

Turning points: Exploring power transitions in an incremental upgrading process in Enkanini, Stellenbosch

by

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Declaration

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Abstract

This study explored whether co-production of knowledge could contribute to shifting power from government to citizens in an incremental upgrading process. It is premised on the notion that such a shift is desirable. The title of the study *Turning points: Exploring power transitions in an incremental upgrading process in Enkanini, Stellenbosch* indicates the complex, transient and shifting power dynamics at play in the illegal settlement of Enkanini in Stellenbosch.

The study was conducted within a larger transdisciplinary research framework seeking to implement socio-technical innovations, generated through a co-production of knowledge process with settlement residents, to move Enkanini towards becoming a sustainable human settlement. A case study provides an overview of engagement the residents have had with the local Stellenbosch Municipality, NGOs and academic researchers from the Sustainability Institute, Stellenbosch University. It is complemented by the personal narrative of one of the first residents who moved there in 2006. From personal observations, interaction with residents and co-researchers, meeting notes, the literature review and a grounded experience over the three-year study period, four turning points were identified.

These four turning points, interpreted as bifurcations that could open up new ways of engaging with the present to determine alternative futures are explored dialectically. The initial problem for each is described, followed by the response and the resultant challenge that emerged. The four turning points were the initiation of the iShack concept, the start of the iShack Project, the iShack stakeholders meeting and the establishment of the Enkanini Research Centre.

As power, in both visible and invisible forms, manifested itself in this volatile settlement and in awareness that the researchers role held power and that the researcher's sets of knowledge, assumptions and prejudices could affect both research process and outcome, there was a need to find complementary methodologies to the main transdisciplinary research framework.

Indigenous research methodologies spoke directly to power and the importance of capacity building and empowering research participants (shifting them to co-researchers), while reflexive research methodologies allowed the disciplined reflection and re-reflection to ameliorate influencing of process and outcome. In addition, each overcame the limitations of the other, in particular the limitation of transdisciplinary research that does not take power dynamics into account. This resulted in the creation of a methodological triad and a conceptual mechanism through which to view the results, termed co-arising.

The three themes that had emerged during the process – understanding through knowledge co-production, capacity building through the awareness of power dynamics and engagement with the research space – are fused in this notion of co-arising served by the methodological triad.

The turning points, or bifurcations, were analysed through an “open” coding system used in grounded theory to minimise pre-conditions determining the outcome. Three dominant categories emerged – empowerment, identity and agency – as determinants for shifting power from government to citizens through effective co-production of knowledge in an incremental upgrading process. The study concludes with recommendations for future research.

Keywords: informal settlement upgrading, Enkanini Stellenbosch, power dynamics in informal settlements, incremental informal settlement upgrading.

Opsomming

Hierdie studie wou vasstel of die medeproduksie van kennis kan bydra tot 'n magsverskuiwing vanaf die regering na burgers in 'n trapsgewyse opgraderingsproses. Dit het van die veronderstelling uitgegaan dat so 'n verskuiwing wenslik sal wees. Die titel van die studie, *Turning points: Exploring power transitions in an incremental upgrading process in Enkanini, Stellenbosch*, dui op die komplekse, veranderlike en verskuiwende magsdinamiek in die onwettige nedersetting Enkanini op Stellenbosch.

Die navorsing is binne 'n groter kruisdisziplinêre navorsingsraamwerk onderneem wat toegespits was op die inwerkingstelling van sosio-tegniese innovasies om Enkanini in 'n volhoubare menslike nedersetting te omskep. Die innovasies is deur medeproduksie van kennis in samewerking met inwoners van die nedersetting ontwikkel. 'n Gevallestudie bied 'n oorsig van skakeling tussen inwoners en die plaaslike Stellenbosch Munisipaliteit, nieregeringsorganisasies en akademiese navorsers van die Volhoubaarheidsinstituut aan die Universiteit Stellenbosch. Dit word aangevul deur die persoonlike verhaal van een van die eerste Enkanini-inwoners, wat in 2006 daar ingetrek het. Persoonlike waarnemings, interaksie met inwoners en medenavorsers, aantekeninge by vergaderings, die literatuuoroorsig en praktiese ervaring oor die studietydperk van drie jaar het vier keerpunte na vore gebring.

