ESSAY 02

DESIGN RESEARCH

2.1 Introduction

2.1.1 Engaging the roles of people and place

In the context of regenerative development and design, the roles of people and the places in which they dwell in the transformation from unsustainable practices to regenerative ones have become central concerns (Mehmood et al 2020:455). Recent sustainability scholarship indicates an evolution in focus from "knowledge integration to user engagement, co-deliberation and co-creation transformative sustainability research" (ibid:455). By extension, the arguments previously absent from sustainability debates such as how space can facilitate social connections and influence social behaviour towards creating more equitable regenerative spaces are important.

This essay considers two aspects of transformative sustainability, that is, human agency and social innovation as the social and material dimensions of the study (figure 2.1). The first section explores the social dimension of the study by considering how to facilitate human agency through participatory processes. The second section investigates the material dimension of the study, exploring the vernacular design of the Melusi informal settlement.

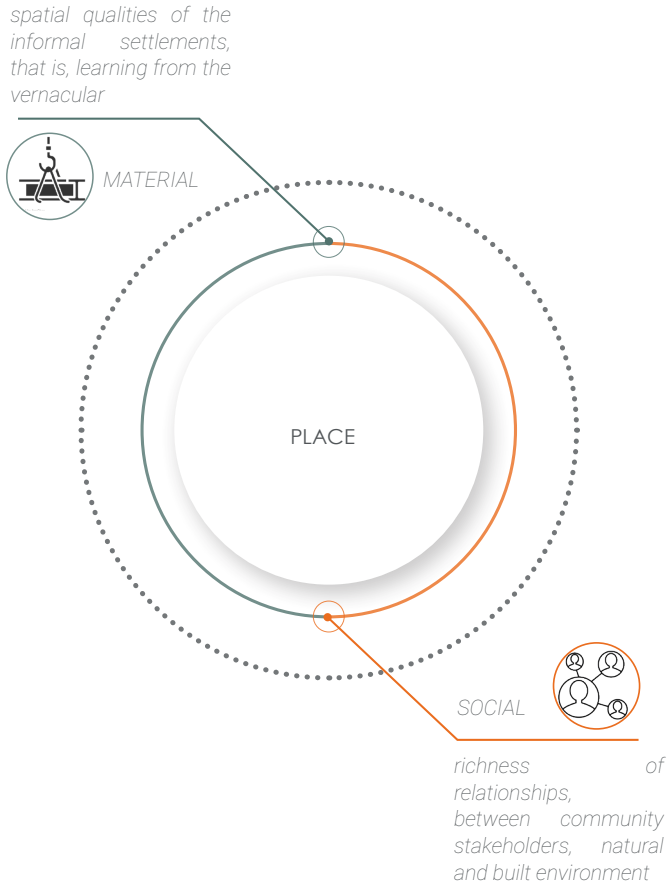


Figure 2.1: Social and material dimensions explored (Author 2021)

2.2 Stakeholder evolution

Regenerative design thinking considers eliciting human agency and change in conduct towards the natural environment. In that regard the concept of user participation is critical. Participation has been promoted in design, sustainability scholarship and urban policy. Regarding design discourse, ongoing conversations are concerned with challenging the role of the architect as the sole author, with growing advocacy for a shift to collaborative design. In urban policy, participation is advanced concerning development in economically distressed environments such as in informal settlement as a remedy to the shortcomings of anti-poor interventions (Simon, 2016; Watson, 2009). However, in many instances it is undertaken simplistically as a tick box exercise (Madimetja and Makombe 2014).

Against this background rigorous participatory research approach was undertaken to engage in learning from and about the community and to elicit human agency in advancing socially innovative transformation. The participative inquiries for the study were conducted as part of the Reality Studio, a program at Chalmers University of Technology in Sweden that involved a collaboration with the University of Pretoria's (UP) Unit for Urban Citizenship (under which this research is conducted). As the Melusi team (including two Chalmers students and two UP students), we investigated an overarching theme of sustainability which encompassed our individual research sub-themes. These included, food (production, access, and nutrition), water (access, practices, and perceptions of the Melusi water features), and the building of community capabilities through social innovation (figure 2.2). These sub-themes were also indicated in the previous vulnerability mapping studies by the Climate Adaptation Studio (2020) as points of concern.

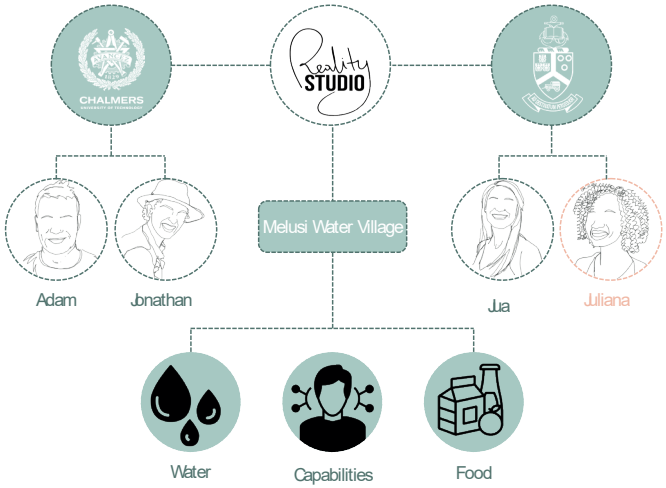


Figure 2.2: Melusi team and focus (Author 2021)

2.2.1 Stakeholder analysis and methods of engagement

Prior to the initial on-ground engagement, we conducted a stakeholder analysis and identified the key stakeholders (figure 2.4). These included: the Community Orientated Primary Care (COPC), a program run by UP's Health Department; Malusi Youth Development Organisation (MYDO); and Ragae Early Childhood Development (ECD), the Booysens Nursery, New Schools for Hope; a Non-Profit Organisation (NPO) and Melusi inhabitants. The community engagement took place in phases during which different methods were employed learn from the various stakeholders groups.

Figure 2.3: Research Timeline (Elinder et al 2021)

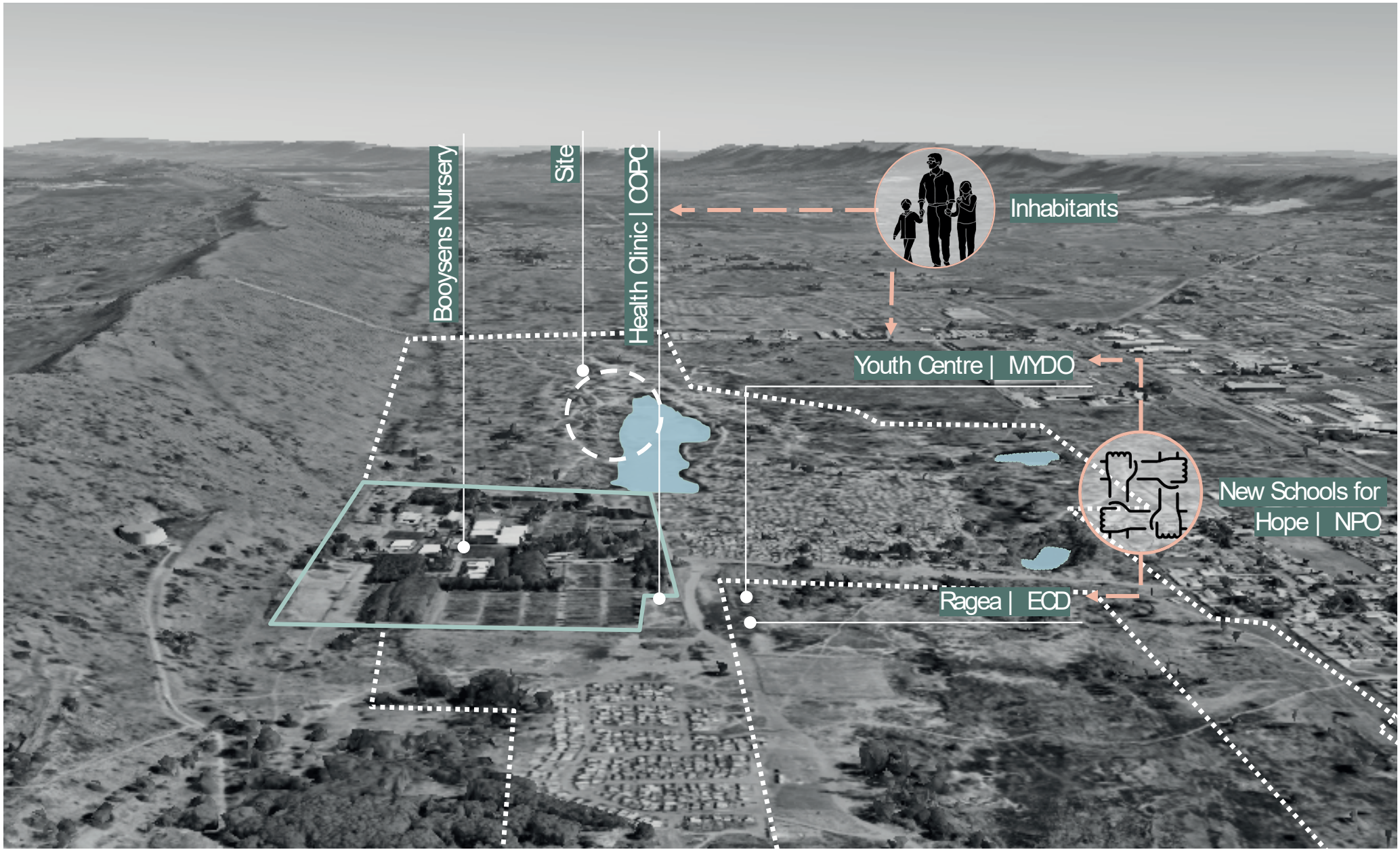


Figure 2.4: Melusi stakeholders. Satelite image from Google Earth (Edited by Author 2021)

2.2.3 Play as a participatory method

Our leverage point to the various households were the children with whom we established a relationship through MYDO and the ECD. Additionally, given that children are the most vulnerable stakeholders and often marginalised, the child perspective and their participation in the project was important (Danenberg et al. 2018). Participatory games were designed to garner participation of children in the community. Play as a participatory approach facilitates a process that is free of creative responsibilities (Birch et al 2016). Play comes naturally to children and as such a helpful tool.

We engaged the children through two participatory games; the 'Melusi Plate' game and 'Water' game, and a Design Thinking workshop for children designed by Play Africa. The aim of the Melusi Plate game was to ascertain the children's dietary and nutrition needs. The Water game was designed to fascilitate our understanding of the household water rituals and water recyling knowledge and practices. The game was built collaborativelly with the children (figure 2.6). The Designing Thinking workshop facilitated the co-design of the Melusi streets as child-friendly streets. Whilst the games were designed to fascilitate quantitative data collection, they also functioned as icebreakers and trust building tools. After each game, we formed a 'circle of trust' (figure 2.5) through which we held conversations about the topic of discussion, gathering more qualitative data. The game design process was iterative and collaborative. The process and detailed findings are attached annexure A1 and A2.

Figure 2.5: Post-game conversations with the children (Zorn 2021)

Figure 2.6: Co-consturction of the Water Game (Zorn 2021)

PARTICIPATORY GAMES

MELUSI PLATE GAME

Questions posed: What do you have for dinner? Where does it come from?

Aim: To ascertain the children's dietary and nutrition needs and sources of food in the community.

WATER GAME

Question posed: Where does/ should the water go at your home?

Aim: to Understand water knowledge around recycling and household water practices.

PLAY AFRICA DESIGN THINKING WORKSHOP

Co-design of the Dwars Street

Aim: To asertaining the child perspective on child-friendly places, testing of design proposals and of ideas around child participation and capabilities.

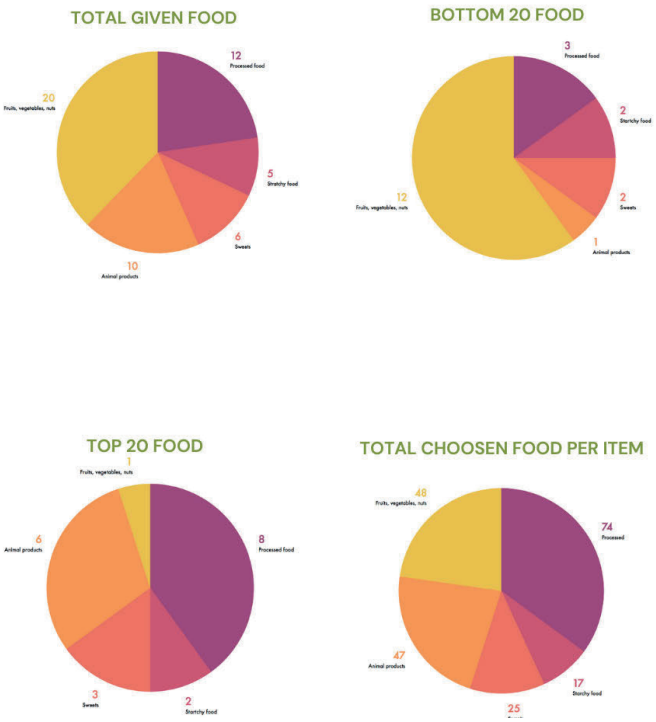
Figure 2.7: Children taking part in the participatory games and workshops (Zorn 2021; Edited by Author 2021)

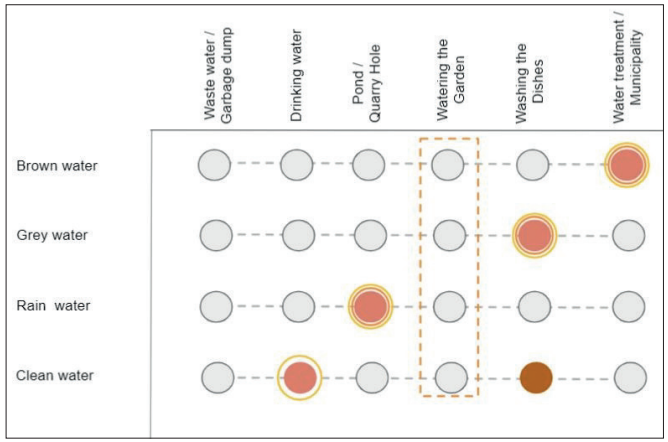
Figure 2.8: Interview with a Melusi inhabitant (Author 2021)

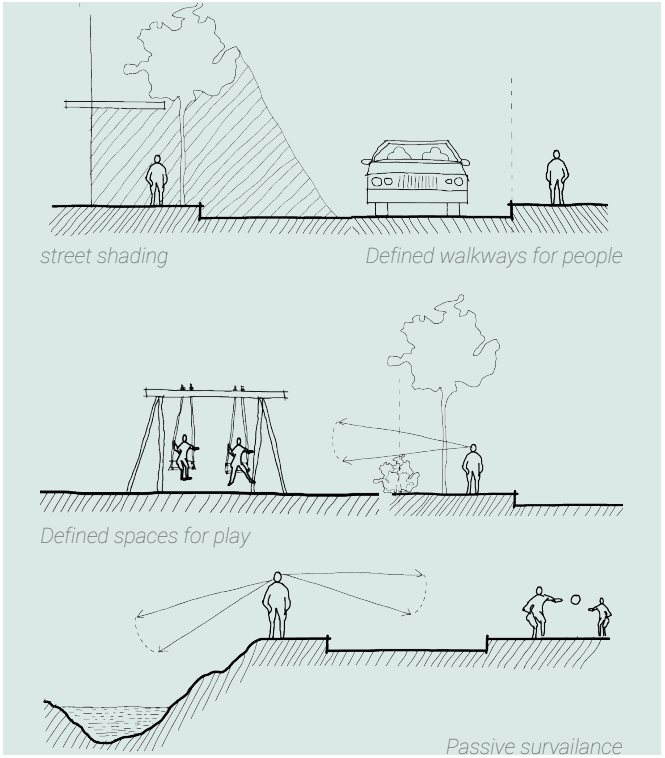
Figure 2.9: Interview with NGO stakeholder (Zorn 2021)

Through transect walks, interviews (figure 2.8 & 2.9) and mapping exercises with the adult stakeholders, we were able to understand the needs, map and understand the quality of the stakeholder relationships and capabilities. Finally, to understand the roles that the stakeholders could play to advance transformation of the community.

