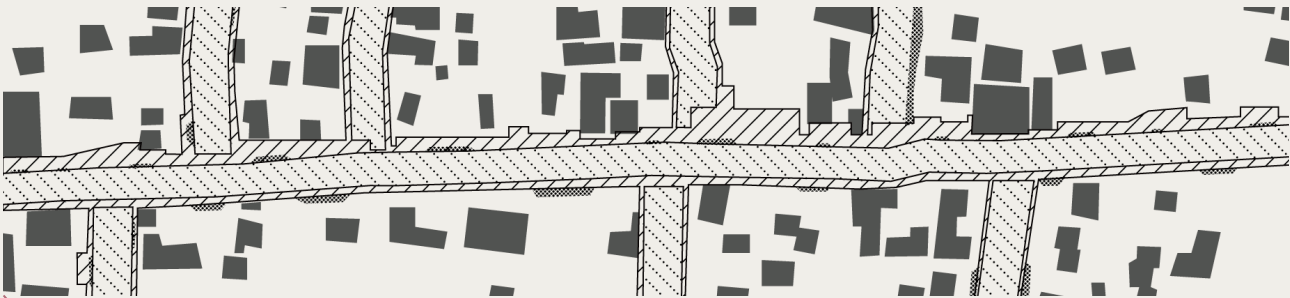
Figure 3.2.36. Spatial Influence of Food Truck Diagram



Figure 3.2.37. Mechanism Diagram

Scenario Creation
Uncertain Action Plan

If



Based on preliminary research, the University of Pretoria proposed a redevelopment plan for the main street. Starting with landscape interventions, the project aims to improve road drainage conditions in Melusi while simultaneously providing informal outdoor spaces for community use and gathering.

Such improvements help attract people and, in turn, enhance commercial activity along the main street. These positive effects can support the diversification of local businesses and improve residents' quality of life. If the action plan is successfully implemented, the various resources along the main street can work synergistically to foster positive development.



Figure 3.2.38. Action Plan Adapted by author from (Urban Citizen Studio, 2025)

Then

1. Action Plan & Local Business & Taxi

Landscape transformation along the main road addresses drainage issues, activates commercial activities, provides public space along the street, and encourages social gathering.

Because drainage issues have been resolved, commercial activity has become more vibrant, and people tend to stay longer in the area.

Taxi drivers did not want to drive into this area because of safety issue. Now, the area is more transparent, taxi appers.

2. Youth Gathering along the Street

Young people have opportunities to gather along the street, and taxis provide them with greater access to the outside world. Many have found better job opportunities beyond the community, and they rely on transport to reach their workplaces.

3. The demand for vehicles driven by commercial expansion

The scale of commercial activity along the street gradually expands, and shop owners require a larger supply of goods. They learn that nearby markets offer a wider variety of affordable products, but the distance is too great, making transport necessary for restocking.

4. Spacial Influence

With the growth of local businesses and strengthened connections to the wider city, small commercial plazas emerge as spaces of exchange and social gathering for residents and children.

Simultaneously, the self-organised development of the informal settlement generates a gradual demand for more permanent and larger-scale transport infrastructure, such as designated verchle or transit spaces.

Scenario Creation Uncertain Action Plan

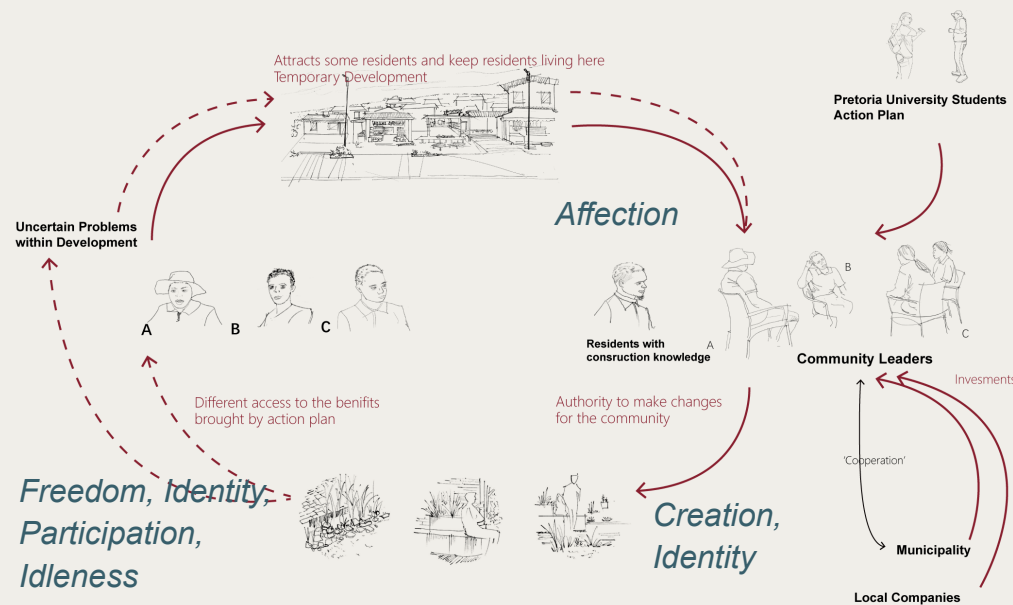


Figure 3.2.39. Social Mechanism of 'Action Plan Happens' before Interaction Diagram
Drawn by author

Before Design Intervention: The main street upgrade completed, distant residents can not ferquently access to this resources, some of whom planned to leave. The community leader's rental income decreased.

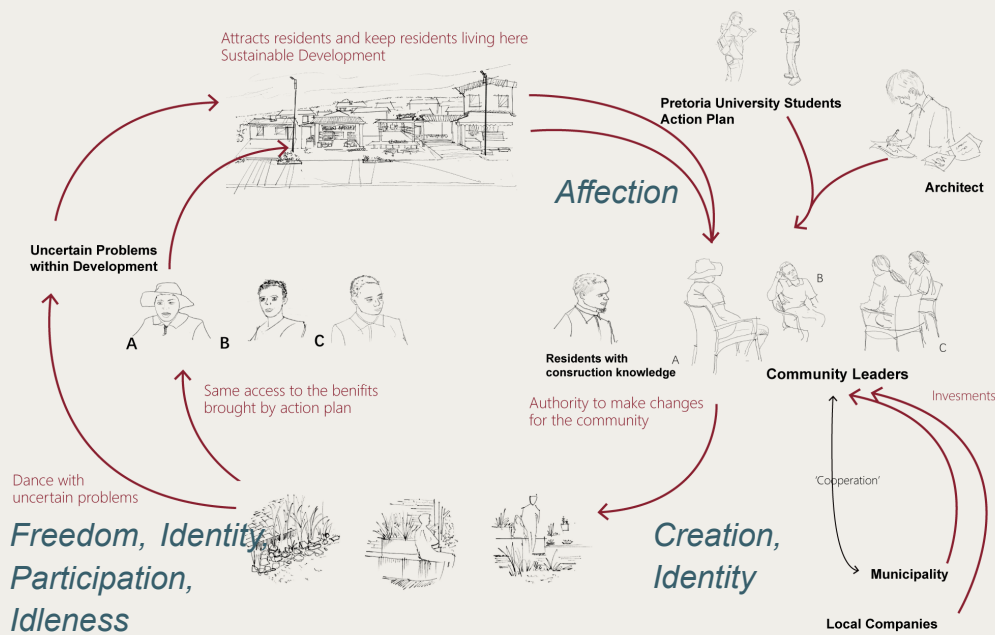


Figure 3.2.40. Social Mechanism of 'Action Plan Happens' after Interaction Diagram
Drawn by author

After Design Intervention: Resources on the main street became accessible to residents from different areas, increasing their willingness to stay, while the community leader's income was stabilized.

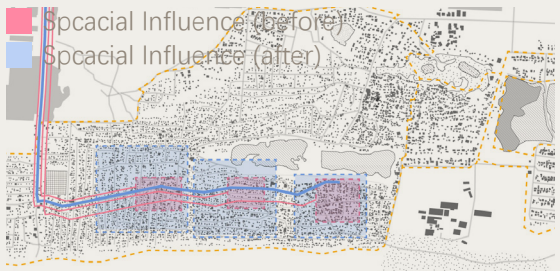


Figure 3.2.41. Spatial Influence Mapping (before and after interaction)

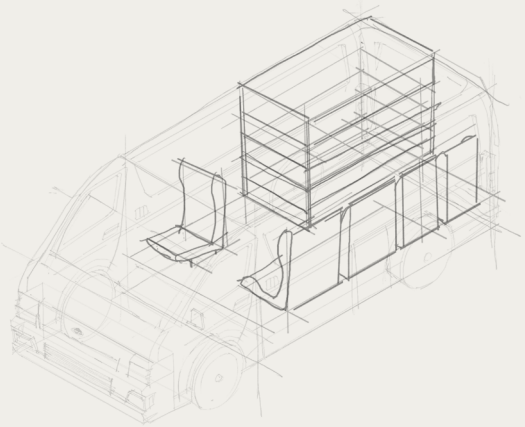


Figure 3.2.42. Design Proposal Sketch of Grocery Delivery Vehicle

With the growth of local businesses and strengthened connections to the wider city, small commercial plazas emerge as spaces of exchange and social gathering for residents and children.

The existing scale of commercial activity can no longer keep up with the pace of development. Shopkeepers need to frequently travel outside the community to restock goods, but taking taxis for each trip is too expensive. As a result, they decide to collectively rent a Toyota Hiace from the community.



Figure 3.2.43. Spatial Influence Collage Adapted by author from (Urban Citizen Studio, 2025)

Scenario Creation Uncertain Action Plan

If not?

Due to the high uncertainty of the informal community's self-governance system—for example, MYDO2 ceased operations in early March this year. So if action plan does not happen...

Some changes occurred in the landscape along the roads, and water management became more rational. However, renovations of public spaces and street pavements were delayed due to a lack of sufficient support. Street-facing businesses saw some improvement, but the gains were limited.

Then

1. Business Find a New Land

The owners of several small shops had hoped that the road renovations would boost their businesses and therefore prepared extra stock in advance.

However, the limited number of customers meant that much of their merchandise remained unsold.

Several local business owners joined forces with the idea of converting the vehicle into a mobile shop that could travel to different areas within the community.

The shop carried goods from multiple owners, including liquor from a tavern owner. In areas where there were few permanent shops, a small market quickly formed around the vehicle.