Hierdie vier keerpunte kan vertolk word as bifurkasies wat kan lei tot 'n nuwe benadering tot die hede vir die skep van 'n alternatiewe toekoms. 'n Dialektiese verkenning van die keerpunte is gevolglik onderneem. Die aanvanklike probleem word in elke geval beskryf, gevolg deur die reaksie en die uiteindelijke uitdaging wat daaruit ontstaan het. Die vier keerpunte was die bekendstelling van die iShack-konsep, die aanvang van die iShack-projek, die vergadering van iShack-belanghebbendes, en die vestiging van die Enkanini-navorsingsentrum.

Aangesien sowel sigbare as onsigbare vorme van mag in hierdie onstuimige nedersetting te sien was, en gedagtig daaraan dat die navorser oor 'n magsrol beskik het en die navorser se kennis, aannames en vooroordele die navorsingsproses sowel as -uitkoms kon beïnvloed, moes bykomende metodologieë ter aanvulling van die hoof- kruisdissiplinêre navorsingsraamwerk gevind word. In dié verband het inheemse navorsing direk betrekking gehad op mag en die belang van vermoëbou en bemagtiging onder navorsingsdeelnemers (om hulle as't ware in medenavorsers te omskep). Oordenkingsnavorsing het weer 'n geleentheid gebied vir gedissiplineerde besinning en herbesinning om enige beïnvloeding van die proses en uitkoms te temper. Daarbenewens het elke benadering die beperkinge van die ander ondervang, veral die geneigdheid by kruisdissiplinêre navorsing om magsdinamiek buite rekening te laat. Sodoende is 'n metodologiese drietal en 'n konseptuele meganisme genaamd mede-ontstaan ("co-arising") geskep, waarmee die resultate ondersoek kon word.

Die drie temas wat gedurende die proses uitgewys is – begrip deur die medeproduksie van kennis, vermoëbou deur 'n bewustheid van magsdinamiek, en betrokkenheid by die navorsingsruimte – is byeengetrek onder die gedagte van mede-ontstaan, wat deur die metodologiese drietal ondersteun is.

Die keerpunte, of bifurkasies, is deur 'n 'oop' koderingstelsel uit gegronde teorie ontleed om die invloed van enige voorafbestaande toestande op die uitkoms te beperk. Hieruit is drie dominante kategorieë afgelei – bemagtiging, identiteit en vrye wil – synde bepalende faktore vir doeltreffende medeproduksie van kennis en die gevolglike verskuiwing van mag vanaf die regering na burgers in 'n trapsgewyse opgraderingsproses. Die studie sluit af met sekere aanbevelings vir verdere navorsing.

Trefwoorde: opgradering van informele nedersettings, Enkanini, Stellenbosch, magsdinamiek in informele nedersettings, trapsgewyse opgradering van informele nedersettings

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Key concepts and terms

Actor: A person involved in the research space either through active participation or through their passive presence.

Co-arising: The interdependent mechanism of the methodological triad used to understand, engage and build capacity in the research space.

Co-researcher: An active participant in the research space that contributes to the formulation of the research problem and the dissemination of research findings. Co-researchers are also part of the Transitions Collective.

Enkaninian: A resident of Enkanini, an informal settlement of Stellenbosch.

Incrementalism: The step-by-step approach applied to upgrading whereby each new step does not make the previous step redundant.

Indigenous knowledge: Local and traditional knowledge developed in the post-colonial period by a social group or community.

iShack Project: The institutional outcome of the iShack concept tested on a project level to endorse a business-orientated strategy for informal settlement upgrading.

iShack: “Improved” shack. The first socio-technical implementation strategy established through the research of Keller (2012).

Life-world: The everyday life comprising empirical and experiential knowledge.

Problem field: The theoretical and practical problems within the research space that form the starting point of a research process.

Recursiveness: Revisiting certain points in the research process to test assumptions, actions and to validate outcomes.

Reflexivity: Situating the researcher in a social space that acknowledges the rhetorical, political and interpretive nature of empirical research.