PARTICIPATORY GAMES: Outcomes







MELUSI PLATE GAME

Water practices indicated a limited optimisation of rain water and of water recycling practices.

Figure 2.10: Water game findings summary (Elinder et al. 2021).

WATER GAME

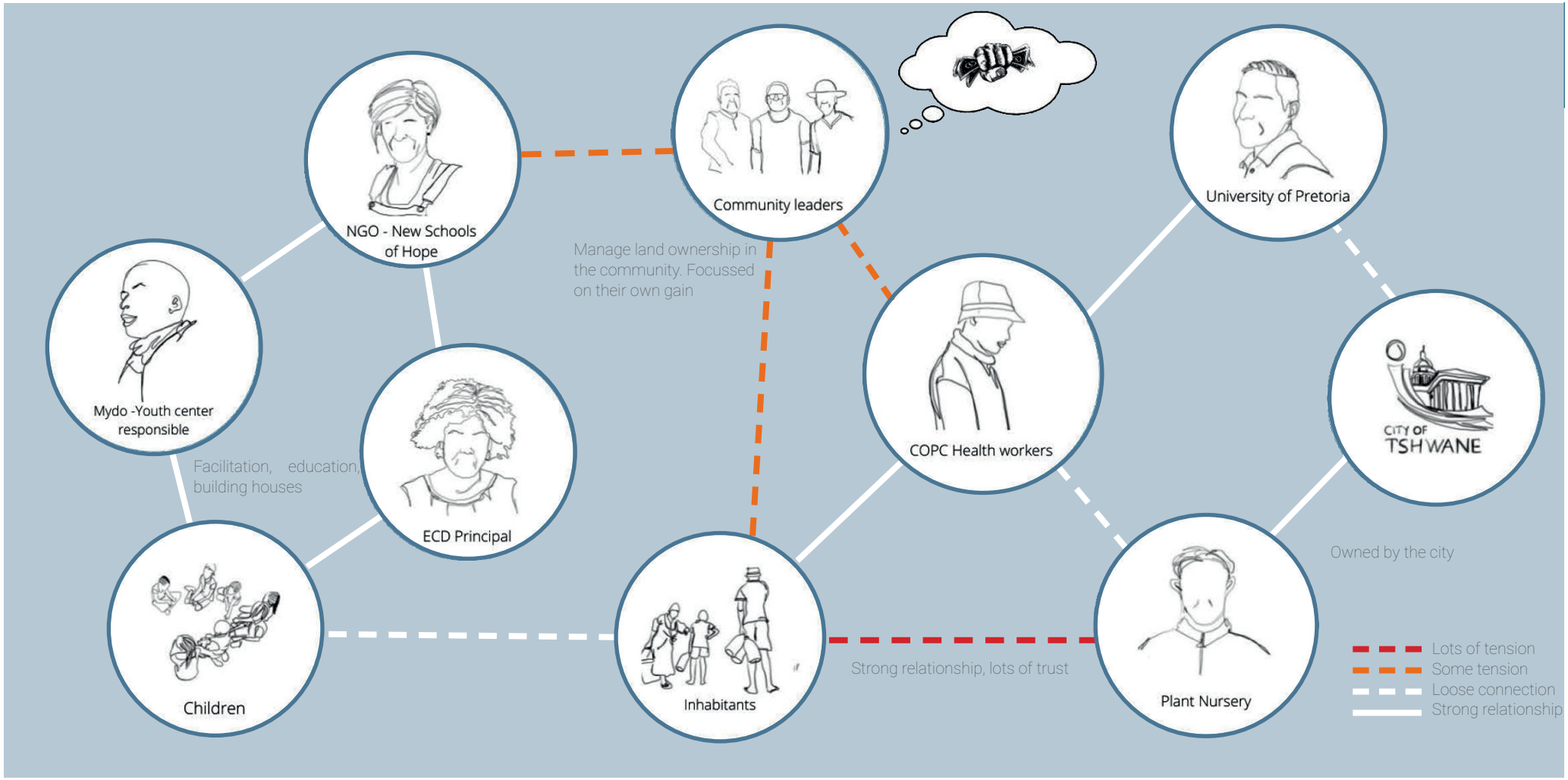
The children's diet showed low intake of fruits and protein.

Figure 2.11: Melusi plate game findings summary (Elinder et al 2021).

PLAY AFRICA DESIGN THINKING WORKSHOP

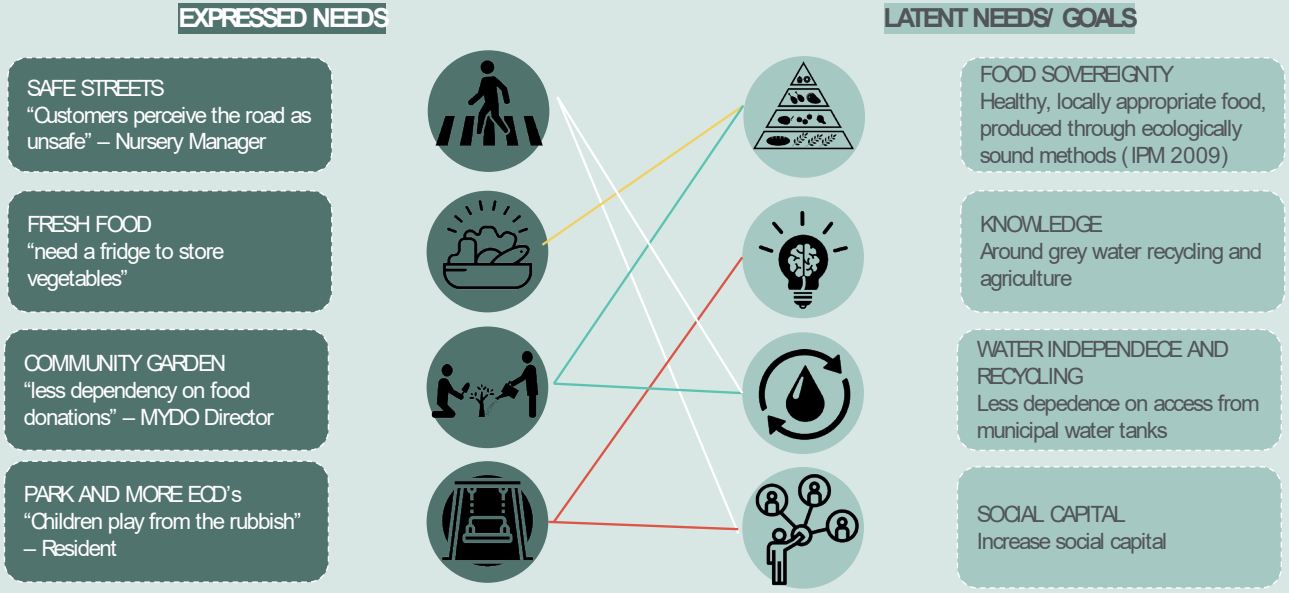
The above strategies were defined from the workshop with the children as means to make child-friendly streets, which were considered as marginalising to the children

Figure 2.12: Strategies for child-friendly streets (Author 2021).



Weak stakeholder connections were observed, which were also an opportunity for establishing networks that capitalise on social capital and build capabilities for co-evolutionary participation.

Figure 2.13: Stakeholder relationships (Elinder et al 2021; edited by Author 2021).



The expressed and latent needs were also identified.

Figure 2.14: Expressed and Latent Needs (Author 2021)

2.2.4 Urban Vision

An outcome of the participatory research was an urban framework. It was envisioned as a phased project that would commence with small-scale interventions to garner participation and increase social capital through strengthened stakeholder partnerships.

The first of five phases is situated on Dwars Avenue, where the bulk of the stakeholders are situated and engagement exercises were undertaken. Proposed are five small changes (figure 2.15): a recycle workshop, eco bricks, water reuse, tree wells and fruit trees. This was to align the urban framework with Hamdi's (2004) 'small changes' approach which advances the taking of small-scale actions that build on local knowledge and partnerships towards large-scale impact over time. The recycle workshop will act as an educational hub for the youth. One of the focus areas for the recycle workshop is the provision of materials in form of eco-bricks, for the construction of the tree wells. Eco bricks are constructed out of plastic bottles which are filled with plastic waste (figure 2.16). This provides an affordable building material whilst also promoting waste recycling. The second small change is the addition of water recycling mechanisms such as gutters from the schools and youth centre along the street.

Figure 2.15: Five small changes (Elinder et al 2021)

Figure 2.16: Making of Eco-bricks (Elinder et al 2021)

The grey water and storm water will be channelled to the tree wells (figure 2.11) in which fruit trees are planted abd used as bioswales. The fruit tree wells erected at the walkway edge will define a boundary that will protect the pedestrians from moving vehicles. The proposal is for the co-construction of the tree wells by community members and the NGO (as facilitator). The fruits harvested from the trees will contribute to the community's general nutrition state given that the findings indicated a lack of fresh fruit in the diet and of local sources.

Figure 2.17: Fruit tree wells (Elinder et al 2021)

Figure 2.18: Fruit tree wells (Elinder et al 2021)

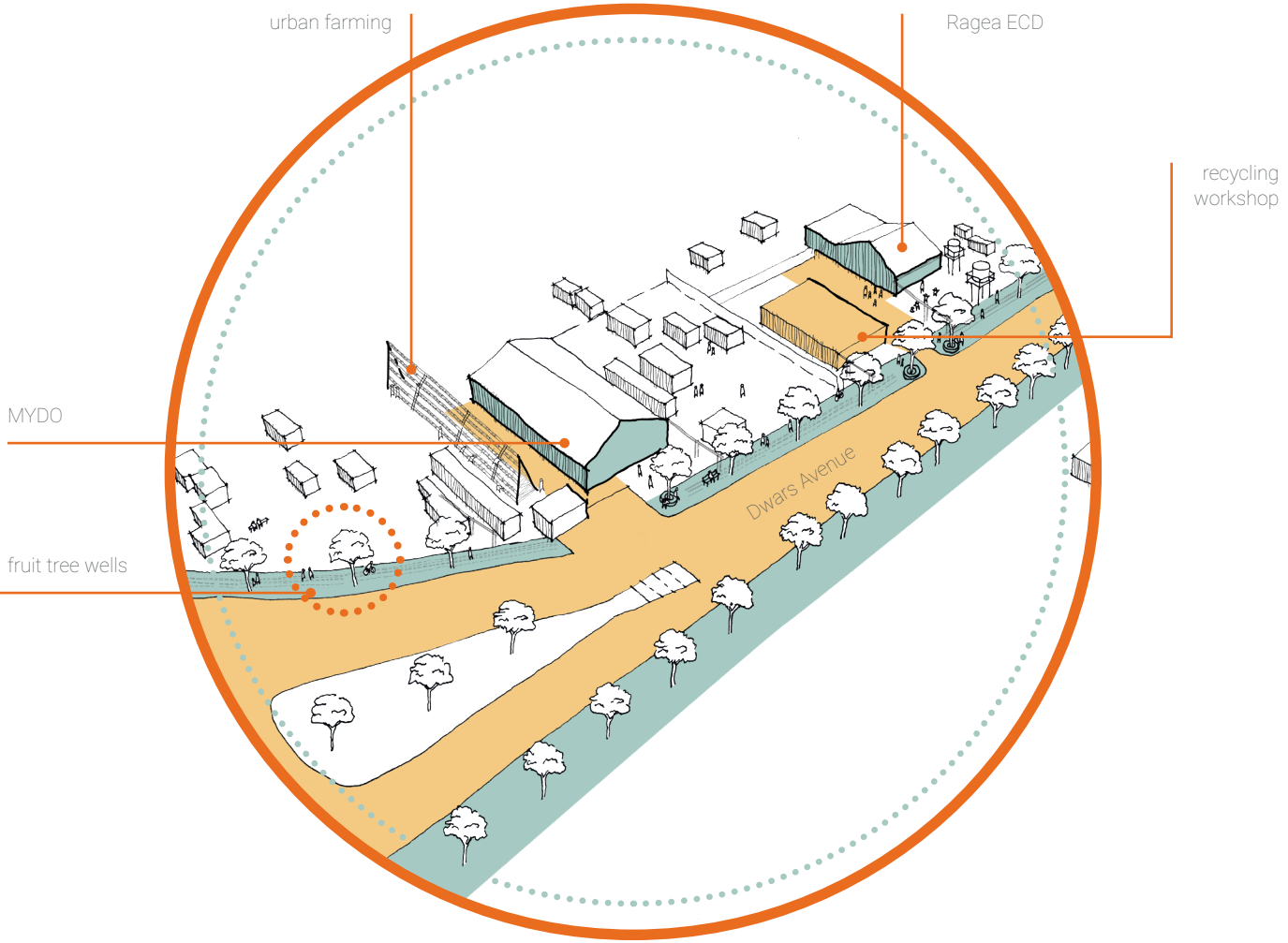
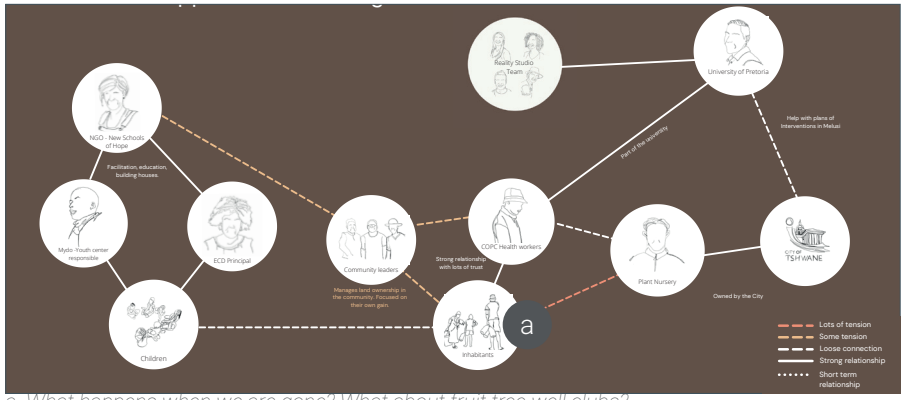
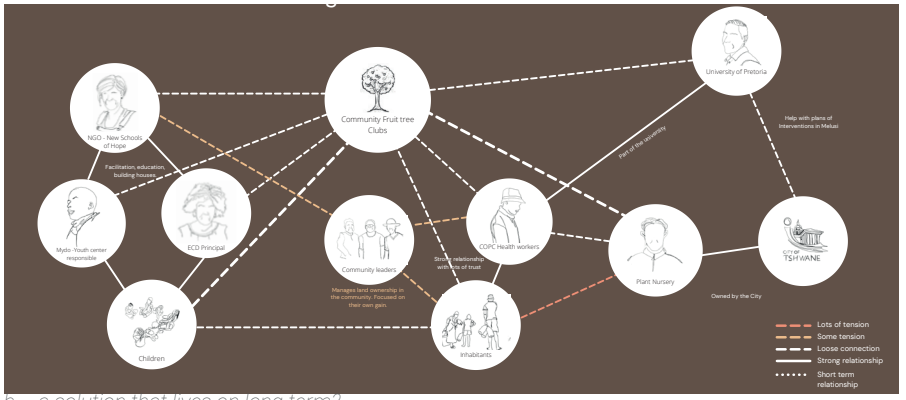