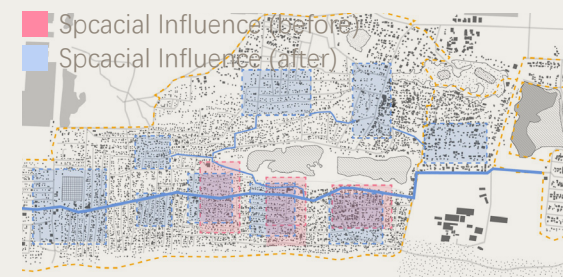


Figure 3.2.44. Spatial Influence Mapping (before and after interaction) by author

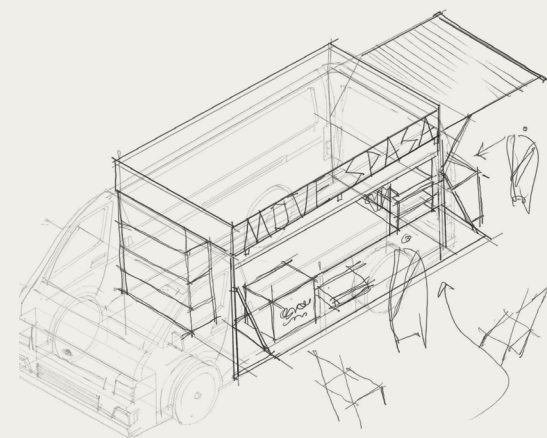


Figure 3.2.45. Design Proposal: Sketch of Movable Material Storage by author

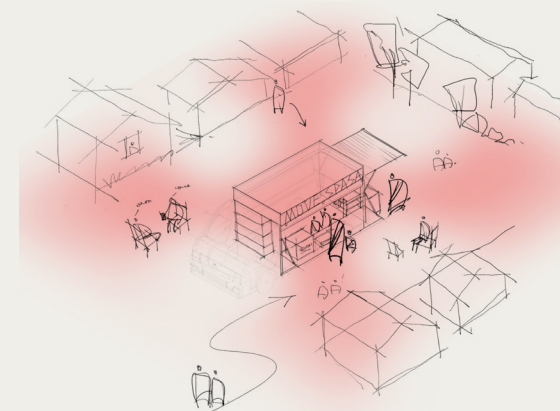


Figure 3.2.46. Spatial Influence of Movable Material Storage Diagram by author

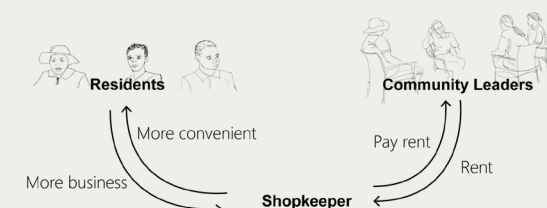


Figure 3.2.47. Mechanism Diagram by author

Shopkeepers on the main street jointly rent a Toyota Hiace to sell goods across different parts of the community to support their businesses. This not only brings convenience to residents but also generates benefits for themselves, transforming spatial influence from point and line into a more multi-dimensional condition.

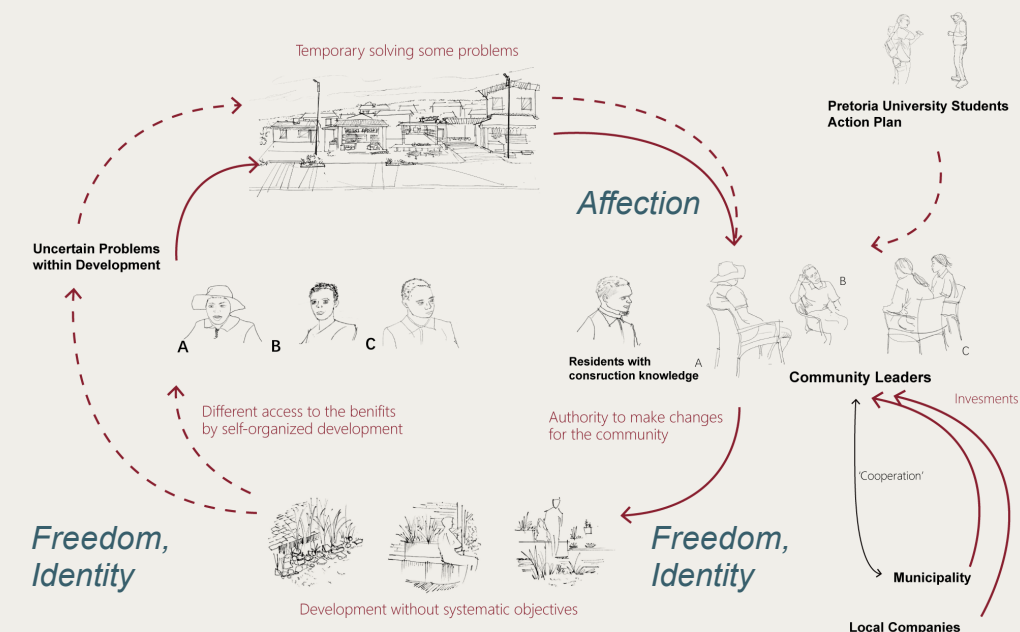


Figure 3.2.48. Social Mechanism of 'Action Plan does not Happen' before Interaction Diagram Drawn by author

Before intervention: The main street upgrade was only partially completed, with limited impact on distant residents, some of whom planned to leave. The community leader's rental income decreased.

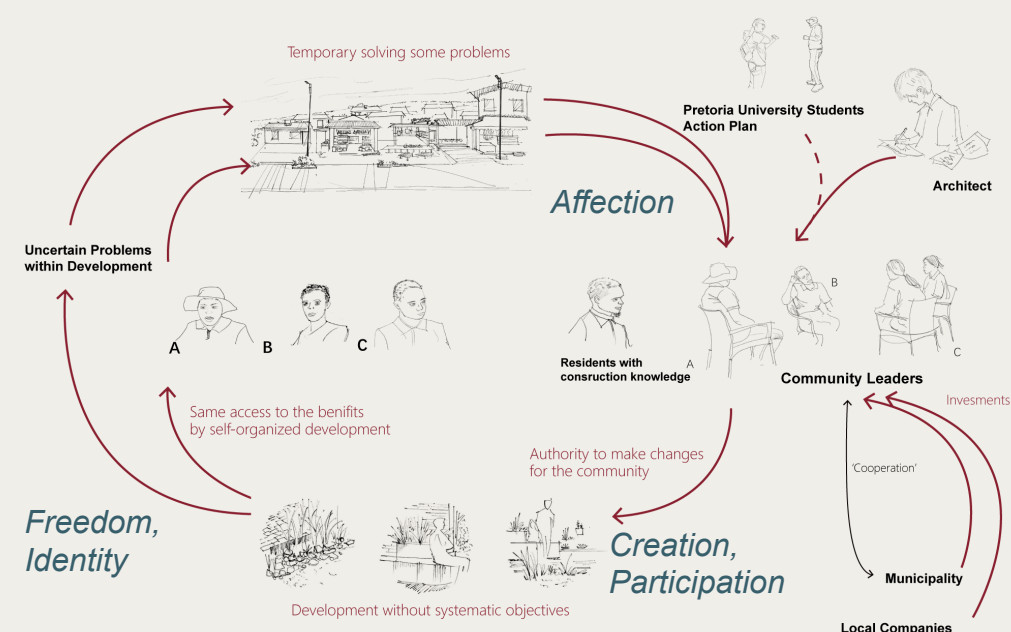


Figure 3.2.49. Social Mechanism of 'Action Plan does not Happen' after Interaction Diagram Drawn by author

After intervention: Resources on the main street became accessible to residents from different areas, increasing their willingness to stay, while the community leader's income was stabilized.

3.3 Demonstration Site Visit



Figure 3.3.1. Research Content Drawn by author based on Personal Site Visit in Melusi and Pretoria.

Due to disputes over land within the community, the expansion of MYDO has been delayed. MYDO2 could only undergo renovations based on its existing structure. MYDO3 and MYDO4 remained indefinitely on paper, with no construction progress. There were still many children and adolescents in need of MYDO’s involvement. Their extracurricular lives required proper guidance, otherwise they could easily go astray.



Figure 3.3.2. Research Driving Route Mapping Drawn by author



Figure 3.3.3. Behavior Observation Picture Took by author

Through the field observations presented in Figures 3.4.4 and 3.4.5, a deeper understanding of the specificities of informal settlements was achieved, including their localized construction knowledge and systems of social self-governance. These observations also lay a solid foundation for the subsequent design proposal, helping to clarify which assumptions typically taken for granted in conventional architectural practice do not hold true in this context.