Research space: The geographical area in which research takes place and the theoretical and practical characteristics of the research process and its participants.

Slum: The term has the same connotations as informal settlement. These terms are used interchangeably; however, slum primarily refers to the non-South African context.

The interdependent methodological triad: Composed from three interdependent methodologies and forming the foundation of the theoretical framework.

Transitions Collective: The research group comprised of researchers from the Sustainability Institute and co-researchers from Enkanini.

TsamaHub: Transdisciplinary, Sustainability Analysis, Modelling and Assessment Hub.

List of acronyms and abbreviations

GIS: Global information system mapping

NGO: Non-governmental organisations

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Chapter 1: Introduction

1.1 Introduction

The South African government is struggling to provide housing for its people given the rapid urbanisation trends over the last few decades (Huchzermeyer, 2006; 2010). Past government initiatives and interventions have not been able to eradicate or even alleviate the pressures faced by those living in informal settlements. Government has a constitutional responsibility to do so (Department of Local Government and Housing, 2007). Many residents of informal settlements have to wait up to nine years for basic infrastructure and housing (Department of Energy, 2011 in Swilling, Tavener-Smith, Keller, von der Heyde & Wessels, 2013) and those at the bottom of the housing list in the Western Cape will have to wait 32 years for housing (Madikizela, 2012).

This delay and the resultant frustration have in many cases led to service delivery protests and reactive responses from politically motivated individuals and groups. These types of responses have failed to generate constructive engagement and relationships with local government. Non-governmental organisations (NGOs) have, in many cases, intervened to encourage collaboration between citizens and government and to initiate a particular development process by first mobilising the community, planning and then implementing socio-technical solutions aimed at upgrading in informal settlements (VPUU [Violence Prevention through Urban Upgrading], n.d.; SDI [Slum/Shack Dwellers International], 2013). However, standardised approaches often do not work in complex informal settlements that are characterised by transiency, informal social organisations and local adaptive strategies. In addition, the perspective of the average shack dweller is rarely taken into account when these types of strategies are developed. It is also often not clear who participates, how representative they are of the broader community, and who is excluded from these processes (Cornwall, 2002).

This study explores the unfolding power dynamics, crystallised in four turning points, within the informal settlement of Enkanini, Stellenbosch that emerged during a process of incremental upgrading.

Power dynamics influence the way in which actors engage with and within the settlement, how capacity is built among residents and how complexities are perceived. A variety of research techniques and methodologies were used to incorporate the notion and effect of power dynamics into the findings.

1.2 Study background and personal motivation

I was born to Afrikaans farmers in the northern Free State in 1978 and grew up in apartheid South Africa within a particular cultural tradition and worldview, which was only challenged and reshaped during my travels to other countries after leaving school. This exposure to different cultures inspired me to obtain a degree in Anthropology and Philosophy from the University of South Africa in 2010. In 2011, wanting to deepen my knowledge of sustainability issues, I signed up for the masters degree at the Sustainability Institute, Stellenbosch. I note my cultural heritage here as social researchers need to understand and monitor their own assumptions, knowledge sets and prejudices before and while engaging in social research.

I have been actively involved in Enkanini, an informal and illegal settlement in Stellenbosch, South Africa since 2011, as a researcher and the field coordinator of the iShack Project. The iShack Project, funded by the Bill and Melinda Gates Foundation (hereafter referred to as the Gates Foundation) and the South African government's Green Fund, grew out of a transdisciplinary research project initiated by the TsamaHub (Transdisciplinary, Sustainability Analysis, Modelling and Assessment Hub). In 2011 the National Research Foundation funded a three-year community engagement programme to initiate a development process that would alleviate the pressures experienced by informal settlement residents in Stellenbosch.

Led by the Sustainability Institute under the auspices of Stellenbosch University's Hope Project and guided by Prof. Mark Swilling from the School of Public Leadership at Stellenbosch University, a group of postgraduate diploma, Mphil and PhD students formed the Enkanini Group (later renamed the Informal Settlements Upgrade Group and then the Transitions Collective, by which it is referred throughout this study), which focused on informal settlement upgrading.