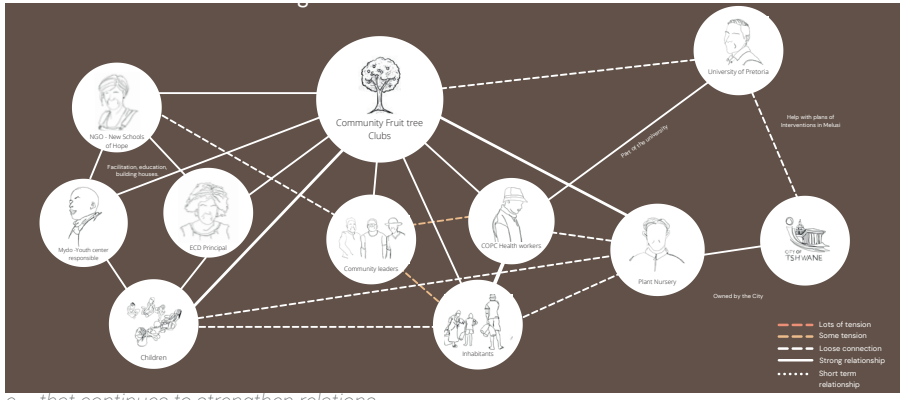
Figure 2.19: Sketch of phase one (fruit tree wells, recycling workshop) along Dwars street (Author 2021).



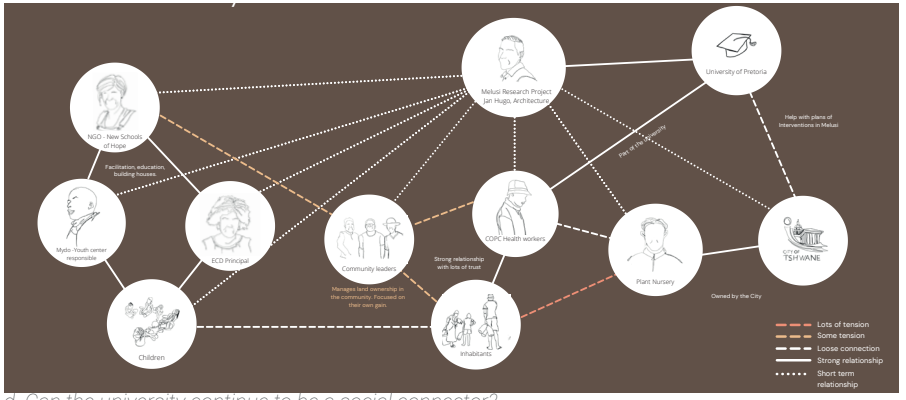
a. What happens when we are gone? What about fruit tree well clubs?



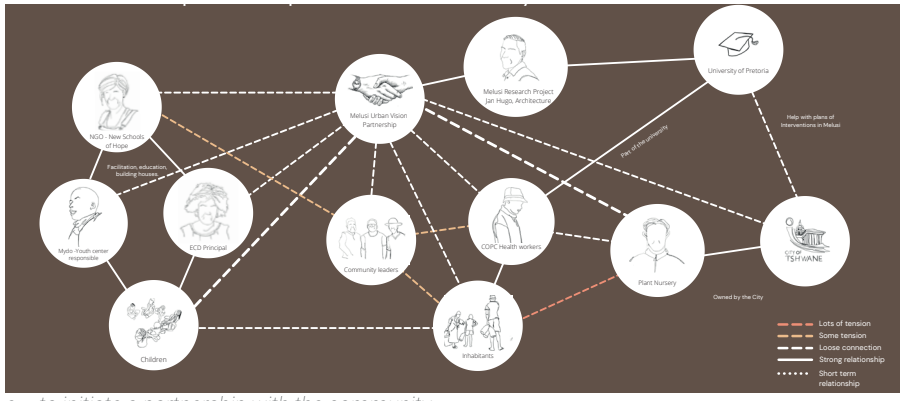
b. ...a solution that lives on long term?



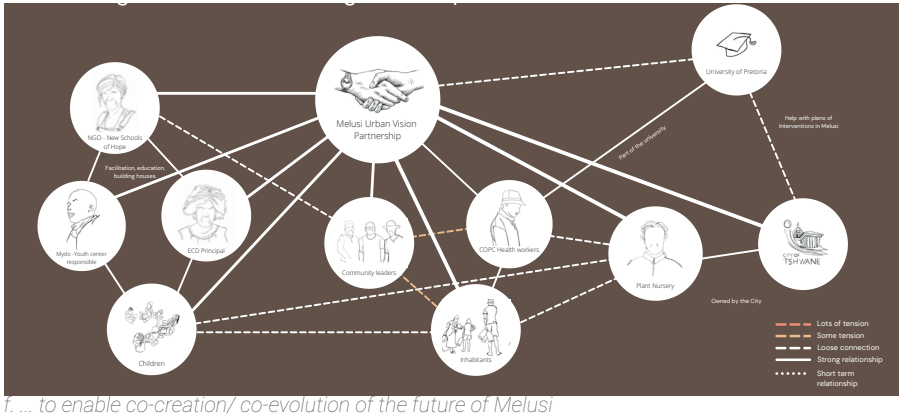
c. ...that continues to strengthen relations...



d. Can the university continue to be a social connector?



e. ...to initiate a partnership with the community...



f. ... to enable co-creation/ co-evolution of the future of Melusi

Figure 2.20: Stakeholder evolution (Elinder et al . 2021; edited by Author 2021)

The urban vision (figure 2.21) and stakeholder evolution diagrams (figure 2.20) indicate how the stakeholder relationships will be enriched over time after as stakeholders participate in the building of tree wells with fruit trees provided by the plant nursery. The small changes will encourage co-creation and building of social capital during the first phase. In the second phase, the fruit tree aisle is extended from Dwars street to the quarry pond. The design project explored in this study is the proposed third phase. It is envisioned as a 'neighbourhood facility for regeneration' that harnesses the latent potential of the quarry banks and water source with a focus on upscaling vernacular innovation. In phase 4 the existing Plant nursery corner lot will be accessible to the community for relocation of the people occupying the banks of the quarry. This will soften the currently harsh threshold between the community and the plant nursery. In the fifth phase is the establishment of the large-scale

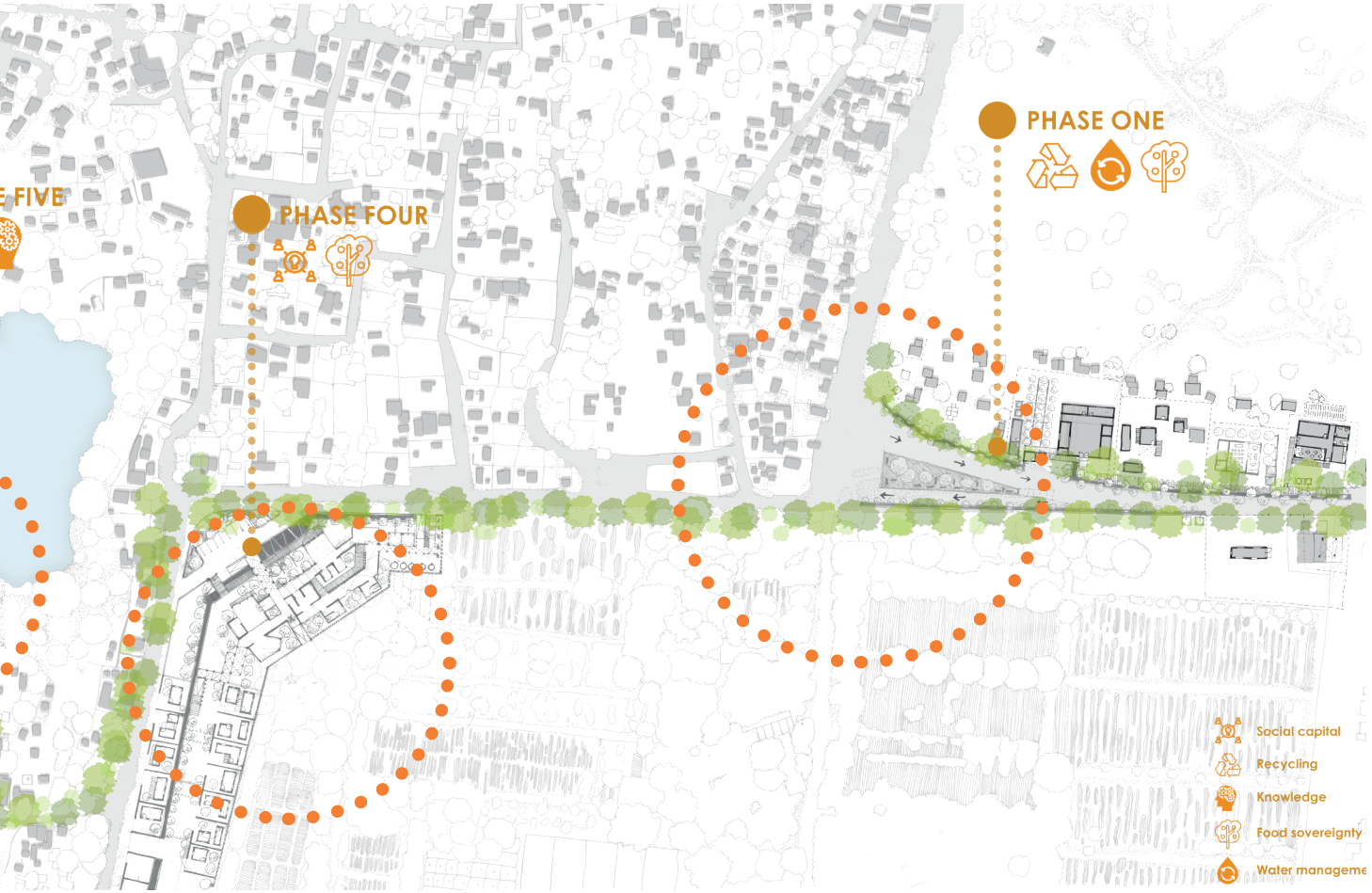


Figure 2.21: Urban Vision (Author 2021)

food production facility on the South-Eastern edge of the Quarry.

In conclusion, by situating the design project within this urban framework the immediate needs of the community are addressed through small changes whilst building capacity for the realisation of the large scale project in through increased social capital and participation. As such, the proposal is part of a network facilitating emergence from social innovation whilst using and building upon existing capabilities. The role of the architect through the participatory process was one of an advocate and co-designer; promoting social connections through co-creation and envisioning a design in which these networks are strengthened.

2.3 A contemporary urban vernacular

Informal settlements, also referred to as 'spontaneous settlements' were once ubiquitously prejudiced against as "visual and social pollution" (Kellet 2011:3). These views were challenged in the work of the architect John Turner who suggested looking at informal settlements not as a housing problem but as a possible solution (Turner 1976). A growing body of literature has adopted Turner's view, exploring, and highlighting the positive attributes of informal settlements, particularly the high levels of self-determination exhibited by the urban poor in providing for themselves, rather than waiting on hand-outs. Observing from the Egyptian context, Khalifa (2015) notes that a similar perspective shift motivated a change in the state's approach concerning informal settlements from eradication to upgrading policies. Similarly, Huchzemeyer (2009) writing from a South African perspective points out that informal settlement upgrading was added to the housing policy of the new democracy in 2004 upon the state's recognition that the construction of low-cost houses through the housing scheme was happening at a slower rate than the increasing housing demand. Upgrading of informal settlement in that regard provided a possible corrective. Concerning the upgrading of informal settlements, research shows an advocacy for responses informed by lessons drawn from the vernacular of the informal settlements (Osman and Karusseit, 2008; Hernández and Peter, 2010). To proceed in this study on learning from informal settlements as the urban vernacular, it is of importance to situate informal settlements in vernacular architecture discourse and establish them as a vernacular construction.