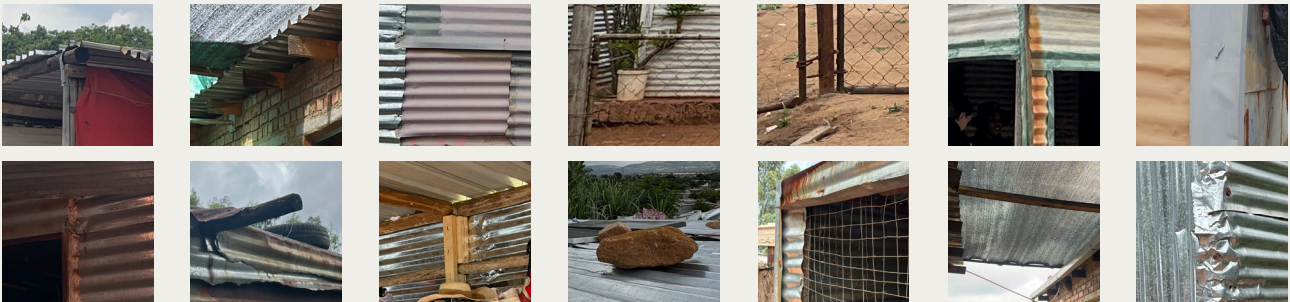


Figure 3.3.4. Construction Detail Observation Picture Took by author

3.4 Demonstration Workshop 1

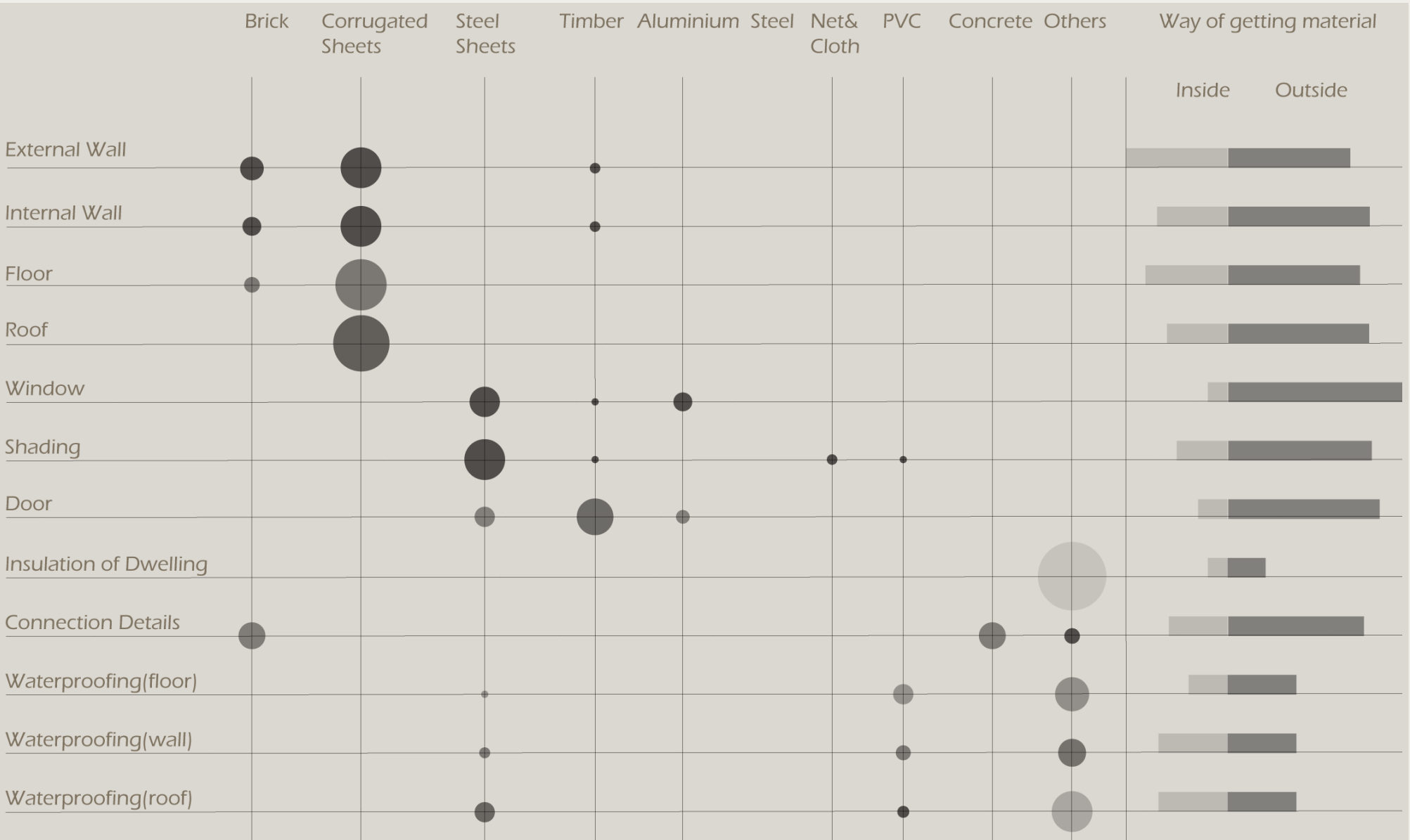
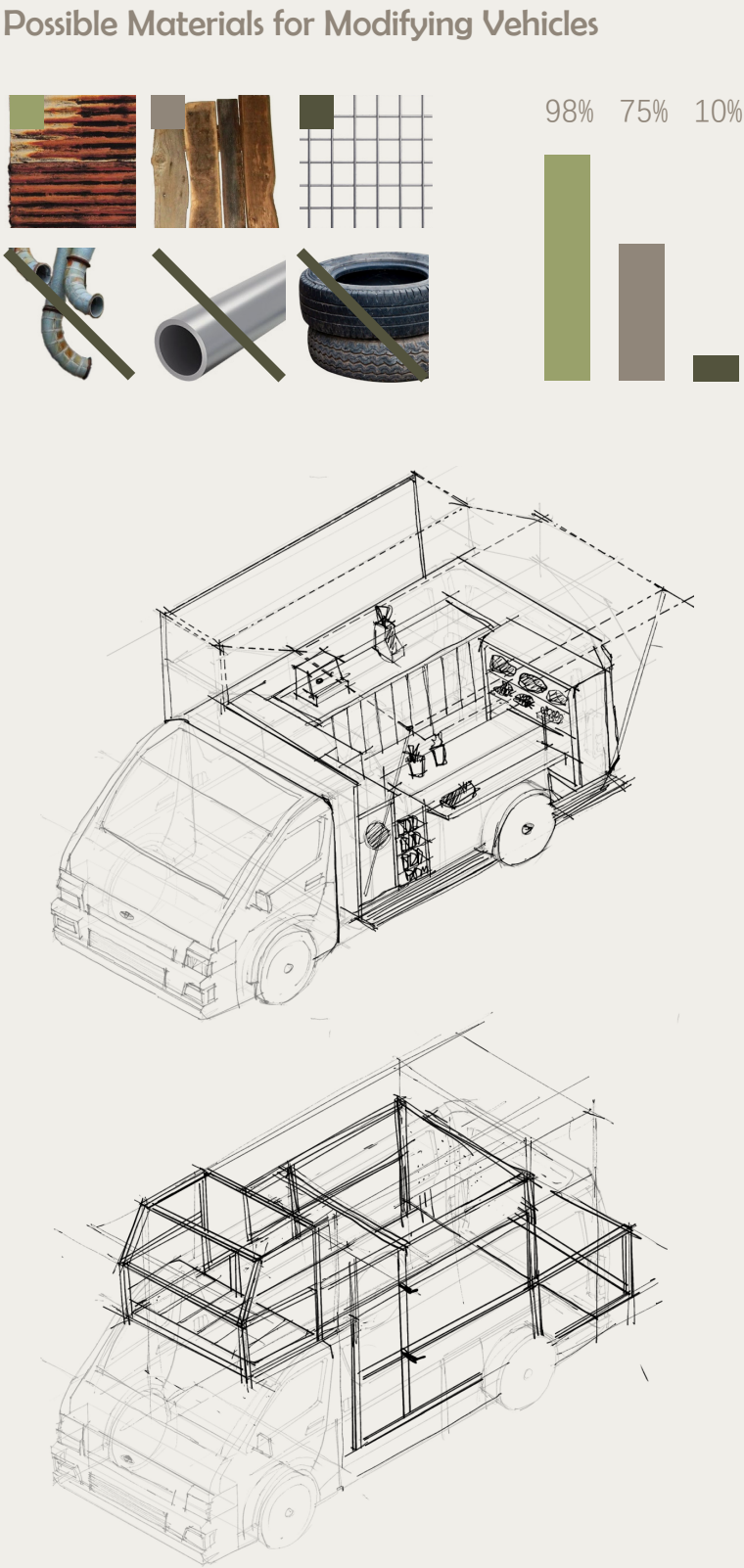


Figure 3.4.2. Material Research Form Drawn by author

Workshop 1 focuses on local materials and construction knowledge in informal settlements. Through showing Melusi residents the design drafts and interview them about the local materials they may use for modification (Figure 3.4.6), *I identified which materials should not be used in the design proposal.*

At the same time, by examining material usage in residential buildings in Melusi—including the proportion of different materials and their maintenance conditions *I further defined the material strategy for the design proposal.*

Materials get within Melusi
Materials get out of Melusi
Color: matainance degree
Size: propotion of specific material
Wood Stick & Pannels
Steel Panels
Steel Wires

3.4 Demonstration Workshop 2

Due to disputes over land within the community, the expansion of MYDO has been delayed. MYDO2 could only undergo renovations based on its existing structure. MYDO3 and MYDO4 remained indefinitely on paper, with no construction progress.

There were still many children and adolescents in need of MYDO's involvement. Their extracurricular lives required proper guidance, otherwise they could easily go astray.

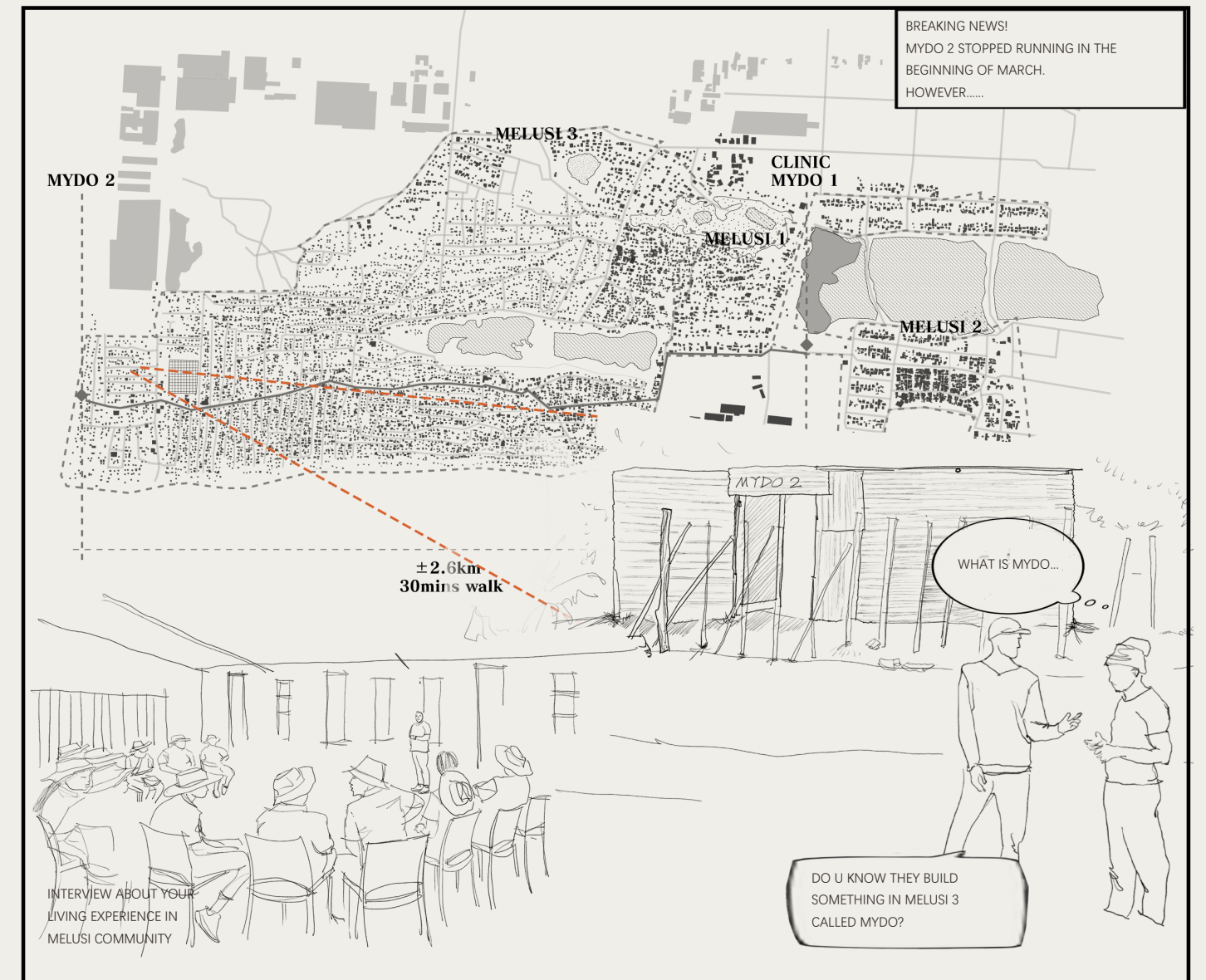


PRACTICAL EXPERIENCE

The system's exclusivity and the inherent disorder of self-organization

Figure 3.4.3. Behavior Observation and Social Mechanism Workshop in Melusi Drawn by author.