It aimed to facilitate new conceptual debates around community engagement in South Africa, to produce new forms of knowledge in this area and to develop capacity both within researchers and research participants (National Research Foundation, 2012). The Transitions Collective worked within a transdisciplinary research framework to design a research strategy that would introduce problem-solving strategies and institutions in the informal settlement through the co-production of new knowledge for innovation.

The collective's initial research question was, "What does incremental upgrading of informal settlements mean from the perspective of the average shack dweller?" and the project's underlying premise that incrementalism (the policy of making change, particularly social change, by degrees), practised through socio-technical implementation strategies, provides a platform on which residents and researchers could engage with complex challenges in the immediate term (Swilling, Hodgson, Keller & Wessels, 2012; Swilling et al., 2013). In addition, the group believed that implementing socio-technical systems that ultimately would be operated by residents would open up space for deliberation around policy issues. Research projects, encompassing the skills of academics and Enkanini residents, focused on managing waste, sanitation and energy needs, upgrading dwellings and building a research facility. The energy project developed into the iShack Project, which aimed at developing a sustainable business model that could be managed by trained solar technicians from the settlement and provide for basic electricity needs at affordable prices.

As field coordinator of the iShack Project between 2012 and the beginning of 2014, I was able to observe the project's effect on the community and gather the data and personal observations that led to the formulation of this study. I was initially interested in how sustainable human settlements could be created and aimed to learn from both a scientific and experiential perspective how informal settlement dwellers adapted to their difficult environments. I was exposed to technical aspects of sustainable human settlements, such as solar energy, biogas generation and ecological design, and to the social dynamics of the community. I am particularly interested in the "lived" spaces in which people confront the effects of our anthropogenic era.

My brief from my supervisor was to design an institutional model within a socio-technical system to ensure the sustained use and maintenance of technologies introduced into the community. This stems from the premise that introduced technologies will deteriorate and collapse if there is no maintenance and repair plan in place. To facilitate this, community members need to be taught how the technology functions and they need to be trained to maintain it.

I soon realised that the static nature of institutional design did not align with my interest in the transient nature of an informal settlement and that I was increasingly more interested in the power dynamics unfolding within such a space. I shifted my research focus accordingly to explore the ways in which power manifests in the upgrading process in Enkanini. The perspective of the settlement dweller on the nature of power in the informal settlement agenda has not yet been investigated in South Africa and I was interested, in particular, to explore whether an understanding of power could contribute to constructive interaction between the South African government and informal settlement dwellers.

1.3 Research question and process

1.3.1 Research question

If it is accepted that the locus of power needs to shift from government to citizens during the incremental upgrading of informal settlements, then how can the co-production of knowledge contribute to this shift?

The research question emerged from an unfolding engagement with the Enkanini community in a process of research discovery that encompassed “interacting with the research environment, exploring and manipulating events, and examining controversies” (Brown, Harris & Russels, 2010:109) in an attempt to answer the collective’s initial research question: “What does incremental upgrading of informal settlements mean from the perspective of the average shack dweller?”

During this process I made three observations that informed the construction of my research question. Firstly, that power dynamics were expressed in both the political strategies played out by government and residents and the self-help strategies of residents.

While exploring these dynamics within a transdisciplinary framework, it became obvious that the research process would itself provide a platform for building capacity in the researchers, co-researchers and participants. Secondly, that co-produced and new knowledge was an emergent property of the research process in that resident's lived experiences informed the researcher's scientific knowledge and vice versa. This contributed to an understanding of the research space, in particular the nature of incrementalism. This new knowledge allowed for incremental upgrading because it was innovative and catered for local conditions.

Thirdly, that space is a contested area within the settlement and this contestation unveils different loci of power: government and residents. In addition, space can be conceived from the perspective of personhood – the space from within – using reflexive methodology. This methodology allowed me to engage with the research space including its actors, theories and practices. A conceptual analysis of space opened up an understanding of a possible method of engagement. The themes of “understanding”, “capacity” and “engagement” emerged from these observations and led to the formulation of the research question.