A vast body of literature exists on vernacular architecture; however, definitions of vernacular architecture vary, especially regarding the accommodation of informal settlements as vernacular design. For instance, in the

"Charter on the Built Vernacular Heritage" (ICOMOS 2009:3), vernacular building is defined as "the traditional and natural way by which communities house themselves. It is a continuing process including necessary changes and continuous adaptation as a response to social and environmental constraints." The reference to a 'continuing process of change' accommodates informal settlements which are often characterised by incremental growth, but the excludes them on grounds of tradition. Oliver's (1997: preface) definition also makes a reference to tradition. It reads:

> "Vernacular architecture comprises the dwellings and all other buildings of the people. Related to their environmental contexts and available resources they are customarily owner or community built utilising traditional technologies. All forms of vernacular architecture are built to meet specific needs, accommodating the values, economies and ways of living of the cultures that produce them".

Vernacular architecture is "associated with traditional practices and forms in rural areas and historic centres" but scarcely with informality (Goel 2010:2; Kellet 2011). In that regard, informal settlements are assumed by some to be the opposite of vernacular architecture given that they result from informal rather than traditional practices (Goel 2010). Despite recent critiques, the above perspectives based on visual appearances but often neglecting the socio-economic conditions, persist and are also used to cast informal settlements in a negative light (Kellet 2011:4). By contrast, Rapoport (1988:55), argues that informal settlements "are closer to traditional vernacular than to any other type of environments and farthest from professionally designed or high-style environments." Central to Rapoport's (1988:72) argument is the notion that informal settlements "are frequently even of higher quality than those of designers working in much more developed and wealthier places." By 'quality' he refers to the appropriateness of the responses to the needs of the inhabitants (Keller 2011). He suggests that, if appropriately framed, definitions of vernacular architecture can highlight more commonalities between traditional and informal settlements and establish grounds for the consideration of informal settlements as vernacular architecture (Rapoport 1988). This is a conclusion drawn by a few other theorists (Lawrence 1987, 1990; Stea and Turan 1990, 1993; Oliver 1990, 2006) who like Rapoport (1988) propose "analytical frameworks designed to redress the previous imbalances and partial interpretations surrounding vernacular environments" (Kellet 2011:4). These frameworks accommodate not only the product, referring to the formal characteristics, but also the process characteristics and causative factors attributed to them (Goel 2010; Kellet 2011). Focus on the product aspects in other frameworks prioritises aesthetics and has often resulted in the exclusion of informal settlements which are cast in a negative light.

Process Characteristics	Product Characteristics
1. Identity of designers 2. Intentions of designers 3. Anonymity of designers 4. Reliance on a model with variations 5. Presence of a single model 6. Extent of sharing of model 7. Nature of underlying schemata 8. Consistency of use of a single model for different parts of the house-settlement system 9. Relationships among models used in different environments. 10. Specifics of the choice model of design 11. Congruence of choice model with ideals of users 12. Degree of congruence between environment and culture-life style 13. Use of implicit vs. explicit design criteria. 14. Degree of self-consciousness of the design process 15. Degree of constancy vs. change of basic model 16. Form of temporal change 17. Extent of sharing of knowledge about design and construction	1. Degree of cultural and place specificity 2. Specific models, plan forms, and morphologies 3. Nature of relationships and underlying rules 4. Presence of specific formal qualities 5. Use of specific materials, textures, and colours. 6. Nature of relation to landscape 7. Effectiveness of response to climate 8. Efficiency in use of resources 9. Complexity due to place specificity 10. Complexity of a single model with variations 11. Clarity of the environment: order expressed by the model. 12. Open-endedness allowing changes. 13. Presence of 'stable equilibrium' vs. the 'unstable equilibrium' of high style 14. Complexity due to variations over time 15. Open-endedness regarding activities 16. Degree of multi-sensory qualities of environment 17. Degree of differentiation of settings 18. Effectiveness as setting for lifestyle and activity systems. 19. Ability of settings to communicate effectively to users. 20. Relative importance of semi-fixed features vs. fixed feature elements

Table 2.1:Attribute list for identifying vernacular environments (Rapoport 1988)

Rapoport's (1988) framework (table 2.1) provides a list of product and process attributes which can be used to identify and analyse the vernacular condition of a settlement. Several attributes listed refer to models. These models result from a generative process through which abstracted ideas inherent in local logic and passed on between people and generations are applied, tested and new ideas added depending on the use of either implicit or explicit design criteria (Asadpour 2020). The application of these models contributes to the visual coherence that can be observed in a settlement. He claims that observed distinctions can be attributed to the introduction of new elements desired by the builders. Individual decisions are made independently over time. Kellet (2011) notes that Rapoport's view on the presence of 'shared models' shows similarities to Christopher Alexander's identification of the use of 'pattern languages' (ibid.:6).

Informal dwellings, satisfy the definitions of vernacular architecture such as, being constructed from found materials, by untutored builders and having a visible correlation between user groups and their local needs in relation to their environments, economies, and by means of knowledge sharing and existence of shared models (Whelan 2016; Goel 2010; Kellet 2011). More commonalities can be identified through analysis of the physical products and the processes that result in them using frameworks such as Rapoport's (1988).

An anomaly in the list of attributes is product attribute "1. degree of cultural and place specificity" (table 2.1). Whilst this might be noted in traditional vernacular which exists in places with as shared culture and often in response to a specific climate, informal settlements such as the case study are multicultural and a driver for the design decision is scarcity, that is, satifying unlimited needs with limited resources. Other attributes also often characteristic of traditional vernacular are also not observed in Melusi, such as "11. Clarity of the environment" and "7. Effectiveness of response to climate" (table 2.1). Notably, Rapoport (1988) does not call for adherence to all aspects for a design to qualify as a vernacular. Rather in line with his argument, by considering the attributes listed commonalities between informal settlements and traditional vernacular can be drawn and in doing so, establishing them as a vernacular design. Looking at the attributes, Melusi is in congruence with more attributes than the anomalies observed. For instance, the existence of a model (discussed further in section 2.2.3).

Figure 2.22: Aspects in definitions of vernacular architecture satified by informal design (Author 2021)

2.3.1 Approach to architecture in this Project

Rapoport's (1988) framework facilitates the analysis of vernacular architecture, and to an extent, how to learn from it. However, there is a lack of clarity on how to translate the lessons learned into design. In a later publication (Rapoport 1999:58), he claims that there are four attitudes towards vernacular design 1) "it can be ignored" 2) acknowledged with an opposition of the notion that it offers worthwhile lessons 3) copied or 4) "have lessons and principles derived from it." Essentially, concerning learning from vernacular design the approaches (options 3 and 4) are either 'replicative' or interpretive (Barker 2012) (figure 2.17). An entirely replicative approach poses the danger of romanticising the vernacular. Consequently, Rapoport (1999:58) advocates for interpretive approaches pointing out that "the lessons derived from vernacular design become applicable to the full range of environments and problems encountered." However, that too poses the danger of 'placelessness' of architectural interventions. Given that the concept of 'place' is central to this study, the approach is aligned to Barker's (2012:36) notion that "[n]either approach of these diametric poles is a satisfactory response."

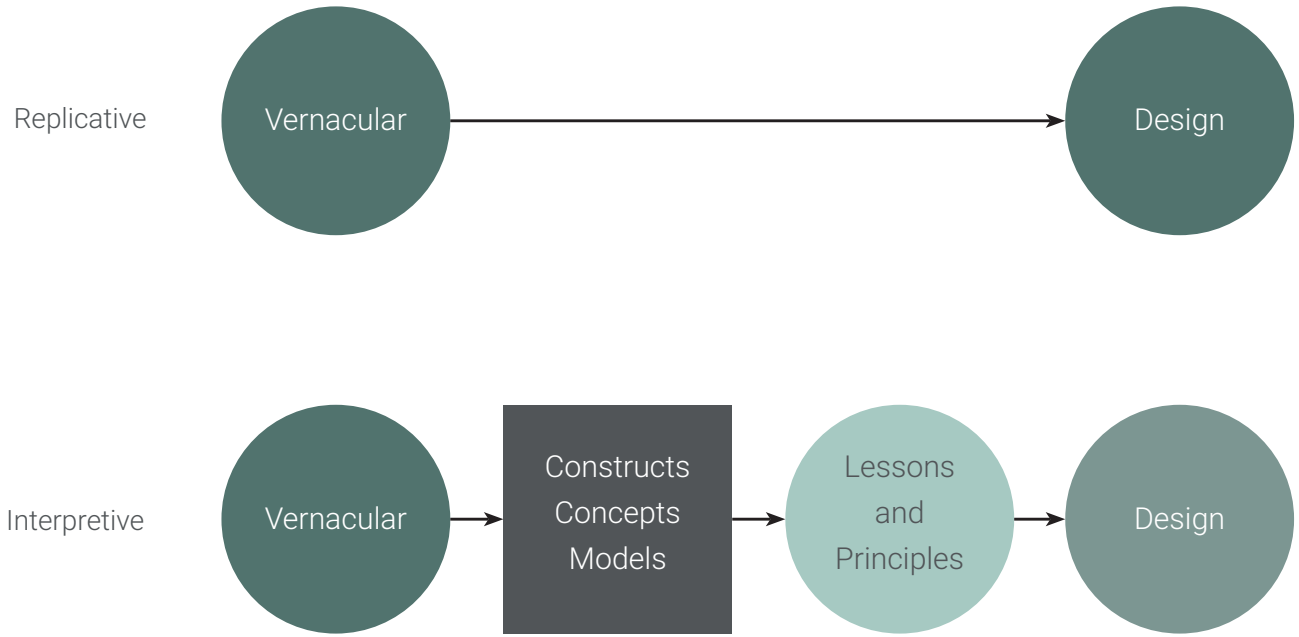


Figure 2.23: Approaches to vernacular architecture (Rapoport 1999) (Adapted by Author 2021)

The stance taken is, therefore, that between the two diametric poles is a gradient along which decisions can be made at various scales. The approach to applying lessons from Melusi vernacular is firstly, to undertake a precedent analysis to gain insight into how design projects in which the vernacular design of their contexts was engaged were informed by it. Secondly, to understand the Melusi vernacular model which contributes to the visual coherence (figure 2.18). The vernacular model of Melusi will be unpacked at the following scales: context/ site, structure, material and technology. The elements and aspects of the vernacular will be analysed through a regenerative lens, considering the enablement of or hinderance to the realisation of the regenerative design principles as set parameters. Accordingly, the design decisions on 'replication' or 'interpretation' will be made at the different scales. Notably, the Melusi vernacular considered is applied largely to domestic architecture and limited to the human scale. The program is motivated by the needs analysis, therefore, demands upscaling of the vernacular innovation.

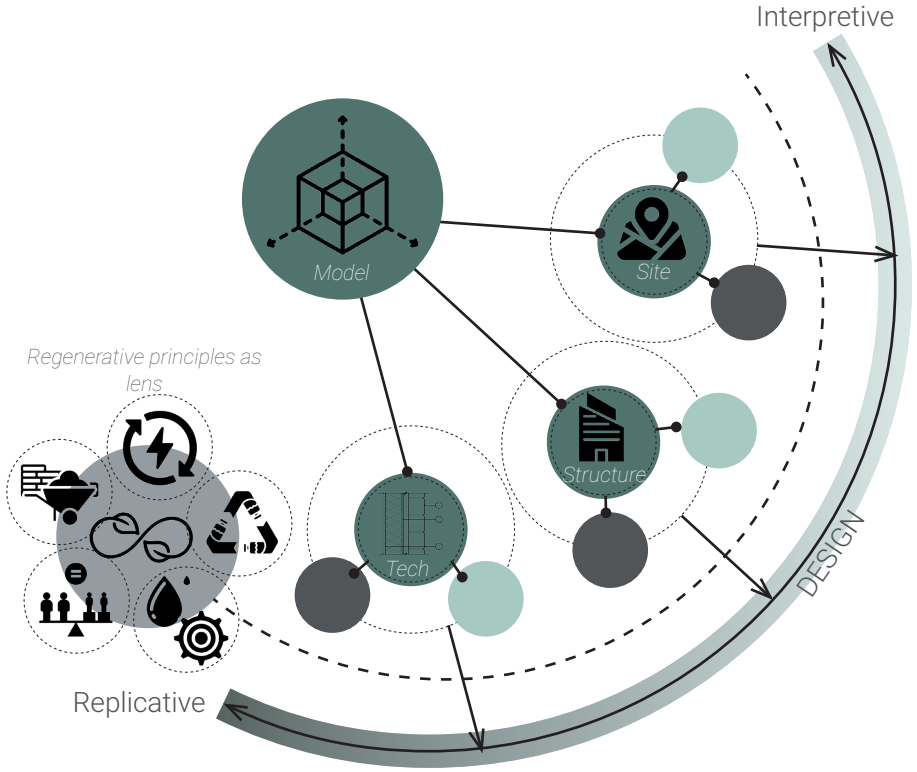


Figure 2.24: Approaches to architecture (Author 2021)

2.3.1.1 Predecent Analysis

Figure 2.25: Table house (Noero Architects undated)

Project: Table House
Location: Philippi, Cape Town, South Africa
Architect: Noero Architects

The project is a prototype that was developed as a solution for low-cost housing. The design approach strips the architecture to its elements as in Marc Antoine Laugier's primitive hut, roof, columns, and beams. The 'Table' is a 3.6 by 3.6m in plan and 3.2m high" structure (Melvin 2017). It has four columns and beams and a flat roof (figure 2.26). It facilitates appropriation by putting in place a structure that addresses the concerns for stability in a shack, but allows for appropriation in use, materiality, floor, and more, to be left to the unskilled builder.

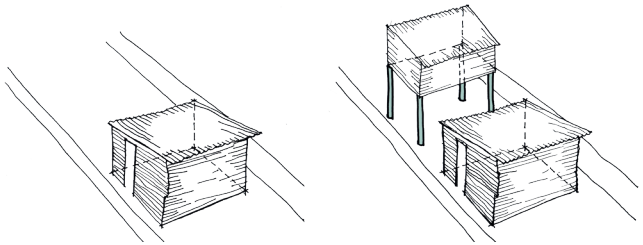


Figure 2.26: Sketch of approach (Author 2021)

Figure 2.27: Empower Shack (Ras 2016)

Project: Empower Shack
Location: Khayelitsha, Cape Town, South Africa
Architect: Urban Think Tank

The project is a prototype that was developed as a solution for low-cost housing. It draws from the incremental growth characteristics of informal settlements. The design is for modular construction of dwellings in a row-housing form in order to facilitate the efficient use of space. The primary structure is composed of concrete blocks so as to counter the vunerability in informal shacks to fire and the elements. The occupant then has full automony to appropriate the interior spaces and add a third floor ontop of the roof (figure 2.28).