The unique mechanism makes it impossible to interact with normal spacial strategy.



Limited resource flow within the community

BREAKING NEWS

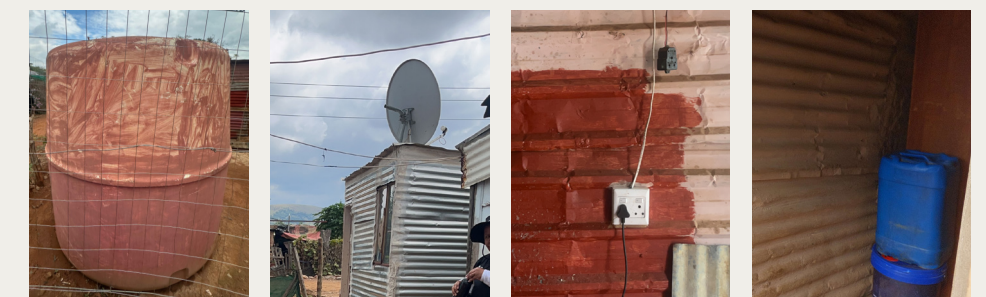


Figure 3.4.4. Informal Infrastructure Picture in Melusi Community Took by author

SELF-MANAGE INFORMAL INFRASTRUTURE

3.5 Design Proposal

The Structure of Toyota Hiace

Clarify the structure and pre-drilled openings

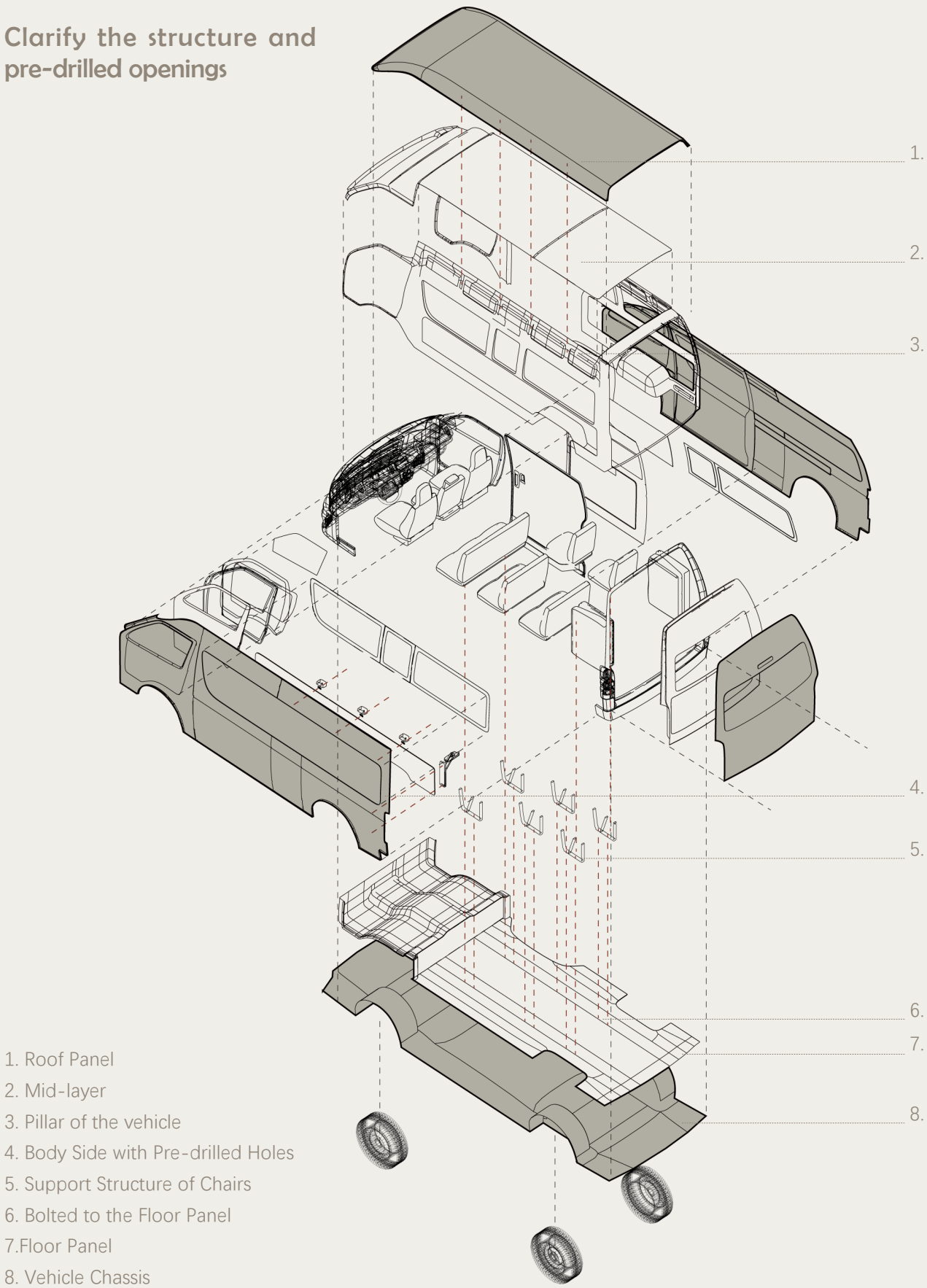
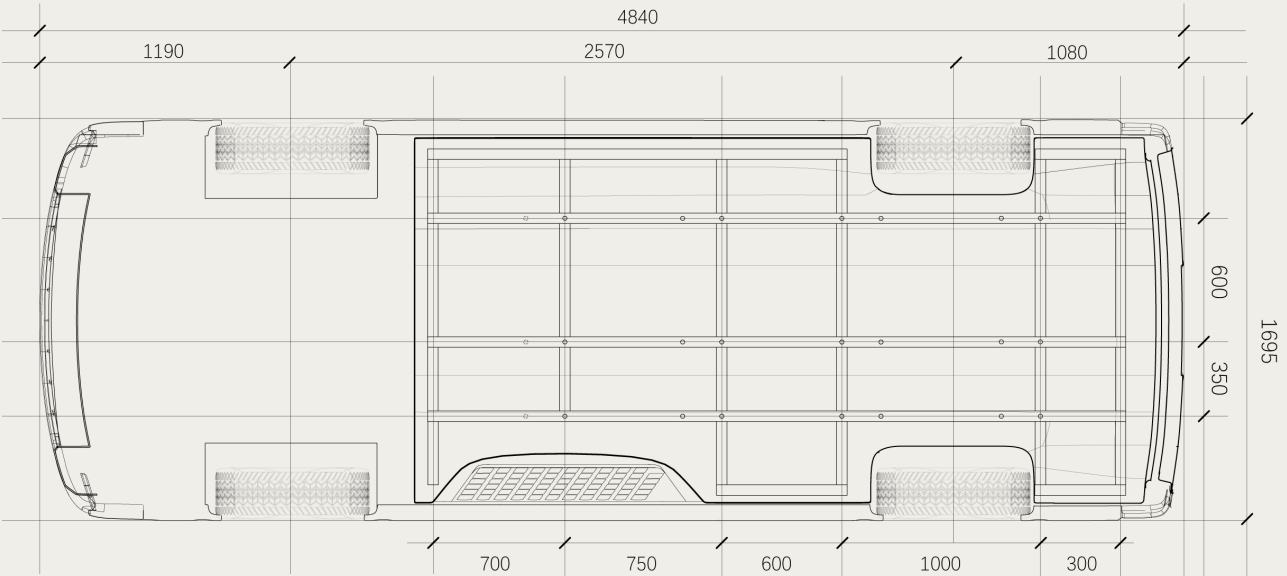
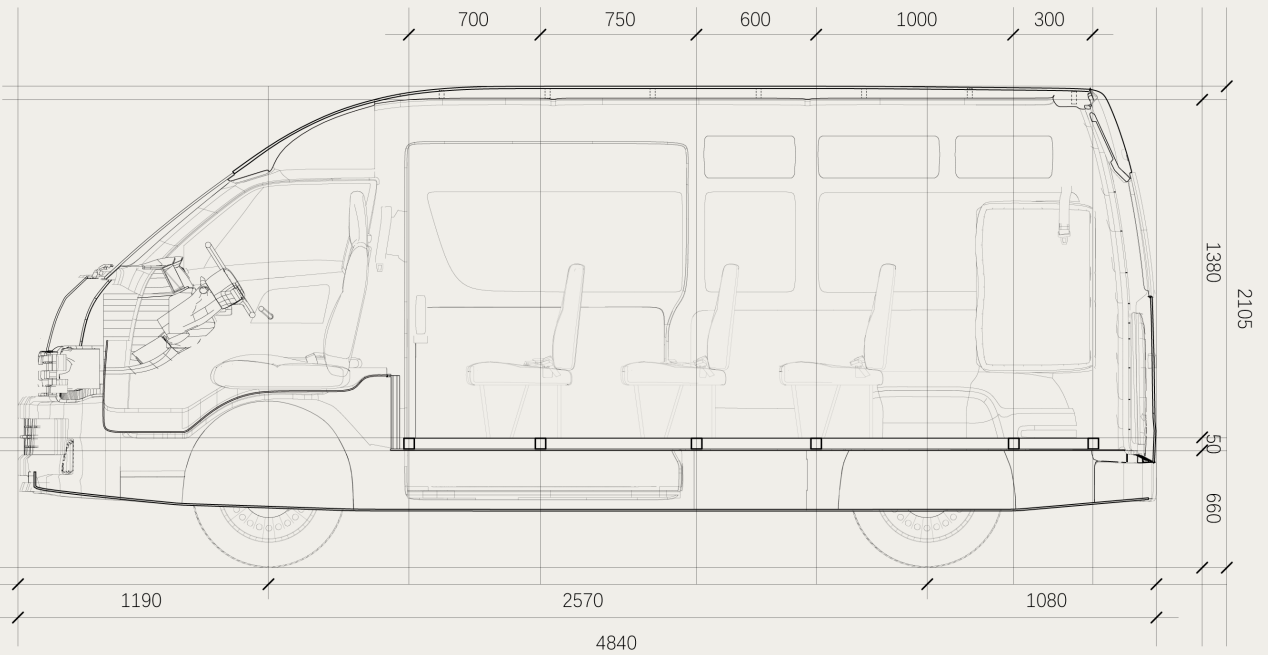