Foucault (1984:76 in Flyvbjerg, 2004:298) emphasises that research of a social or political nature needs to start from the “little question ... flat and empirical” of how to enable an understanding of the dynamics of practice. Asking “how” challenges the researcher to understand the study as a dynamic, changing process (Flyvbjerg, 2004). In addition, when asking both the “how” and the “why” questions while conducting a narrative analysis, Flyvbjerg states that the researcher can understand and explain the influence of power on the research process (Flyvbjerg, 2004:298). I undertook to explore how power influences the research outcome and how to engage with people willing to take on the challenge of a dynamic research process.

1.3.2 Research process

The research process was structured in a series of steps. These are outlined below.

Step 1: Build a theory of power relationships to understand how power influences the co-production of knowledge process during projects focused on incremental upgrading of informal settlements.

Step 2: Construct a methodological framework that contributes an understanding of the influence of power on the transdisciplinary research process of knowledge co-production.

Step 3: Identify turning points at which power dynamics influenced the outcome of the co-production of knowledge process.

Step 4: Analyse these turning points to identify how the co-production of knowledge process contributed to shifting the locus of power from government to citizens.

1.3.3 Research timeline

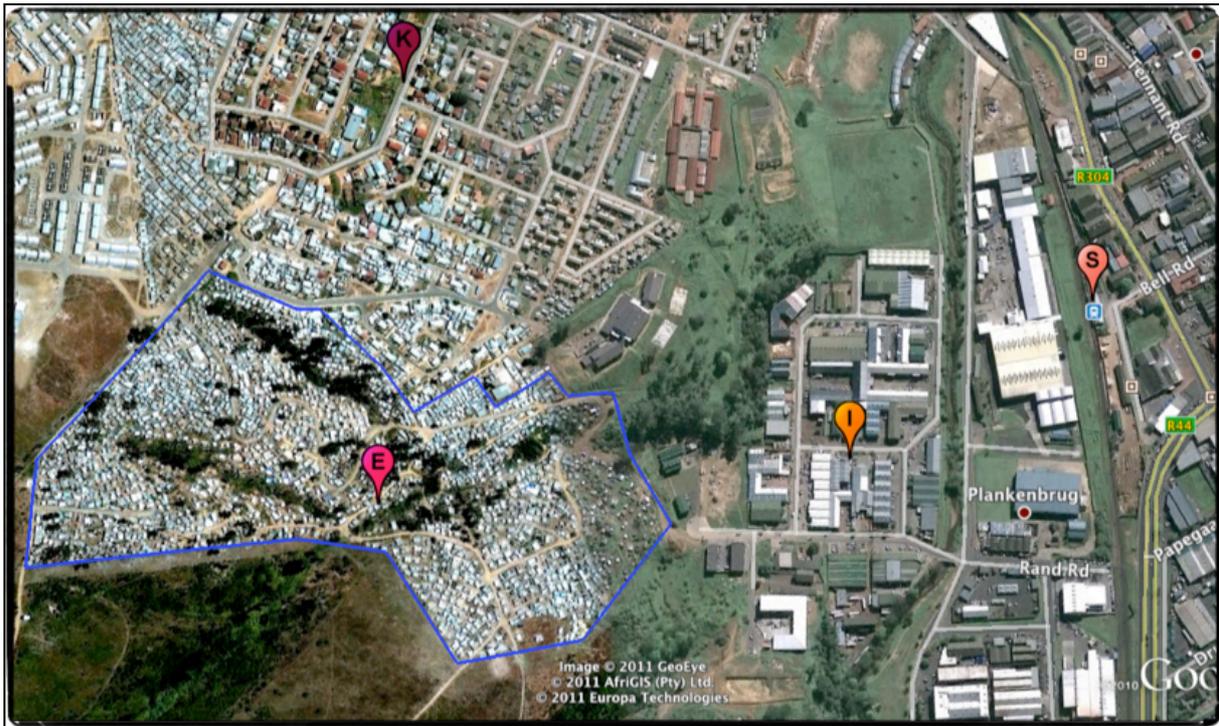
I conducted research in Enkanini between 2011 and 2014 and have delineated the different stages of the bigger research setting, my research process and influential events that took place during this period – these are expanded on in chapter 4.