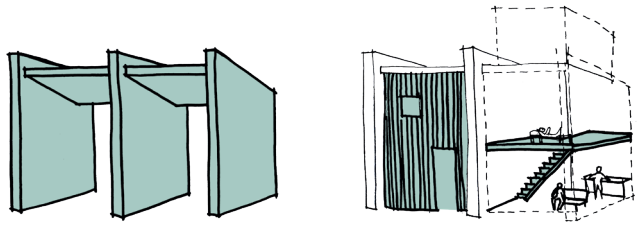


Figure 2.28: Sketch of approach (Author 2021)

Figure 2.29: Exterior view (Ouwerkerk undated)

Project: Gando Primary School
Location: Gando, Burkina Faso
Architect: Kéré Architecture

A project aim was to address poor ventilation and lighting which were characteristic concerns of the educational buildings in the region. The design response engaged the use of traditional techniques and modern engineering. Materials used in the vernacular were used in transformative ways to respond to the concerns within the set parameters of "cost, climate, resource availability and construction feasibility." Clay was used to make structurally robust bricks for thermal protection. The roof landscape was re-defined into a structure separated from the learning space with great overhangs figure 2.30). (Kéré Architecture undated).

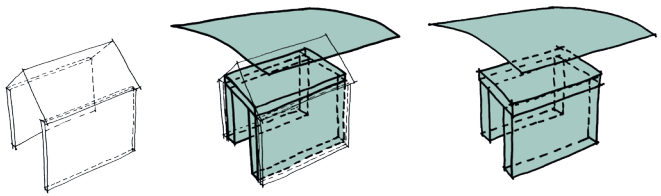


Figure 2.30: Sketch of approach (Author 2021)

Figure 2.31: Makoko floating school (NLÉ undated)

Project: Makoko Floating School
Location: Lagos, Nigeria
Architect: Kunlé Adeyemi – NLÉ

The school, a 220sqm A-frame timber structure was constructed in Makoko, an informal settlement off Lagos' lagoon. It was based on the Makoko model, wooden stilt houses. NLÉ's approach involved upscaling this model and improving the climate resilience of the architecture by decreaseing vulnerability due to increase in sea levels. This saw the re-interpretation of the Makoko stilt structure through the introduction of floatation technology (figure 2.32). The materials used are like those in the Makoko model, timber, and corrugated metal sheets. The structure was conceived to facilitate assembly by non-specialised workers, flexibility in functionality and affordability.

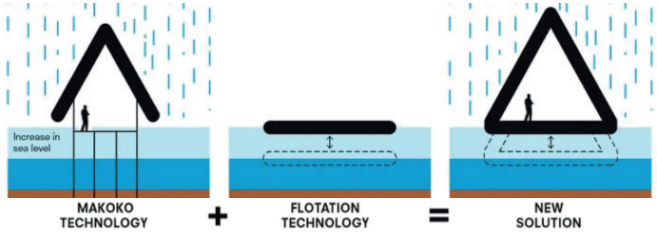


Figure 2.32: Empower Shack (archidatum.com)

Figure 2.33: Walter's Way (Archdaily 2016)

Project: Walter's Way
Location: Lewisham, London
Architect: Walter Segal

The project was a design of a housing system that facilitated self-build. A modular timber system was design based on timber frame construction. It allowed for flexibility and user interpretation in construction and future use. As in the Table house project, it gives the user autonomy in making design and construction choices concerning their environment. It employs aspects of the open building concept in that the structure and the service and circulation cores are pre-determined and set, and the infill is left to the owner to appropriate according to use and means. The structure was lightweight and demountable facilitating the collaborative participation of all members of a family.

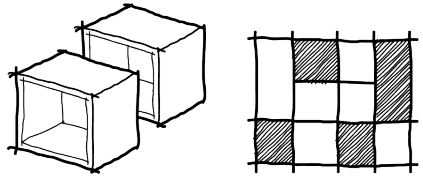


Figure 2.34: Sketch of approach (Author 2021)

In each of the above precedents the approaches taken were neither exclusively replicative nor interpretive. Rather decisions were made concerning different elements of the architecture or at varying scales. The Makoko project for instance considered intervening on the technological scale, by challenging the stilt structure and providing a more robust solution. With regard to materiality, materials similar to those in the vernacular were used and sourced in similar ways. In the Gando project, the intervention considered altering the roofscape to counter the problem of ventilation all the while using local materials and labour as is characteristic of the vernacular design. Essentially, the decisions were motivated by set parameters and lenses through which the vernacular was critiqued, and the architectural contribution established. From the above reflection on the precedents and Rapoport's (1988) framework, the design strategy for this study was proposed as follows:

1. Identify the process and product characteristics of the vernacular condition at the different scales. These scales include context/site, structure, material and technology. This will facilitate the definition of the Melusi vernacular model.

2. Critique the architectural condition with regarding the identified lens or set parameters to understand where the architect's contribution to authorship can be made.

2.3.2 Melusi Vernacular condition

2.3.2.1 Context/ Site

The spatial pattern is largely composed of relatively compact rectilinear buildings with narrow streets or wide streets depending on the degree of formalisation; that is, wider defined streets in the areas with higher formalisation. The settlement is relatively dense in comparison to the neighbouring residential zones, and blurs into the formalised streets. The dwellings are closely layered over each other in some areas, creating a compact urban form with a combination of flat and mono-pitched roofs.

Three distinctions in morphologies were observed within the settlement (figure 2.35), highlighting some underlying rules concerning density, formalisation, and the relationship to the street. The first, A (figure 2.36) was observed in Melusi 1, the least formalised of Melusi's three regions. There, are narrow streets

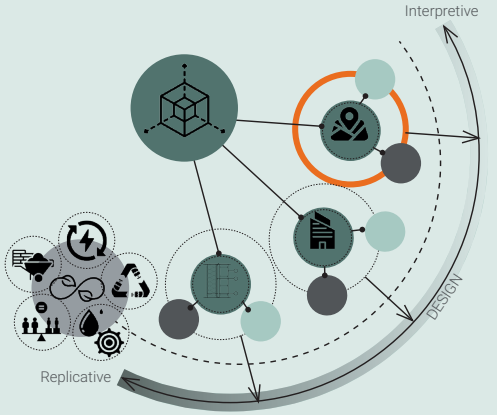
Figure 2.35: Distinctions in Morphology (Author 2021)

Figure 2.36: Distinctions in morphology - A (Author 2021)

Figure 2.37: Distinctions in morphology - B (Author 2021)

Figure 2.38: Distinctions in morphology - C (Author 2021)

that grew organically as did the houses around them. However, in comparison to the other regions, there is a higher ratio of green space to built-up space within the home stands. Also, in Melusi 1 is the second distinction, B (figure 2.37) which has narrow organic streets, with buildings layered over eachother creating a compact urban form. The third, C (figure 2.38) in Melusi 2, has formally defined and wide linear streets. The dwellings are oriented towards the streets but are also compacted together. An observation was made from previous mapping that these three distinctions were different stages of growth with A being at the early stages prior and B being an evolution from it (figure 2.39). C is the result of formalisation. However, densification continues, but within the limits of the street and in relation to it. In essence, the street is an ordering device, that is, if it is planned the densification occurs within the space it delimits. If the street is unplanned, the densification around it occurs organically.



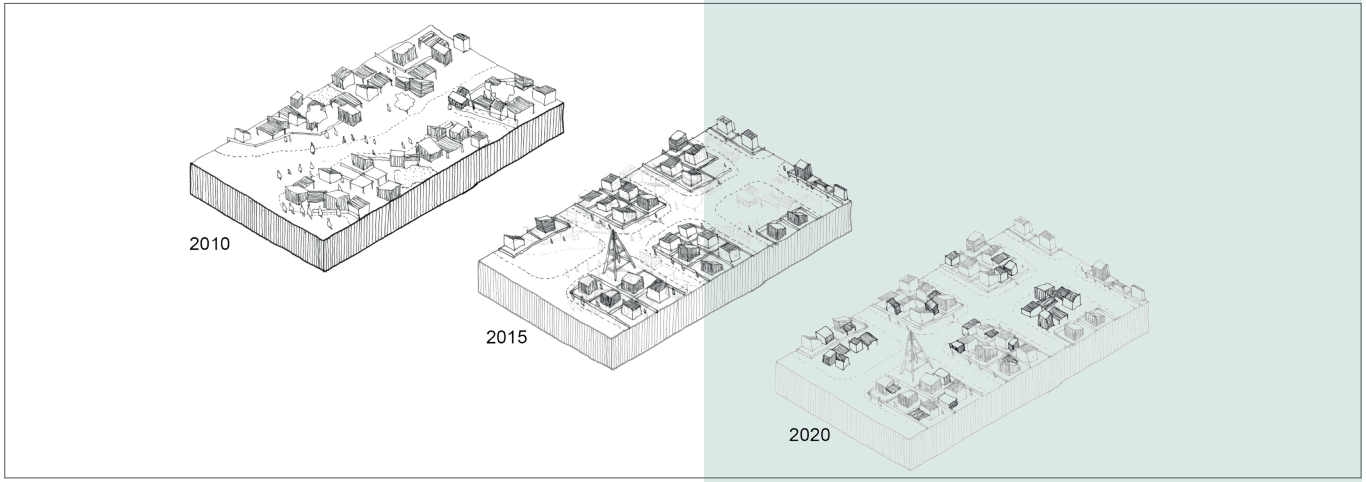


Figure 2.39: Evolution of spatial pattern (Climate Adaptation Studio 2020)

Whilst Melusi is punctuated by a few open spaces, they are often used as garbage dumping sites due to the inadequacy of the waste management. Public space is inadequate and given that most spaces are concerned with activities for the adults or in the case of the street, perceived as unsafe for the children.

Figure 2.40: Open spaces used as dumpings sites (Zorn 2021)

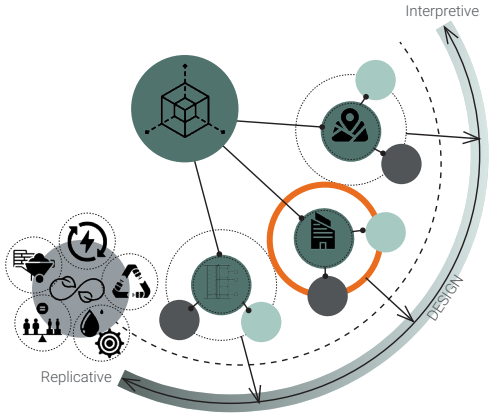
2.3.2.2 Structure

In the most basic form (explicit model), a building unit contains two spaces and has a single floor (figure 2.85). The spaces are not designed for specificity in function but are maximally used to accommodate multiple activities; sleeping, cooking, entertaining and communing together. Overtime, more spaces are incrementally added onto a structure, either accommodate spatial needs due to growth in a family or economic purposes by adding rental units (figure 2.85c). The toilets are generally communal and located on the periphery (figure 2.40).

Aesthetic desires are achieved through the use of vibrant colours, careful selection of materials, textures and patterns, façade sculpturing and in ornamental gardens (table 2.2). A typical feature is that the entry to a single-family residential unit is faced by a yard separating it from the street from which it is setback to achieve privacy (figure 2.42). This pattern (figure 3.2c) is observed mostly where there are single-family residences within a stand. Where multiple units occupy a stand, often rental units, a different pattern is observed. Often the entirety of the stand is maximised resulting in a layering of buildings over eachother which are access through narrow alleyways. Alternatively, they are organised along a spine from which each unit is accessed.

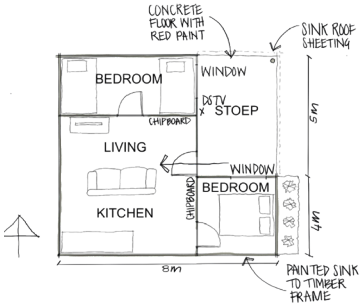
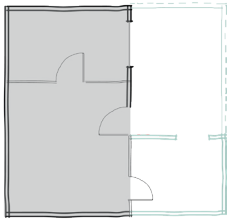
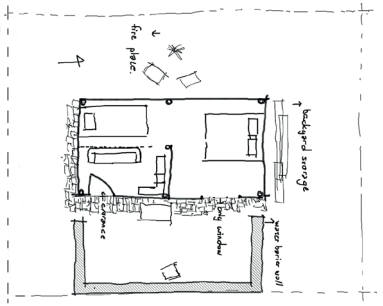
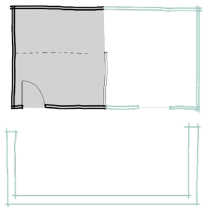
Table 2.2 shows images of the dwellings of the research participants in a study conducted by Honours students in the Malusi RFS studio (figure2.41). This involved the installation of sensors (an exercise that the researcher

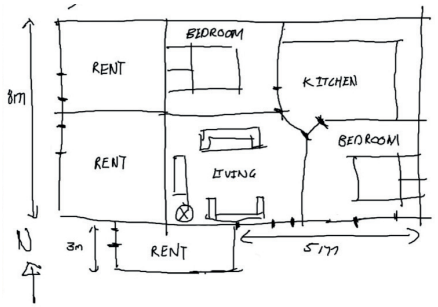
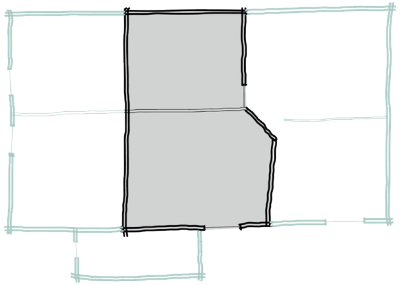
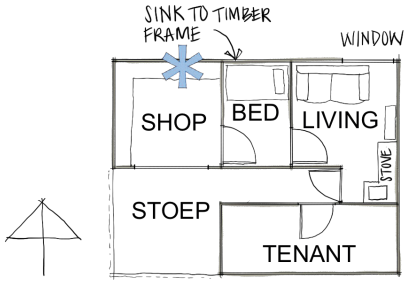
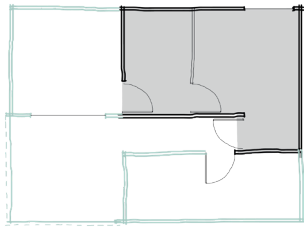
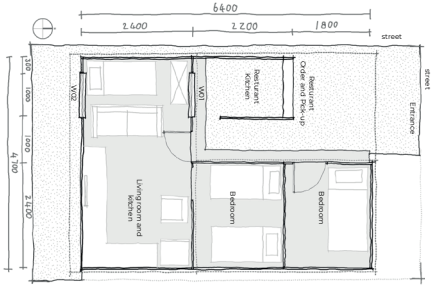
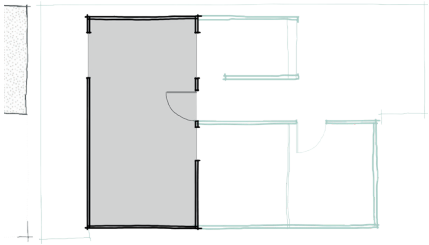
Figure 2.41: Installation of sensors and structured observations in Melusi with BArch Honours students (Eyescape 2021).