Figure 3.5.1. Exploded Axonometric Drawing Drawn by author



First Floor Plan 1:30



1-1' Section 1:30

Figure 3.5.2. Technical Drawings (First Floor Plan 1:30 and Section 1:30) Drawn by author

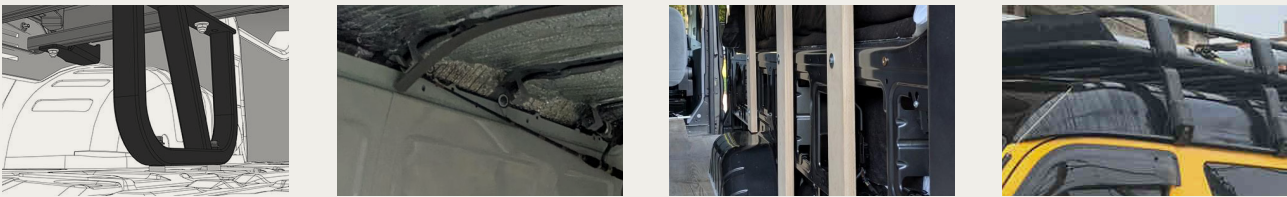


Figure 3.5.3. Detail and Reference of Modification Pictures from Toyota Hiace Commuter H300 SLWB Product bulletin

In order to carry out an informal modification of the Toyota Hiace, it is necessary to study its internal structure. I found that the vehicle contains many pre-existing mounting holes, which not only

reduce the need to engage extensively with specialised automotive engineering knowledge, but also *make the design proposal more feasible within the context of informal settlements.*

Interior Modification for Uncertain Scenarios



Figure 3.5.4. Modification of Toyota Hiace Picture Truck by author and Website from [Melusi, Pretoria].
Figure 3.5.5. Structural Installation Steps Drawn by author

The conversion of this vehicle is already highly developed in Pretoria, making the design proposal in informal settlements feasible. Figure 3.5.5 illustrates the installation process of the modular frame. No power tools are required during the process; the installation of the frame can be completed using only existing community tools such as wrenches and plastic sockets.

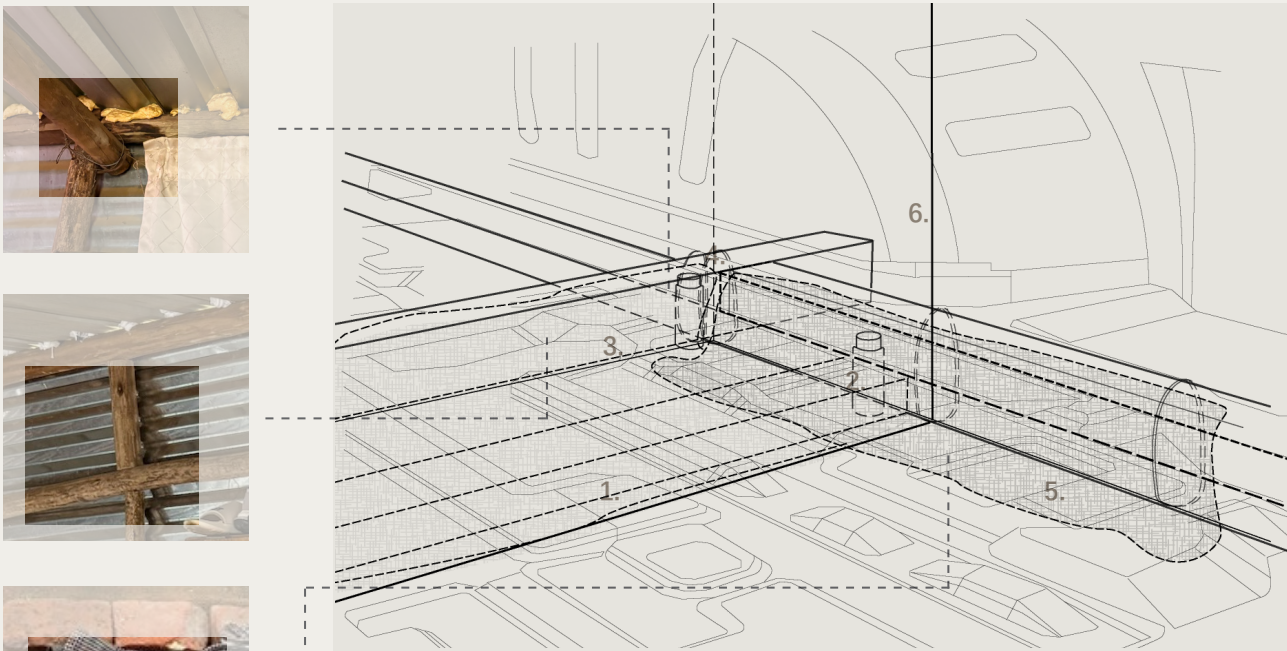


Figure 3.5.6. Interior Conversion Frame Joint Detail Drawn by author.
Figure 3.5.7. Local Construction Picture Truck by author from [Melusi, Pretoria].

- 1. Recycled Material Frame
- 2.Fixed with Original Factory Bolts
- 3.Recycled Timber Frame, Adjusted to 4.
- Different Furniture Dimensions
- 5. Frame Secured with Wire
- 6.Clothing and Fabric Used as Gap Fillers Furniture in Various Sizes

Local materials and construction practices in Melusi is translated into the retrofit design of a modular structural frame which interact with uncertain furniture size as well as uncertain scenarios within Melusi



Figure 3.5.8. Interior Rendering Generated by Gemini based on author's Rhino Model and Sketches

By adapting the interior modifications to different uncertain scenarios, the transformable structures developed through learning from local construction knowledge are able to accommodate various types of furniture found in informal settlements.

In hence, the design proposal can respond to uncertainty at both the meso and micro scales.

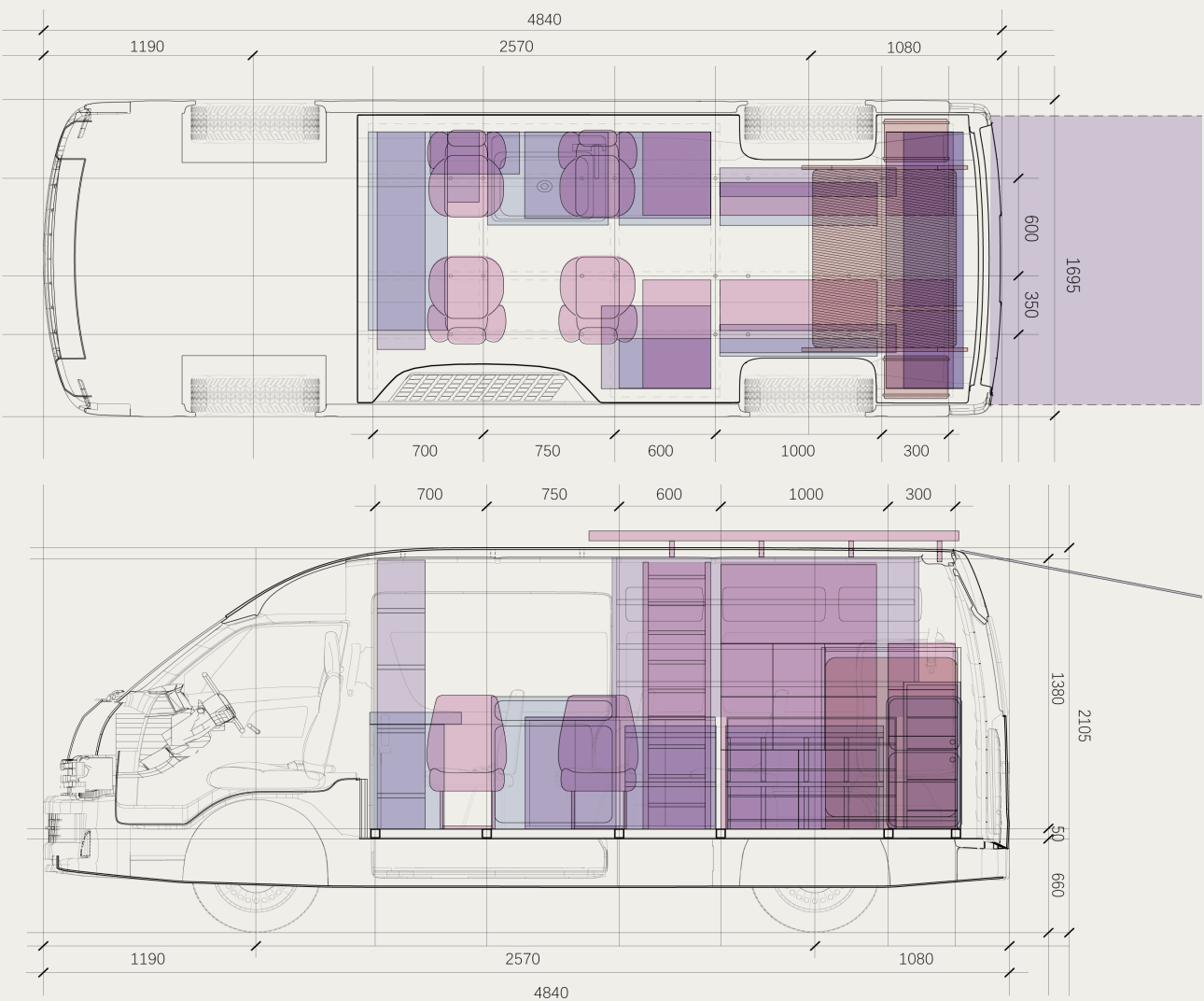


Figure 3.5.9. Interior Conversion Plans and Sections Drawn by author.

Interior Modification for Uncertain Scenario

Uncertainties in different scenarios within informal settlements can be translated at the design level into, for example, variability in furniture dimensions and unpredictability in patterns of use.

Based on the initial scenario research and analysis of social systems, a series of recurring conditions can be identified. For instance, in Melusi, the distribution of food resources is uneven across many areas, meaning that when NGOs donate food, not all residents have equal access.

Based on these conditions, the design proposal is developed without over-determining the system.

Instead, it responds to these identified scenarios while remaining grounded in local conditions, preserving a degree of uncertainty and, at the same time, enabling the community to develop adaptive capacities within it.