1.4 Study context: Enkanini informal settlement, Stellenbosch

People, primarily from rural Eastern Cape, began moving from Kayamandi, a predominantly black African residential area of Stellenbosch, onto the adjacent municipal conservation land in 2006. They did this because some were unwilling to pay the high rents demanded in Kayamandi or they could not pay rent at all (Wessels, Enkanini field notes). Others moved straight from the Eastern Cape, among other locations, in the hope of entering urban life and enjoying the benefits of job opportunities, better health care and transport systems, and the city's facilities (Wessels, Enkanini field notes). This settlement, known as Enkanini, is Stellenbosch's largest informal settlement (Community Organisation Resource Centre, 2012).

Enkanini is set on the steep slope of Onder Papegaaiberg, just 1.8 kilometres from Stellenbosch's central business district. Map 1 situates Enkanini (indicated as "E") next to Kayamandi (K). It is above the Plankenburg industrial area (I) and less than 1 kilometre from the Stellenbosch railway station (S), which is adjacent to the R44 road that links the towns of Somerset West, Franschhoek and Paarl. It is close to a predominantly white middle- and upper-class neighbourhood. An aerial map of the settlement and a table indicating its demographics follows.

Map 1: Enkanini, an informal settlement of Stellenbosch, 2013



Source: Google Earth, 2013

Table 1: Enkanini's demographic profile in 2012

Age of settlement	Seven years.
Type of structures	Shacks.
Number of shacks	2 494
Population	4 449 (females comprise 46%)
Land ownership	Municipality.
Number of communal toilet blocks	80 blocks. Nine needed maintenance and nine were vandalised in 2014.
Toilet/population ratio	1:72
Water taps	32. All functional and well maintained in 2014.
Tap/population ratio	1:139
Average age of residents	Between 25 and 29 years.
Disasters	111 fires and 840 floods since inception.
Urgent needs	Electricity and alternative sites to flood-prone areas.

Source: Community Organisation Resource Centre, 2012

The settlement faces the stressors of frequent fires, flooding, indoor air pollution due to paraffin and candle use, lack of electrification and high levels of theft. These factors have led residents to protest against the Stellenbosch Municipality and, in some instances, commit vandalism.

Residents demand that the settlement be electrified, while the municipality contends that it is an illegal settlement and located on land zoned for conservation (Van den Berg, 2013). Different leaders have emerged during this ongoing conflict and in 2011 the municipality signed a memorandum of understanding with Slum/Shack Dwellers International to facilitate upgrading and developing the settlement with the residents as active participants in the process (Fieuw & Bowers, 2011). Residents, however, did not agree to the organisation's terms of engagement (these are expanded on in chapter 4) and demanded the immediate electrification of the settlement. The initiative collapsed in 2013. Those from the community who had led the initiative were ostracised and Enkanini was left without a representative structure through which to restart negotiations with the municipality.

1.5 Introduction to the research methodology and methods

This particular research field, an informal settlement with no formal leadership structures and lacking adequate basic public services, is a complex and transient one and this research journey is an attempt to add scientific knowledge to the field of social sciences. I immersed myself in the lives of Enkaninians with a radical pragmatic attitude in efforts to produce empirical data. The findings of the study are corroborated by the research group itself, but also through theory and literature.

The word "journey" is used to describe the research process as it included exploration, navigation through the often messy tensions and lived realities of the research context, and it was non-linear in nature. Intuition, reflection, beliefs and dreams were used as interpretive tools throughout this data-gathering journey and data was gathered and processed using a methodological triad and a series of tools. These are described briefly below.

1.5.1 The methodological triad

Although the Transitions Collective, of which I am part, works within a transdisciplinary research framework, my emergent understanding of the community dynamic led me to bring other methodologies into the framework to take cognisance of power. Each methodology overcomes the others' limitations (the conditions, rationale, limitations and contributions of each are described in chapter 3) and provides insight to the complexity of the research space.

The work of Cornwall (2002), Gaventa (2003), Lukes (2005) and Foucault (1997 cited in the previous authors) is used to explore the aspects of power that manifested in the research process. The three methodologies are transdisciplinary, indigenous and reflexive research.