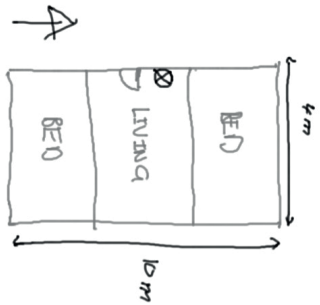
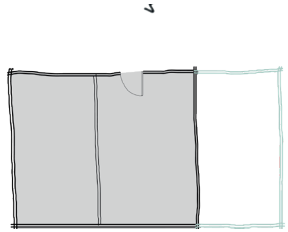
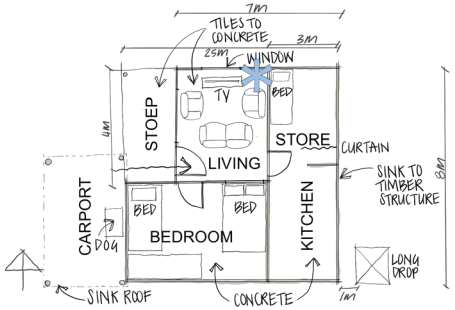
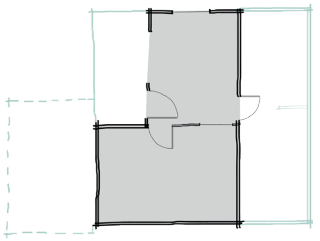
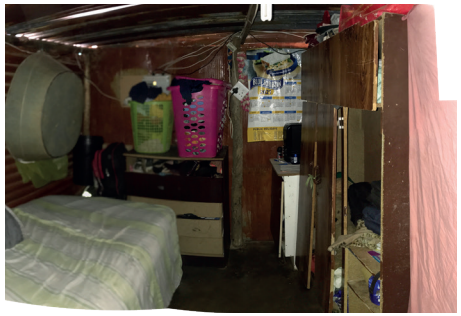
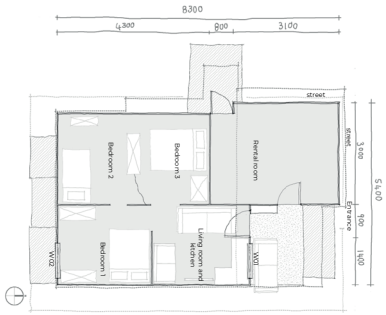
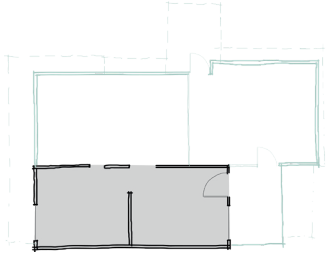


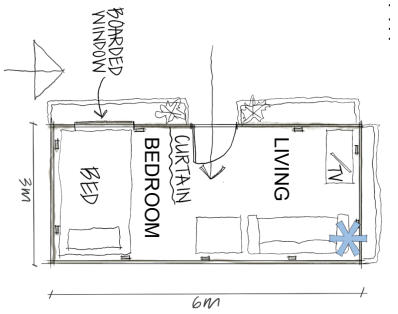
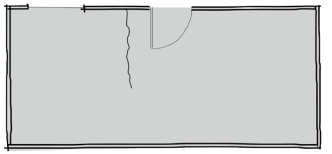
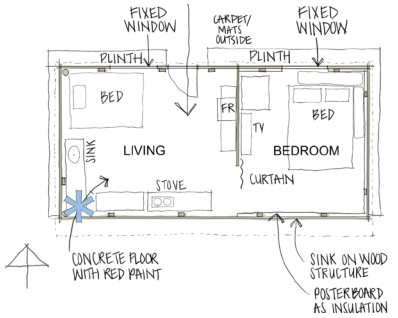
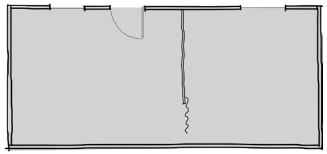
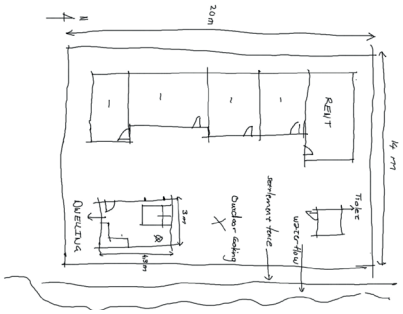
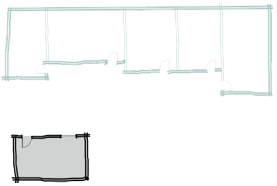
took part in) to record the temperatures and humidity and make structured observations of the dwellings. Observed and highlighted in the plans of the dwellings, is the explicit and implicit application of a model (figure 2.29a) in the various dwellings. Distinctions observed in the model were often incremental adpatations over time to accomodate economic activity or growth in household and accumulation of income.

Table 2.2: Melusi Vernacular buildings (Author 2021)

	Exterior	Interior	Plan	Implicit/ Explicit model
H1	 *Figure 2.42: H1 Exterior (Malusi RFS 2021)*	 *Figure 2.43: H1 Interior (Malusi RFS 2021)*	 *Figure 2.44: H1 Plan (Haese 2021)*	 *Figure 2.45: H1 Plan (Author 2021)*
H2	 *Figure 2.46: H2 Exterior (Malusi RFS 2021)*	 *Figure 2.47: H2 Interior (Malusi RFS 2021)*	 *Figure 2.48: H2 Plan (Schmutz 2021)*	 *Figure 2.49: H2 Plan (Author 2021)*

	Exterior	Interior	Plan	Implicit/ Explicit model
H3	 Figure 2.50: H3 Exterior (Malusi RFS 2021)	 Figure 2.51: H3 Interior (Eyescape 2021)	 Figure 2.52: H3 Plan (Schmutz 2021)	 Figure 2.53: H3 Plan (Author 2021)
H4	 Figure 2.54: H4 Exterior (Malusi RFS 2021)	 Figure 2.55: H4 Interior (Malusi RFS 2021)	 Figure 2.56: H4 Plan (Haese 2021)	 Figure 2.57: H4 model (Author 2021)
H5	 Figure 2.58: H5 Exterior (Malusi RFS 2021)	 Figure 2.59: H5 Interior (Malusi RFS 2021)	 Figure 2.60: H5 Plan (vanLoggerenberg 2021)	 Figure 2.61: H5 model (Author 2021)

	Exterior	Interior	Plan	Implicit/ Explicit model
H6	 Figure 2.62: H6 Exterior (Malusi RFS 2021)	 Figure 2.63: H6 Interior (Malusi RFS 2021)	 Figure 2.64: H6 Plan (Schmutz 2021)	 Figure 2.65: H6 model (Author 2021)
H7	 Figure 2.66: H7 Exterior (Malusi RFS 2021)	 Figure 2.67: H7 Interior (Malusi RFS 2021)	 Figure 2.68: H7 Plan (Haese 2021)	 Figure 2.69: H7 model (Author 2021)
H8	 Figure 2.70: H10 Exterior (Malusi RFS 2021)	 Figure 2.71: H10 Interior (Malusi RFS 2021)	 Figure 2.72: H10 Plan (van Loggerenberg 2021)	 Figure 2.73: H10 model (Author 2021)

	Exterior	Interior	Plan	Implicit/ Explicit model
H11	 Figure 2.74: H11 Exterior (Malusi RFS 2021)	 Figure 2.75: H11 Interior (Malusi RFS 2021)	 Figure 2.76: H11 Plan (Haese 2021)	 Figure 2.77: H11 model (Author 2021)
H12	 Figure 2.78: H12 Exterior (Malusi RFS 2021)	 Figure 2.79: H12 Interior (Malusi RFS 2021)	 Figure 2.80: H12 Plan (Haese 2021)	 Figure 2.81: H12 Plan (Author 2021)
H13	 Figure 2.82: H14 Exterior (Malusi RFS 2021)		 Figure 2.83: H14 Plan (Schmutz 2021)	 Figure 2.84: H14 Plan (Author 2021)

2.3.2.3 Materials and technology

Characteristic of the Melusi vernacular is the use of light-weight recycled and re-used materials. Some materials are sourced locally from neighbours that are deconstructing their dwellings, from local hardware and recycling shops. Recycled materials used include corrugated metal sheets, timber, gum poles, elements such as doors and windows are also re-used indicating an efficiency in material use (figure 2.87). Lightweight materials are used to facilitate assembly by a single person, transportation from source by hand or wheel barrow, and collaborative construction involving both young and old (figure 2.86). The assembly is such that it allows for flexibility and expandability in that the dwelling can be deconstructed or enlarged. Over time, elements are replaced with more permanent elements, a decision driven by attainment of tenure (figure 2.87). This was observed in Melusi two which is undergoing a process of formalisation. Also, as one's income grows, they purchase new materials and adopt more robust materials and use permanent technology (figure 2.87).

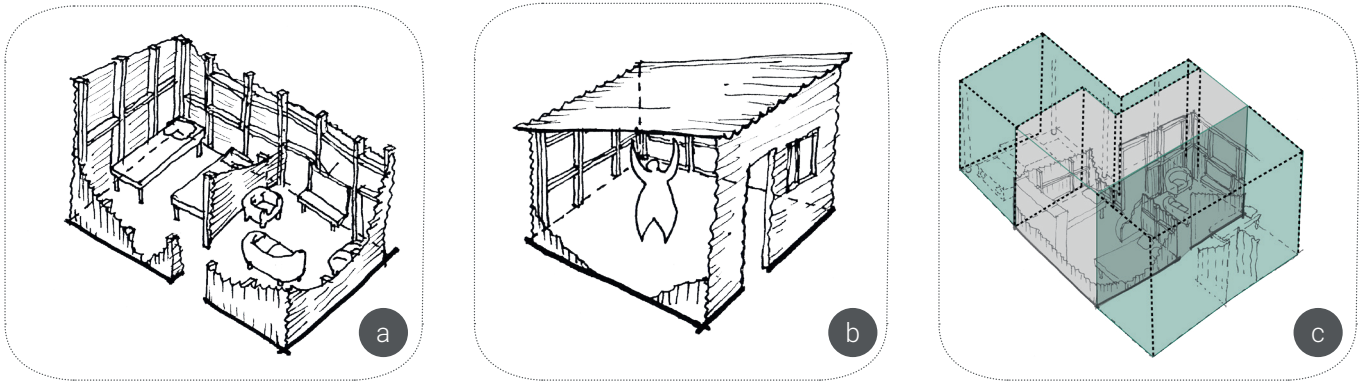
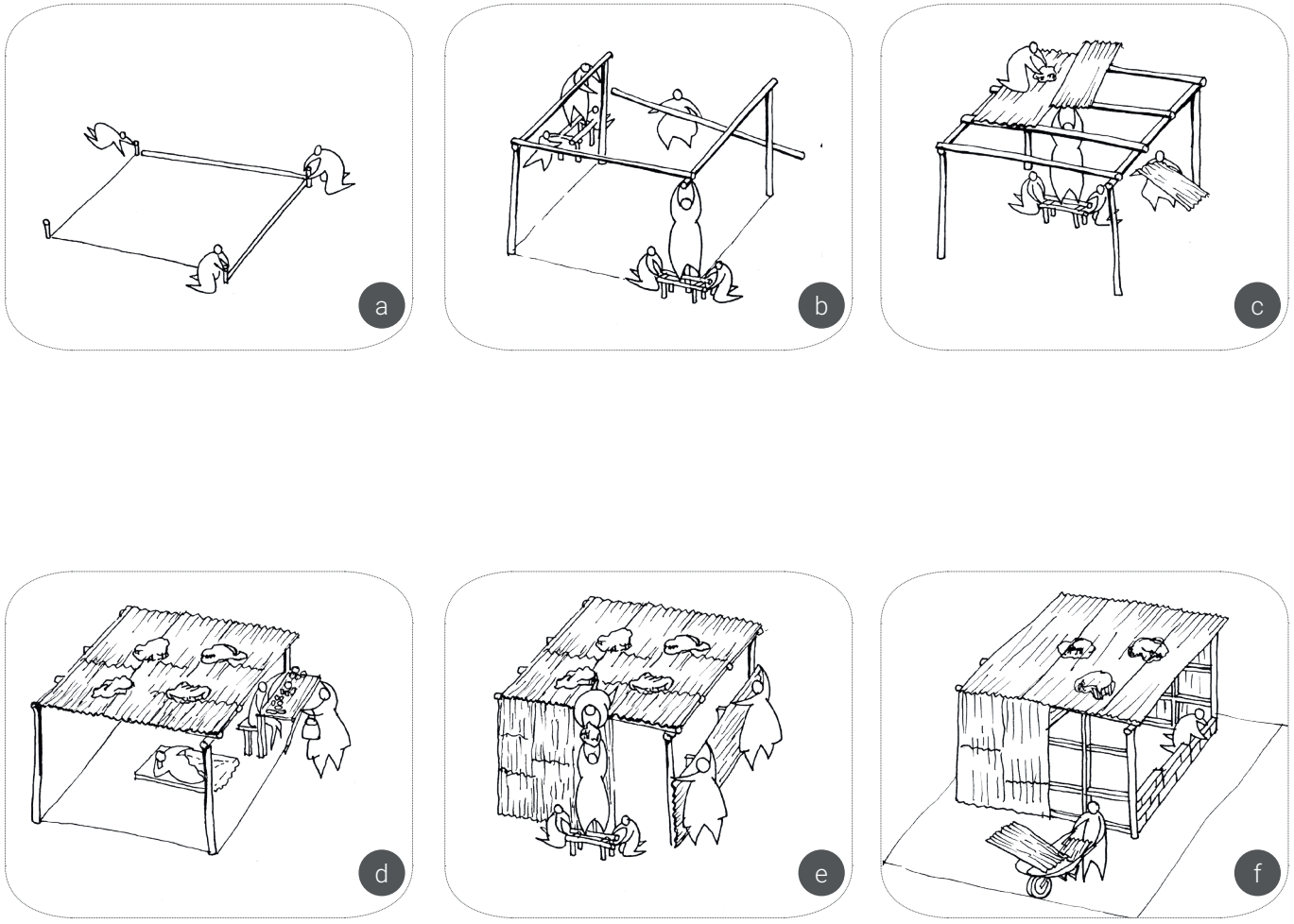