3.5.10. Food Truck Scenario

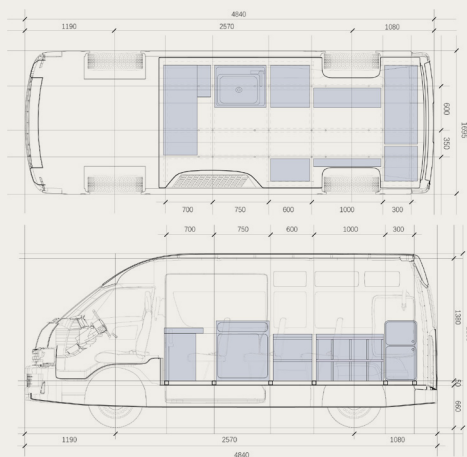
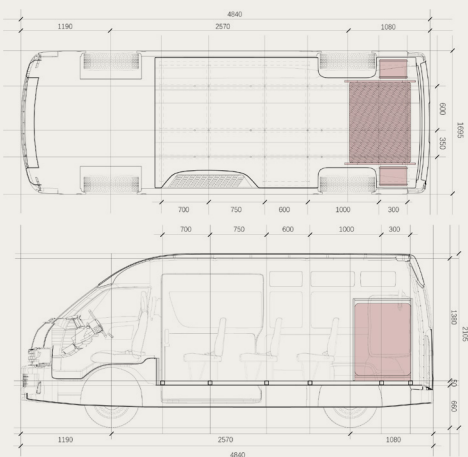


Figure 3.5.10-12. Interior Modification and exterior scenario Rendering Generated by Gemini based on author's Rhino Model and Sketches

Figure 3.5.13. Different Modification Plan and Section Drawn by author



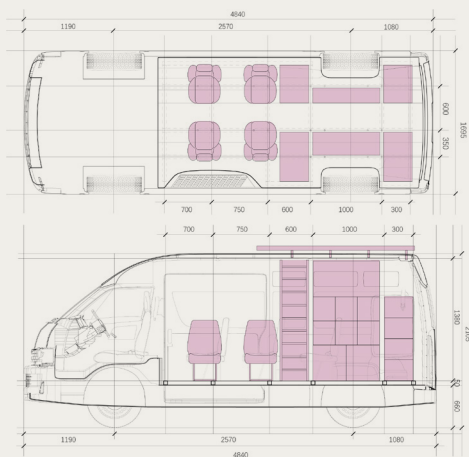
3.5.11. Temporary Infrastructure Scenario



A cable reel made from recycled wood, wound with electrical wires, is mounted onto the vehicle. With the addition of a simple transformer, it enables the temporary sharing of electricity from Melusi 1 to specific area in Melusi 3, making it possible for construction of infrastructure such as signal towers.

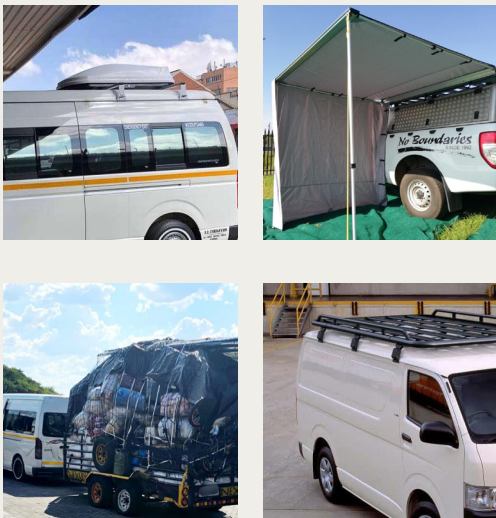


3.5.12. Bussiness Scenario



After the commercial development of the main street, the scale of business expands. Several simple shelves made from recycled wood are mounted onto the vehicle, allowing shop owners along the main street to travel together to the city center for restocking, thereby easing their financial and time pressures.

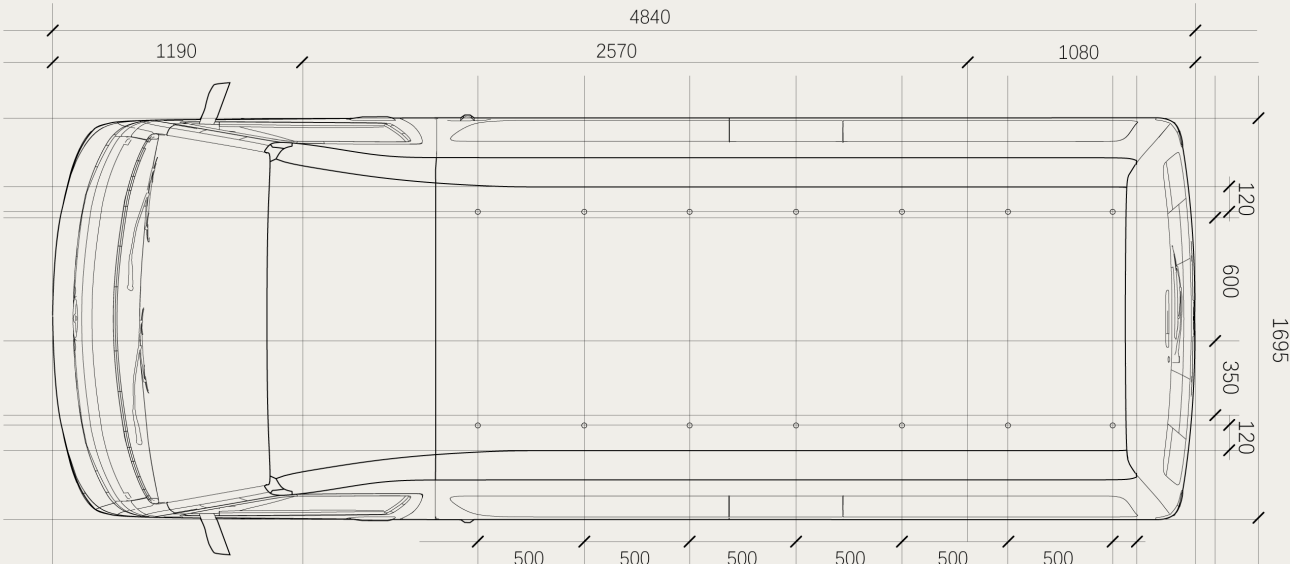
Exterior Modification for Uncertain Scenario



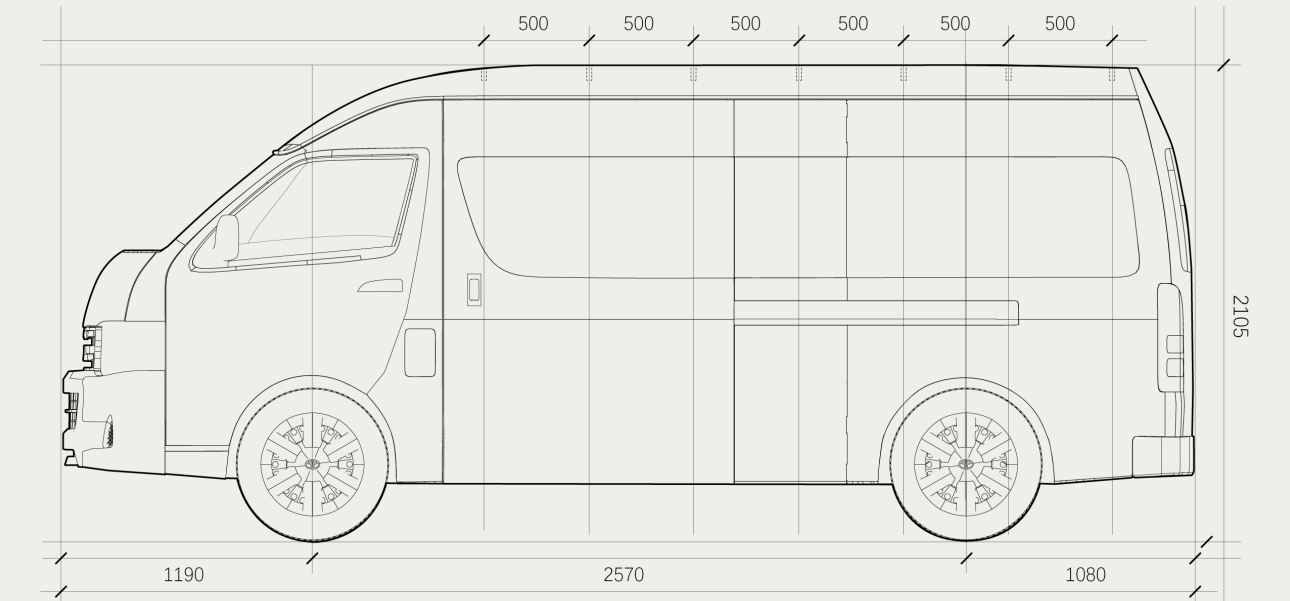
The adaptation of roof-mounted frames is a mature practice within vehicle modification, as seen in Pretoria, making the design proposal in informal settlements feasible.

Figure 3.5.16 demonstrates *how a simple and operable construction strategy, informed by established vehicle modification practices and local knowledge of materials and construction, can engage with the uncertain demands of informal settlements.*

Figure 3.5.14. Current Modification of Toyota Hiace Picture Took by author and Website from [Melusi, Pretoria].



Ceiling Floor Plan 1:30



Left Facade 1:30

Figure 3.5.15. Technical Drawings (Ceiling Floor Plan 1:30 and Left Facade 1:30) Drawn by author



- 1. Pre-drilled Hole
- 2. Wood Structure
- 3. Wood Frame
- 4. Rope or Wire Fixed to the Frame
- 5. Hang with Rope
- 6. Hang clothes on slot

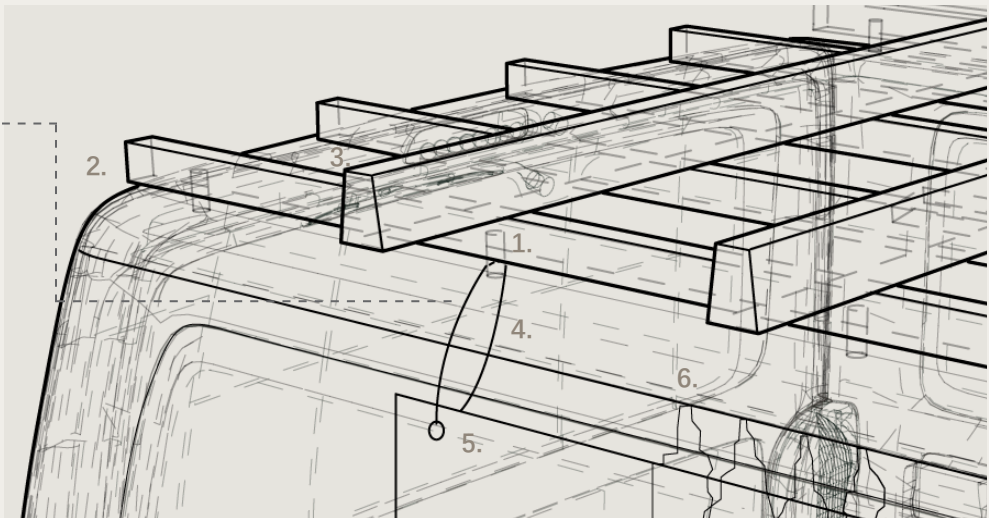


Figure 3.5.16 Exterior Rendering Generated by Gemini based on author's Rhino Model and Sketches