Transdisciplinary research does not explicitly confront power dynamics, while indigenous research explicitly elucidates the existence of power imbalances during the research process. Reflexive research allowed me to analyse my own interpretation of the power relationships playing out and locate myself within the dynamic. I have used transdisciplinary research as the starting point and basis for separating data from analysis following the realisation that this research process produces knowledge that builds upon subsequent knowledge sets. Each methodology speaks directly to one of the aforementioned themes of understanding, capacity and engagement that led to the formulation of the research question.

Transdisciplinary research speaks to understanding, indigenous research to capacity and reflexive research to engagement. The methodological triad forms the theoretical backdrop to the study. The space in which they meet I have termed co-arising, a term which represents the work of systems and complexity thinkers and transitional theorists, such as Morin and Kern (1999), Escobar (2011) and Montouri (2013) and as it embodies a methodological framework that generates results from experience, co-produced knowledge, theory and the literature.

1.5.2 Turning points as data sets

In addition, the study identified and highlighted four turning points that influenced the research process and generated data sets. These were the:

- Establishment of the iShack initiative in Enkanini in 2011 as part of a socio-technical implementation strategy.
- Grant funding obtained from the Gates Foundation in 2012 to initiate the iShack Project, which affected the relationships between researchers and co-researchers.

- Emergence of a charismatic leader in 2012, which shaped engagement strategies with the community. This event culminated in the stakeholder meeting that defined the way forward for the iShack Project.
- Setting up of the Enkanini Research Centre Association in 2013 to serve as a community resource facility and mediating body.

These turning points act as data sets to which the theoretical framework (outlined in chapter 3) is applied in chapter 5 to produce the emergent themes of agency, empowerment and identity, which form the research outcome.

1.5.3 Methods as tools

I used a set of specific methods as tools to process data, experiences and the theory that emerged from the literature review. These are outlined briefly below.

A case study

The case study follows a cross-case narrative approach focused on the lives and histories of multiple actors (Yin, 2011). It is viewed from a multi-themed perspective and culminates in a narrative that expresses the aspects relevant to the research topic. Four biographies are included to give a sense of those actors who have – through open discussion, acting as co-researchers and social interaction – informed the research process and content.

The decision to use a case study was influenced by Flyvbjerg's argument that predictive theories and assumptions cannot be drawn from a study of human affairs as these studies are context dependent (2006 in Robinson, 2011) and Latour's recognition that actors (living and non-living) have an effect on the narrative because they are not static phenomena (2005). Case studies also allow for "phronetic planning" in the research process, which takes into account power dynamics and values by providing real-world examples and detailed narratives that expose these elements (Flyvbjerg, 2004).

Engaging through open encounters

The notion of open encounters is considered the most important form of collaboration in the transdisciplinary research process because it acknowledges the social world of the actor in the research space (Pohl & Hirsch Hadorn, 2007a). This allows the researcher to reach a mutual understanding with the researched about the problem field that needs to be identified, analysed and integrated (Pohl & Hirsch Hadorn, 2007a). Open encounters in this context are informal engagements, as opposed to structured or semi-structured interviews.

In the context of this study, these encounters took place in the street, in shebeens, in churches, in ceremonies and rituals, and while installing solar systems or upgrading shacks. It was an apt method for this study because I played different roles in the community. These roles included the “reflective scientist” providing scientific expertise validated as objective or intersubjective according to the discipline (Pohl, Rist, Zimmermann, Fry, Gurung, Schneider, Speranza, Kiteme, Boillat, Serrano et al., 2010), which enabled me to make observations for subsequent data collection and to test theoretical assumptions, as well as making me aware of power dynamics surrounding project implementation. In addition, I was an “intermediary” connecting those with different styles of thought (Pohl et al., 2010), which allowed me to become aware of the differences in theory, values and methodologies between myself and the research subjects. I was also a “facilitator” and helped groups face their challenges by initiating collective learning processes (Pohl et al., 2010) and I was an “activist” by implementing projects in a settlement deemed illegal by government. Lastly, I was a “companion” in that I built close relationships with research participants, which often blurred the boundaries between us. This allowed me moments of unplanned reflection that ultimately benefited the study. At times, these roles converged.