Figure 2.85: Melusi generative model (Author 2021)



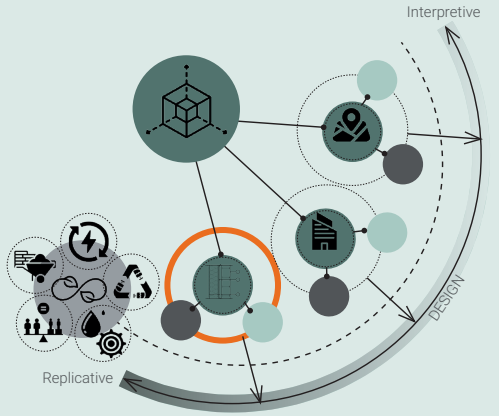


Figure 2.86: Construction sequence (Author 2021)

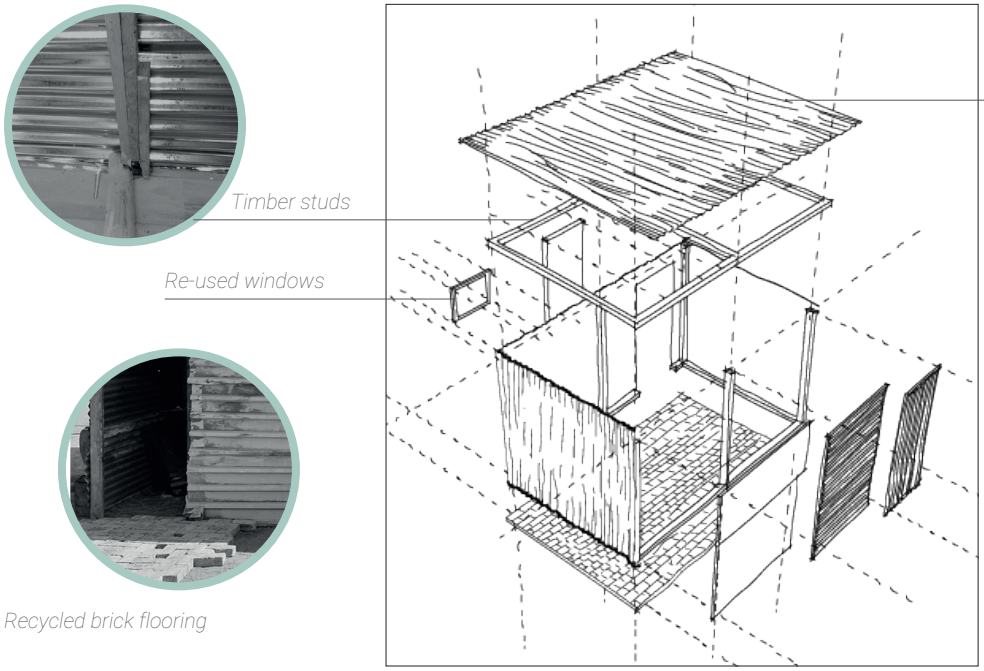


Figure 2.87: Melusi model techne (Author 2021)

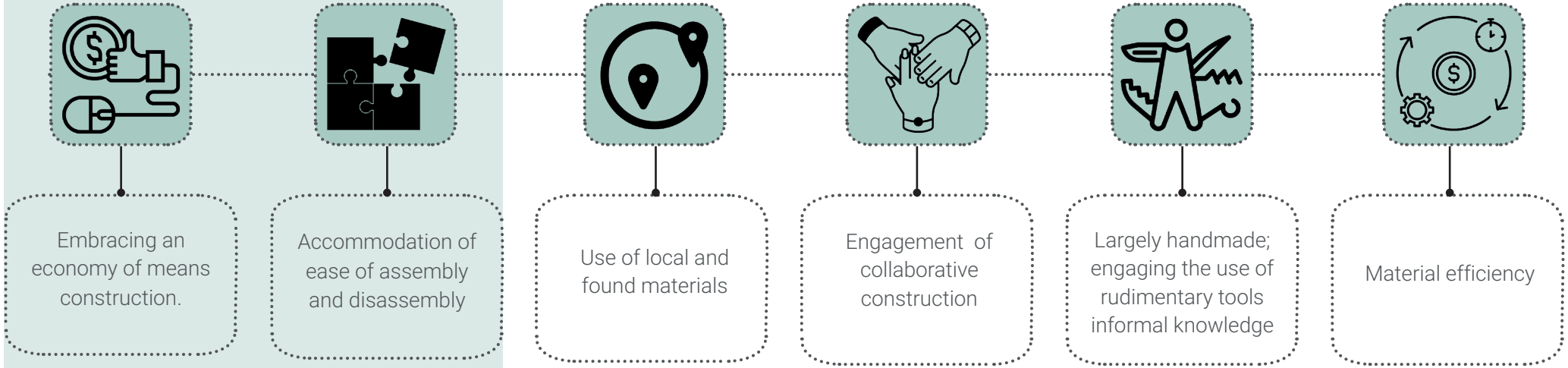
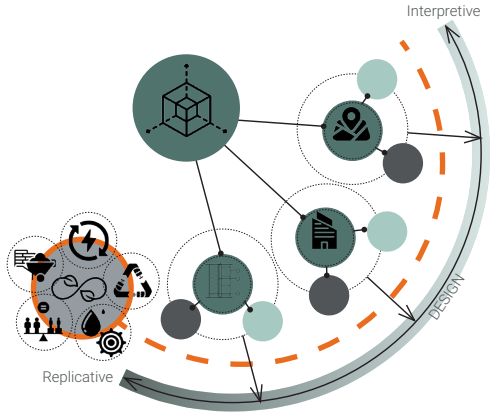


Figure 2.88: Melusi model underlying rules and principles (Author 2021)

2.3.2.4 Applying a Regenerative lens



A regenerative lens was applied to inform the architectural design strategies and interventions. Attia's (2018:22) "five guiding principles of regenerative design addressing safe and healthy materials, material reuse, renewable energy and carbon management, water stewardship and social fairness" were considered. Whilst keeping materials in cycle is characteristic of the Melusi vernacular, concern is with the health and safety around fire and exposure to contaminants. According to interview participants, many interior spaces are thermally uncomfortable especially in summer and winter months. To counter this, dwellers commonly use paper as insulation, however, that is not a durable solution. Also observed was the layering of curtains over the walls as a covering treatment (table 2.2). Applying curtains adds colour and warmth; controls dust; and addresses the mean radiant temperature. An observation from the paricipatory water game was a lack of water stewardship within the community. Additionally, there is a missed opportunity in the use of daylighting (figure 2.89) and natural ventilation.

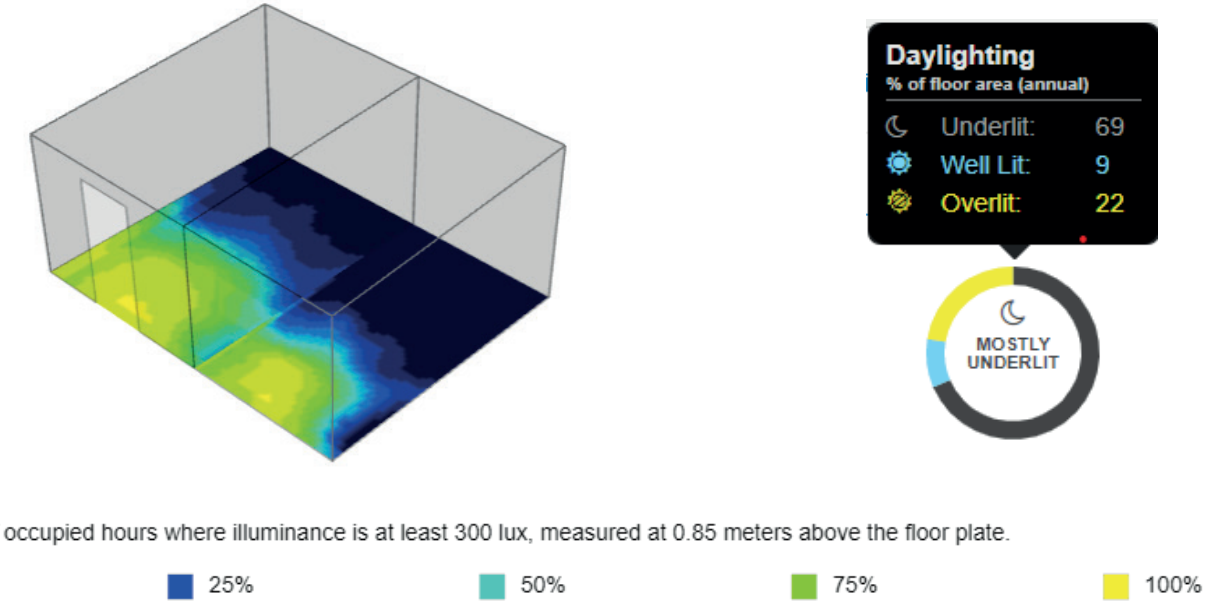


Figure 2.89: Melusi model daylight analysis in Sefaira (Author 2021)

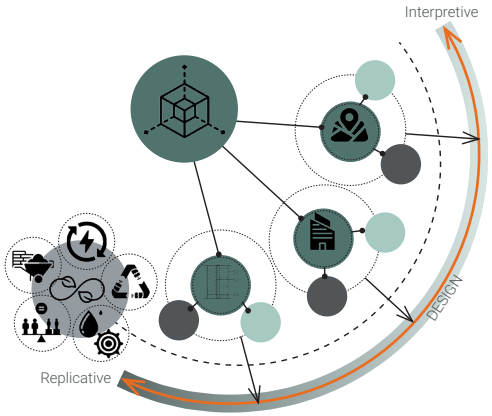
Table 2.3: Table of product attributes (Author 2021)

Process	Condition within Melusi
Identities of designers	The building occupant(s) is often also the designer and builder. Construction is a collaborative process involving all ages and gender (figure 2.86).
Intention of design	The buildings are largely constructed for shelter. Spaces to accomodate renters and small businesses are added to grow income streams (table 2.2).
Presence of a single model	Visual coherence within the settlement indicates the use of both implicit and explicit models
Degree of change due to temporal dimension	The model is incrementally adaptaded over time; flexibility in ease of assembly and diassembly.
Sharing of knowledge	Knowledge is not attained through formal education, but from intuitive decision-making, observation and lessons passed down from one person to another.

The following attributes were identified with reference to Rapoport's framework (table 2.3):

Table 2.4: Table of product attributes (Author 2021)

Product Attributes	Condition within Melusi
Specific models, plan forms, and morphologies	A model characterised by single floor, two-roomed rectilinear buildings, constructed from the immediate scale of the human body. It can be observed in most buildings as a lexicon (figure 2.85 & figure 2.87). The model is shared but variation exists with compliance to the unwritten principles and rules as individuals adopt it explicitly or implicitly depending on their spatial needs and resources.
Presence of specific formal qualities	Framed structure: Skeleton; structural framework built in timber (figure 2.87).
Use of specific materials, texture, colours	A plethora of recycled materials and elements from construction waste, often lightweight. There are ingenious ways in which materials are re-used and repurposed, showcasing a multiplicity in materials. Colour often used to achieve aesthetic desires.
Efficiency in use of resources	High capabilities in the effective use of available resources such as recycled materials.
Open-endedness regarding activities	Distinctions observed in the model were often incremental adpatations over time to accomodate economic activity or growth in household and accumulation of income.



2.3.3 Initial Design Response

An initial response (figure 2.92) engaged the site as informant (figure 2.). Proposed were modular rectilinear forms in rows along the site's slope. The modularity was to facilitate an ease of construction, a strategy employed in the Walter's way precedent (2.33). I envisioned the sub-programs as a market space to activate the street edge with food related spaces on the quary edge to optimise the water as a resource. Platforms ('streets') towards the quarry were to extend the existing street to it and activate quarry edge whilst curving out courtyard spaces. A replicative-leaning approach to engaging the vernacular was taken, regarding aspects such as material, form, and simplicity in construction. At this stage, the program was critiqued as wanting.