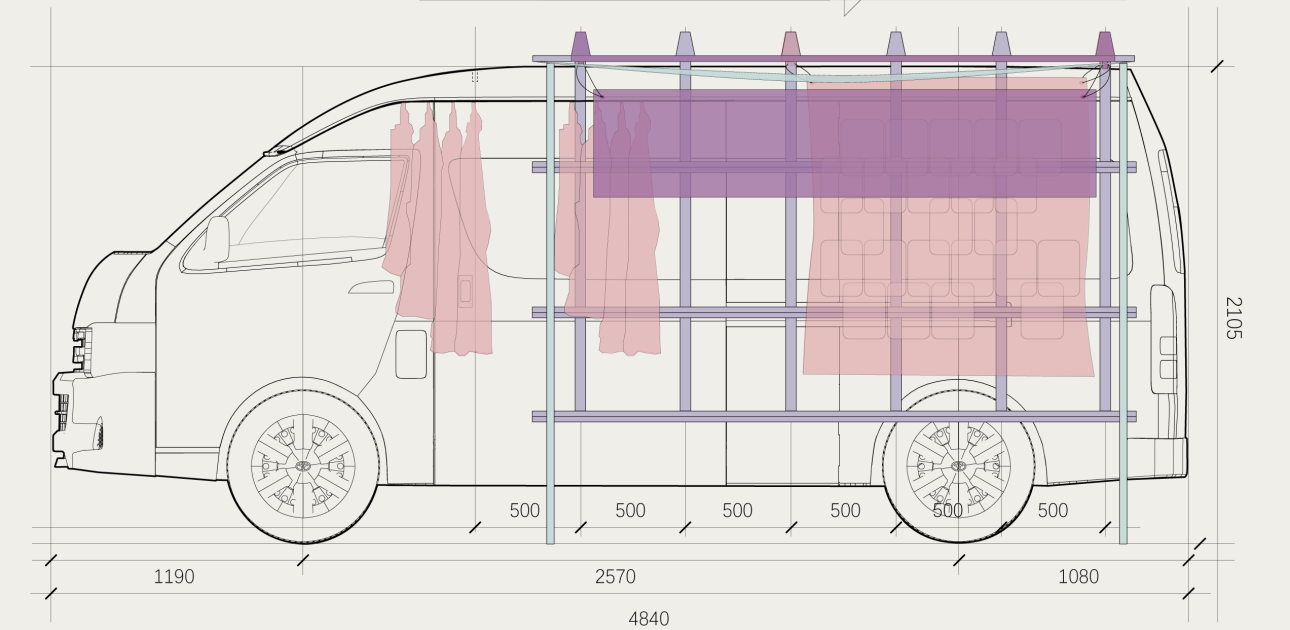
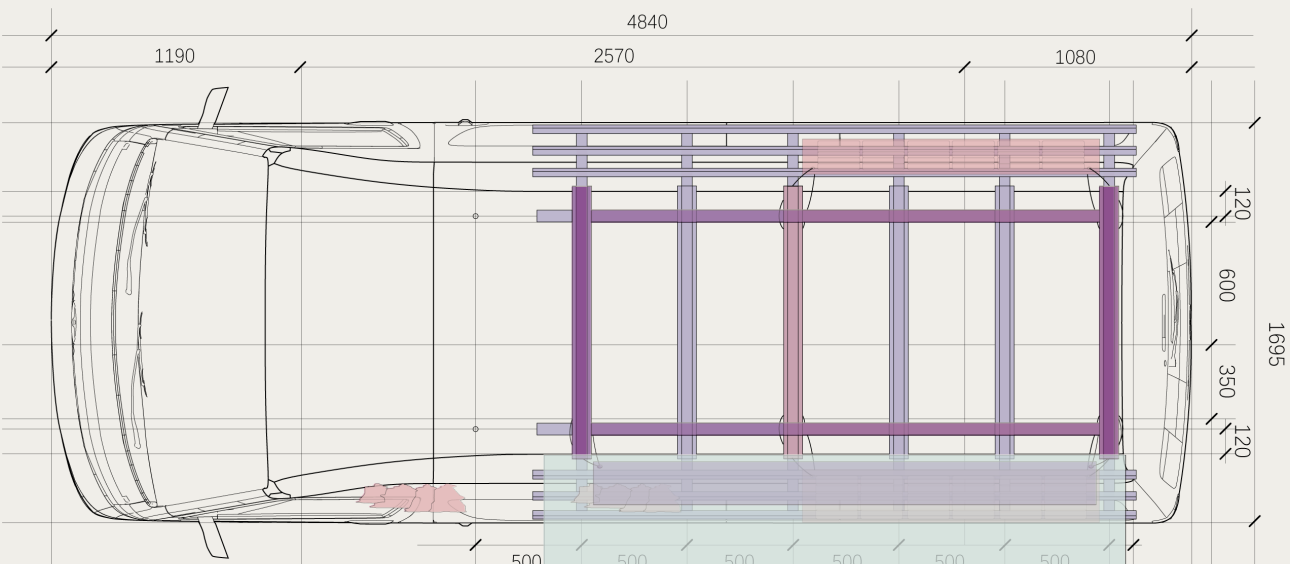
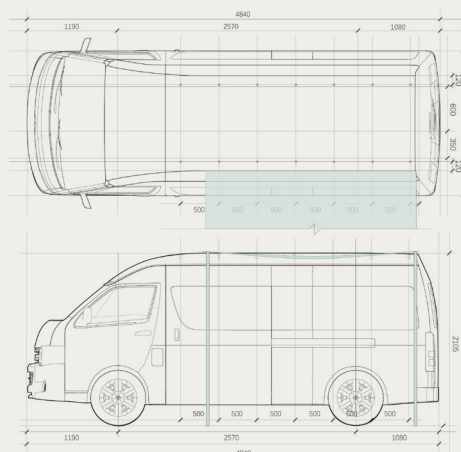


Figure 3.5.17. Exterior Conversion Plans and Sections Drawn by author.



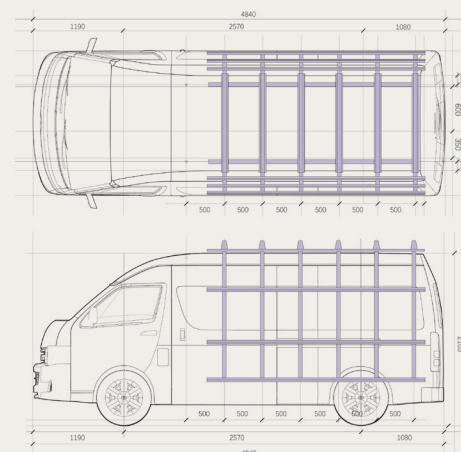
3.5.18. Movable Classroom Scenario



The canvas, supported by two columns and frame on the vehicle, creates an outdoor temporary classroom, enabling children from different areas of the community to gather and access education.



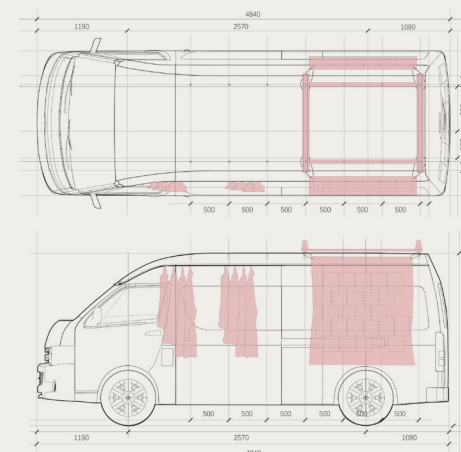
3.5.19. Movable Material Storage



The frame on the roof of the vehicle supports material racks on both sides of the vehicle. As the vehicle moves, recycled materials are displayed to residents, enabling more efficient use.



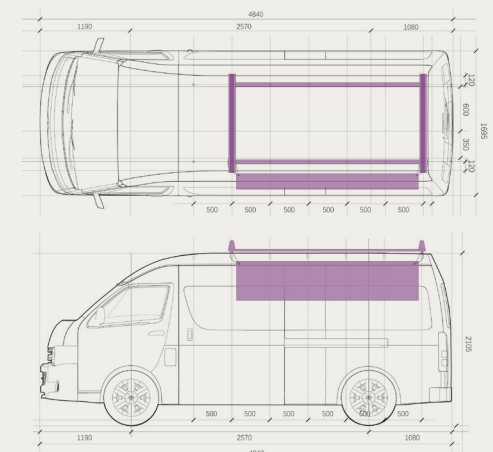
3.5.20. Informal Retail Scenario



Clothing and other small retail goods are tied to the frame on the roof of the vehicle with ropes, forming an informal mobile commerce model that is better suited to the context of informal community Melusi.



3.5.21. Lecture Promotion Scenario



Signboards made from recycled timber are tied to the frame with ropes. As the vehicle engages in different activities, residents across various areas can access information, helping to reduce information asymmetry.

**4. Discussion and
Conlusion**

4.1 Discussion

These scenarios are developed based on the preliminary research on Melusi, as well as fieldwork conducted in the mid-stage of the study, during which the author visited Melusi to carry out interviews and workshops. All scenarios are grounded in existing activities and spatial practices already taking place in Melusi, rather than in externally constructed or hypothetical conditions.

How Scenario deal with the uncertainty and HSD theory?

In this research, “uncertainty” is understood as a broad and multi-layered concept, encompassing material conditions, construction logics, land tenure, and socio-operational mechanisms. Among these, the most critical form of uncertainty in Melusi lies in its self-governing social system, which in turn structures and intensifies uncertainties in other dimensions.

Accordingly, the construction of scenarios does not simply describe isolated spatial phenomena; rather, it uses different dimensions of uncertainty as entry points to trace back and reveal the underlying social operational mechanisms. Through this process, the design is able to be embedded within the existing system, avoiding the position of an external or alien intervention, and instead becoming part of the system itself.

During the scenario development process, it becomes evident that, from the perspective of the HSD theoretical framework, there are structural gaps within Melusi's social operational mechanisms. These gaps prevent the

self-governing system from functioning in a stable and regenerative cycle. At this point, the role of the architect is not that of an external problem-solver, but of an embedded participant within the system. By engaging with and addressing these structural deficiencies at the level of the HSD framework, the architect contributes to the reconfiguration of the system, enabling a more coherent and sustainable cycle of operation.

How Design Proposal respond to scenario& uncertainty

Based on the analysis of the scenarios, this research identifies several structural gaps within the existing social mechanisms of Melusi under the HSD theoretical framework. These gaps affect the integrity and long-term operability of the system, preventing its self-governing structure from forming a stable cyclical process.

On this basis, the study proposes corresponding vehicle modification strategies as a spatial response to these structural deficiencies, thereby partially addressing the shortcomings within the HSD framework. The modification strategy is not positioned as an independent technical solution, but rather as an intervention embedded within the broader socio-spatial system.

At the same time, the scenarios themselves contain multiple layers of HSD-related needs, which continuously evolve over time and across different contexts. Therefore, vehicle

modification should not be understood as a fixed end product, but rather as a continuously adaptable framework system, capable of ongoing adjustment and transformation in response to changing demands, rather than remaining in a final, static state.

How Design Proposal respond to local learning?

Based on the study of local material practices and construction knowledge, this project aims to develop vehicle modification strategies that are fully grounded in the informal local context, rather than relying on complex and high-cost standardized retrofit solutions.

In terms of materials, the modification seeks to utilize locally available resources. However, these materials often come with significant uncertainties in dimensions and specifications. Standardizing or reprocessing them into fixed sizes would require considerable additional effort in terms of both time and resources.

In response, the design makes use of the vehicle's existing pre-defined structural holes as anchoring points to construct a lightweight, frame-based modification system. This approach is combined with local construction knowledge to develop appropriate connection details. In this way, the system is able to respond flexibly to varying modification needs without depending on standardized material systems.

There are numerous spatial issues in Melusi, shaped by historical, planning, and economic factors. While conventional practice relies on spatial solutions, this approach proves ineffective in informal contexts. This research instead focuses on underlying socio-operational mechanisms. Early work at the University of Pretoria and Chalmers University of Technology used spatial and behavioral analysis to uncover these mechanisms. In the mid-phase, uncertainty-based scenarios were developed from identified stakeholders and existing activities, exploring interventions through social systems and the HSD framework.

The subsequent workshops not only focused on learning local construction methods and material practices, but more importantly, through interviews, observations, and exchanges, enabled a deeper understanding of structural deficiencies within the social system—such as unequal resource distribution and the power structures of community leadership. This process allowed the design proposal to evolve from an external intervention into a “co-actor” that can adapt alongside changing social mechanisms.

In this sense, design is no longer conceived as a fixed solution, but as a system that co-evolves with social processes, thereby responding to the inherent uncertainties of informal settlements.

4.1 Discussion

What I did in Workshop 1 and how it bridging the local learning and design proposal?

In Workshop 1, the original plan was to present design sketches and material stickers to residents, allowing them to select which locally available materials would most likely be used for vehicle modification. However, as students from the University of Pretoria were conducting their own workshop at the same time, and I was unable to effectively engage with a large number of residents on my own—particularly since many did not speak English—this approach proved difficult to implement.

In response, I adjusted the strategy and collaborated with local students. After their workshop concluded, they assisted with translation while I presented the design sketches to Melusi residents and asked about the materials most commonly used for vehicle modification in the local context. Melusi residents firmly rejected some of the initially proposed materials and indicated that wood and steel sheets are the most commonly used and practical options.

At the same time, I further developed an understanding of local material practices and construction logic by observing and documenting how materials are used and maintained in local housing. This process provided important empirical references for material selection and connection detailing in the subsequent design proposal.

Deepened Understanding of Self-Governance Structures and Design Orientation

During field visits and on-site investigations within the local community, a series of observed behaviors and interactions allowed me to gain a more nuanced, indirect understanding of the social self-governance mechanisms in informal settlements. Local residents generally maintained a high level of caution toward outsiders, only becoming more at ease after confirming that we were part of a research team from the University of Pretoria. This attitude stems from the legal instability of informal settlements, where land use is constantly at risk of being revoked.

At the same time, students from the University of Pretoria attempted to propose a new community learning center on the site of a former church. However, during multiple engagements, different community leaders provided conflicting responses. This situation highlights the high degree of uncertainty surrounding land ownership and legality in informal settlements, making conventional architectural intervention strategies difficult to implement.

Furthermore, within the local social structure, community leaders occupy a critical “ecological niche,” holding decisive influence over major changes within the community—such as whether a new design proposal is permitted.

Therefore, for any design intervention to be realized, it must be embedded within the existing self-governance system and, to some extent, align with the interests of community leaders, thereby securing their support and enabling implementation.

The role of architects in informal community context

During field visits to other informal settlements and streets in Johannesburg and Pretoria, I came to recognize that space is not a fixed entity; rather, it is people's behaviors that play a decisive role. Space should not be understood as a final, static form, but as something continuously shaped, adjusted, and redefined. As people's behaviors shift in response to environmental, economic, or social factors, they in turn modify and reorganize space accordingly.

More deeply, in dealing with uncertainty, I cannot predict how people will use a design. Architects therefore need to take a humble position and avoid imposing fixed assumptions. Instead, design should emerge from a systematic understanding of the multiple factors shaping the site. Space becomes static when it is excluded from the evolving socio-spatial system. As a medium for human action, it is continuously reshaped by informal social structures. If an intervention does not integrate into this system, it risks being quickly abandoned. Through discussions in Melusi, I found that most residents are willing to stay

as long as living conditions improve. They identify with the community and its logic, but informal mechanisms still produce gaps across HSD dimensions. When design becomes part of the community's operational system and delivers tangible improvements, residents tend to respond positively and actively engage. Based on this observation, the research shifts its focus in informal contexts from “space itself” to the uncertainties generated by underlying socio-operational mechanisms. The aim of design is no longer to deliver a spatial “solution” as a final answer, but to understand and embed itself within these mechanisms, becoming part of the system rather than remaining confined to the conventional role of the architect.

The formal relationship of main client and architect/consultant does not work here (and also other informal contexts). I need to recognise the socio-spatial structure of stakeholders and propose design that aligns with it. The traditional proposal with a single vision doesn't work. I need multiple visions based on possible uncertainty that you predict by looking at past actions. Architecture usually looks at design precedents. In my case, I also had to look at local practices and patterns of behaviour and patterns of spatial change.

Within this framework, space is understood as a product of social processes, rather than their starting point or end result.

4.1 Discussion

How to adapt design proposals to site in different scales?

There are many roads in Melusi with different scales, and during my research, I verified that most of the roads can use design proposals.

However, in the more distant communities of Melusi, due to their latest formation time, the road conditions are even more unfavorable for the passage of cars (in terms of scale, road conditions, etc.).

At this point, modifications based on toyota hiace may not be able to cover those areas. We can adopt the same approach and modify the design scheme based on some movable devices used locally to further enhance its universality. For example, modifying some small carts or bicycles used locally for spatial response.

The strategy provided in this paper on how architects can intervene in informal communities is universal.

When facing roads or community spaces of different scales, it is not limited to a specific modified carrier. The choice of Toyota Hiace is based on common issues and specific situations in the community.

The limitations on its scale can be overcome through corresponding specific strategies

4.2 Conclusion

This thesis aims to study and learn the uncertainties embedded within informal settlements in South Africa and to examine the underlying operational logic of such communities. Drawing upon HSD theory and a critical understanding of the role architects assume within informal contexts, the study constructs a series of scenarios that inform the development of a design proposal. The proposal seeks to address adverse conditions within informal settlements in a flexible and sustainable manner.

Throughout this process of analysis and investigation, the thesis also endeavors to reveal the constitution of informal settlements by observing and representing informal spaces and everyday practices. It examines the formation of spatial structures across different scales, the socio-spatial mechanisms that shape them, and the distinctive internal logic of community operation. Through this lens, the research aims to gain a deeper understanding of the uncertainties (accessibility, construction, demographic, institutional and spacial uncertainty) surrounding the future development of such communities and to explore how these uncertainties might be engaged rather than resolved.

In contrast to the notion of “permanent architecture” prevalent in formal urban contexts, the proposed design does not seek to permanently transform Melusi community residents’ lives. Melusi is an informal and provisional settlement; due to the inherent contingency and discontinuity of community self-governance, its future

trajectory remains unknown. While it may eventually formalize into a permanent neighborhood, many Melusi community residents regard it as a temporary place of residence, often staying only a few years. The project therefore aspires to operate meaningfully within the temporality of everyday life, contributing to residents’ daily experiences rather than imposing a fixed, enduring form.

The nine HSD theoretical factors embedded in the design proposal function as spatial guidelines for responding to fundamental human needs within informal contexts.

All components of the HSD theory are addressed, but different scenarios place emphasis on different aspects. For example, in the investment scenario, subsistence, protection, and affection are partially lacking due to the unequal distribution of investment resources. Under the influence of social mechanisms, this leads to instability in the functioning of informal communities. These spatial responses are conceived as highly adaptable and malleable. The final outcome may, in fact, align more closely with infrastructural or vehicular spatial strategies than with conventional architectural typologies.

Nevertheless, the theoretical and investigative components of the thesis underscore that such forms of spatial production are precisely those most likely to emerge within informal societies.

A central contribution of this thesis lies in its departure from conventional architectural spatial paradigms. It frames informal settlements and their inherent uncertainties not as problems to be eradicated, but as contextual realities to be engaged. Rather than eliminating seemingly negative conditions, the project advocates growing alongside them. This stance is critical: to grow with uncertainty is to respect the socio-spatial context, allowing design outcomes to emerge organically from the ground, rather than being transplanted as idealized solutions from external frameworks.

More specifically, design starts from the socio-autonomous structures that generate uncertainty, using HSD theory to address and repair these systemic deficiencies. Rather than being a finished product, the design proposal offers the possibility for continuous transformation by its users. This is what it means to “grow with uncertainty.”

I argue that the failure to adopt this perspective is a key reason why many architectural interventions in African informal contexts struggle to meaningfully improve the lives of marginalized populations—and why architects from developed countries, in particular, are susceptible to this misconception. For example the MYDO 2 renovation project.

Current practice is based on the assumption that the future can be predicted with a certain degree of certainty, and that design interventions are completed as one-off, finalised outcomes. In informal settlements, however, future predictability is extremely low. Ambiguous land tenure, flexible spatial use, and fluid economic activities are all part of the underlying operational logic of these environments.

Relying solely on conventional current practice in such contexts effectively attempts to eliminate these uncertainties—in other words, it interrupts or even severs existing socio-spatial mechanisms. Moreover, empirical observation and lived experience demonstrate that, in informal settlements, demographic, economic, and policy conditions change continuously and at high frequency. As a result, space must be capable of ongoing evolution.

Therefore, when architects treat with informal communities, they need to rethink their role by understanding the local social mechanism first and let themselves be a part of the system.

4.3 References

AI-based tools, including ChatGPT, were used to assist with translation, language editing, and text structuring.

The rendering of design proposal is generate by AI (Gemini), base on the rhino model made by author and sketches drew by author.

All outputs have been reviewed and validated by the author.

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Sincerely appreciate all the assistance from two supervisors,
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Chalmers School of Architecture
Department of Architecture& Civil Engineering
Society, Justice, Space

Examiner: Liane Thuvander
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