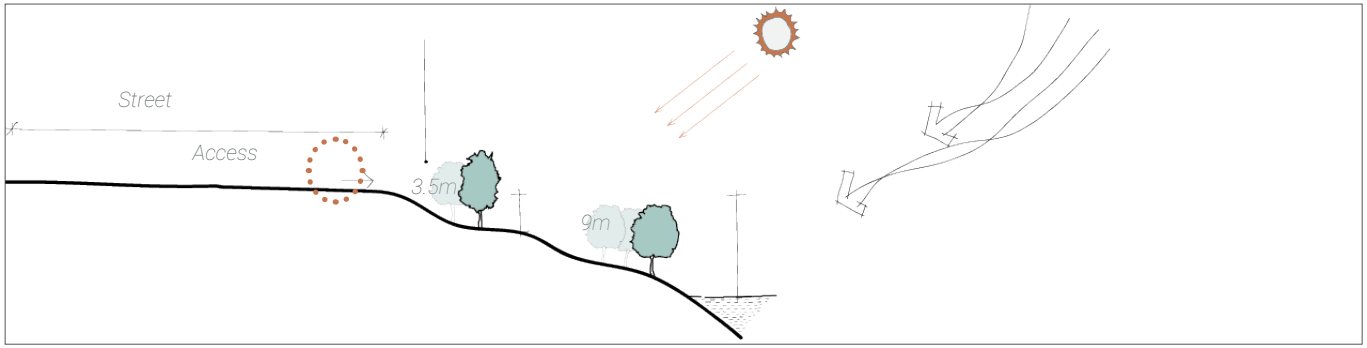
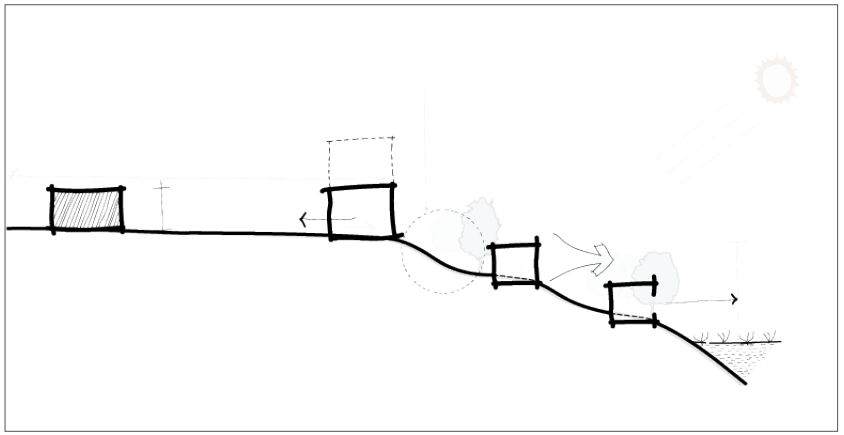


Figure 2.90: Site section showing environmental factors (Author 2021)



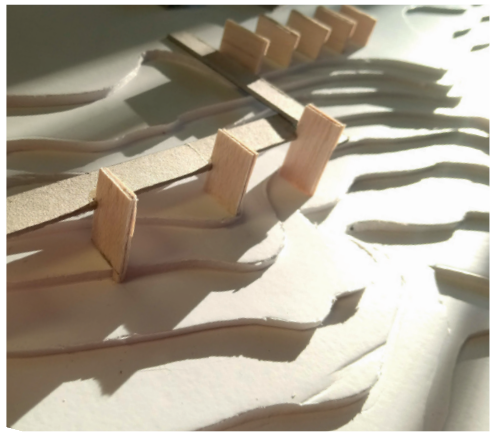


Figure 2.91: Conceptual response to environmental factors (Author 2021)

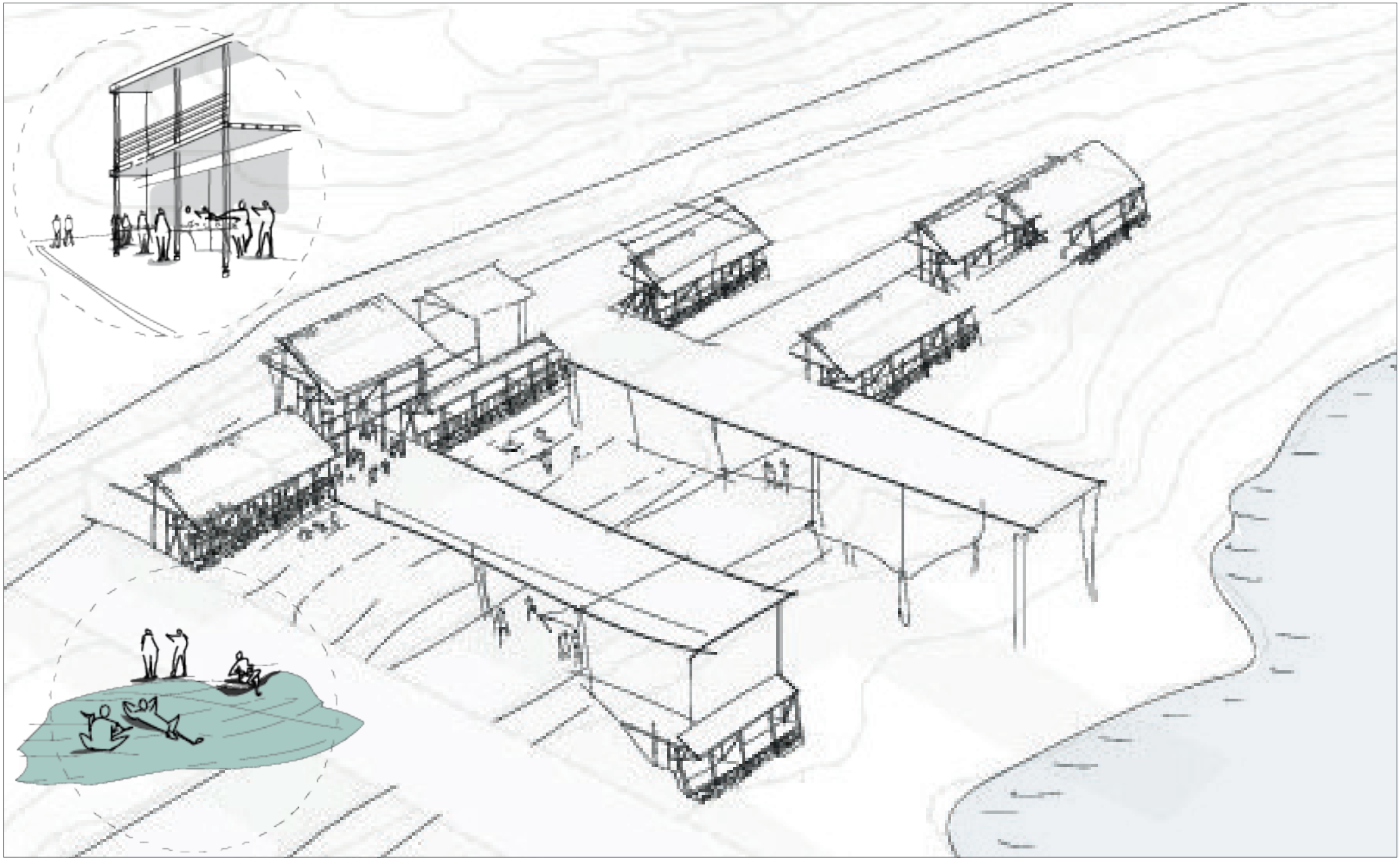
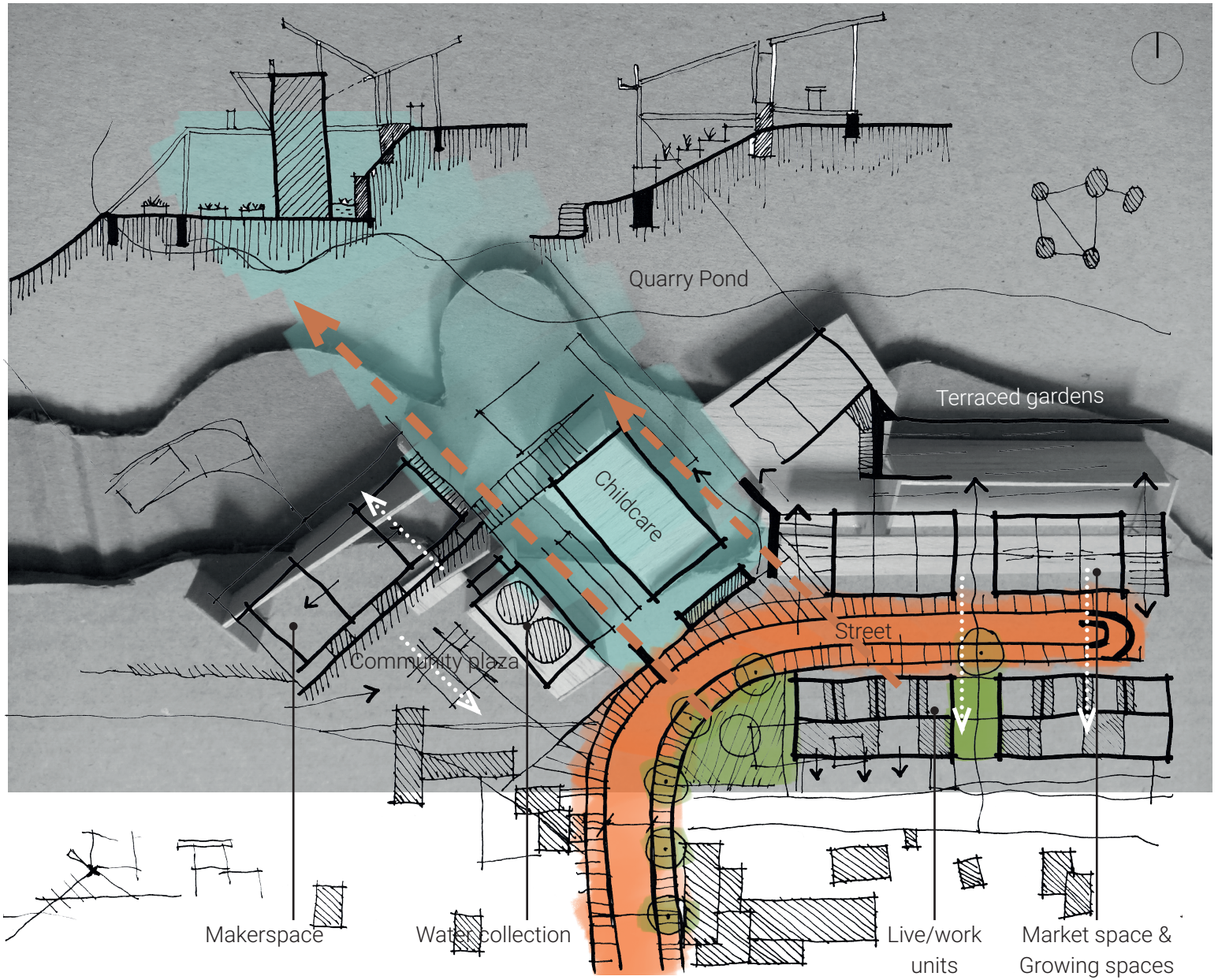


Figure 2.92: Iteration one (Author 2021)



The next iterations (figure 2.93 & 2.94) considered a programme that was informed by activities performed in communal and public space. The buildings orientation were in response to the topography. This created some problematic orientations such as that of the library space. The main concern was a lack of definition of the threshold spaces between the different spaces and between the intervention and with the quarry. Further understanding of threshold spaces and of the site as a liminal space was therefore important.

Figure 2.93: Iteration two (Author 2021)

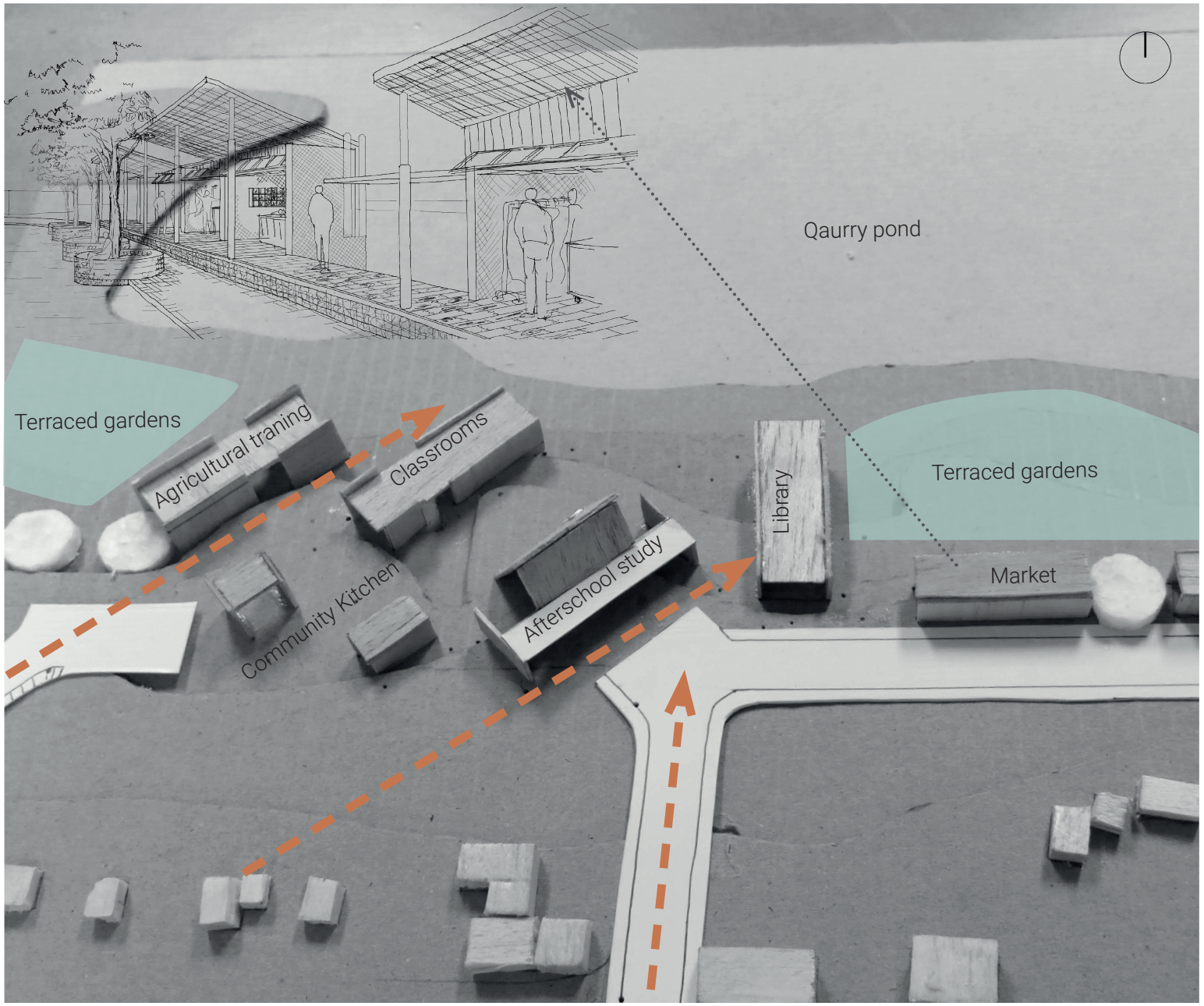


Figure 2.94: Iteration three (Author 2021)

2.4 Conclusion

This chapter considered how to learn for vernacular systems, design and engage the social fabric of the Melusi informal settlement. Different methodologies were considered to engage the social and material dimensions of the Melusi system. Through participatory methodologies, the stakeholders of Melusi were engaged, giving an understanding of the community, that is, its issues, latent potential particularly in the social connections. A spatial outcome was a phased urban framework that envisioned increased social capital and use of emergence inherent in local innovation through the strenghthening of existing stakeholder relationships. The material aspects were studied using and building upon Rapoport's (1988) framework in which the Melusi vernacular model was defined. However, the initial design interventions showed a need for futher appreciation of the spatial strategies in Melusi particularly concerning the threshold spaces. This is to establish a spatial concept and to guide the layering of the different programmes.