Applied anthropology

Applied anthropology encompasses applying knowledge to influence interactions between people, groups and organisations to either preserve or change socio-cultural institutions (De Jong, 2010).

It embodies a holistic approach to the study of human beings, takes into account socio-cultural relativism to eliminate prejudice, uses cross-cultural comparisons to find common ground (Chambers, 1989), transcends time and space to provide a larger context for knowledge and relies on fieldwork, participant observation and interviews to collect qualitative data (De Jong, 2010). These last three actions form the foundation of an ethnographic study (De Jong, 2010). Applied anthropology is particularly informed by the method of ethnography through which knowledge is generated to bring about change. The researcher conducts participant observation when immersed in the socio-cultural context of the researched and can either use an emic approach (interviewing, household mapping, genealogy mapping and action research) (Ervin, 2000) or an etic approach, which involves writing up and reflecting on the research process once complete (Let, 2012) to collect data. Participant observation allows researchers to establish deep levels of understanding between her/himself and the researched (Alvesson & Sköldbberg, 2000). Interviews can be conducted with key informants, normally community or government representatives, and sometimes outsiders, or with groups that share common ground (De Jong, 2010).

1.5.4 On anonymity

Following Mouton's (2002) advice, I have kept the identities of certain actors anonymous (and not indicated when in the text) because in marginalised communities, such as Enkanini, social relationships can play a pivotal role in survival strategies with disfavour leading to expulsion from the settlement. In addition, emergent power can have settlement-wide consequences.

1.6 Limitations of the study

This study focused on methods of engagement with informal settlement communities during the process of incremental upgrading. Its contribution to describing, reviewing or contributing to the body of knowledge around the technicalities of informal settlement upgrading is therefore limited due to space constraints. However, an overview of the construction process of the Enkanini Research Centre, detailed architectural plans, an outline of key stakeholders and the financial budget are attached as appendix 1. I acted as project coordinator and, over two months, built, along with residents and builders, the centre in 2013.

In addition, as the study focused on three modes of power: dominance, transformation and power within a matrix, to uncover relational aspects of power, it does not cover the notion of power within a resistance framework.

This is a context-specific study focused on Enkanini and therefore cannot be compared in a comprehensive way with the engagement methods practiced by other organisations. It was also not possible to compare the process of establishing a research centre within an informal settlement because I could not find similar cases of a research agenda driving the establishment of a centre of this nature.

Finally, despite learning basic isiXhosa, language differences limited the potential richness of this study because many metaphors, jokes and nuances would not have been captured.

1.7 Study outline

This chapter provided an overview of the context, personal motivation and background of the study. It outlined the research questions and objectives and described briefly the methodologies and tools used to conduct the study. The remaining chapters are detailed below.

Chapter 2, a literature review, explores urbanisation and settlement upgrading trends and power through three knowledge sets: systems, target and transformation knowledge. It does this to situate power in a spatial dimension and expose how the research space itself can influence power dynamics, enable capacity building, co-production of new knowledge and of public services.

Chapter 3 expands on the methodological approach taken to the study. Transdisciplinary, indigenous and reflexive research are combined in a triad with the notion of co-arising in the core where their individual contributions intersect to create an interdependent methodological framework that generates outcomes from experience, co-produced knowledge, theory and literature.

Chapter 4 contains the case study and descriptive narrative of the research journey.

Chapter 5 applies grounded theory to analyse four turning points. The theoretical framework constructed in chapter 3 is then used to interpret findings. This process allows the themes of agency, identity and empowerment to emerge as research outcomes.

Chapter 6 concludes the study, aligns the research outcomes with the research question and provides recommendations for further research.

Chapter 2: Literature review

2.1 A background to urbanisation and the rise of the slum

Urbanisation is a natural human phenomenon. The biological, social and technical evolution of societies over the millennia has enabled the spread of people across the globe and allowed them to adopt a sedentary lifestyle, which led to the formation of towns and eventually cities (Diamond, 1997). This sedentary pattern is characterised by the settlers' responses towards environmental pressures, resource availability, opportunities for exchanges, social pressures (breaking away from taboos and traditions) and the innate drive to innovate from new ecological niches (Diamond, 1997).

Rapid urbanisation in the modern era, in particular of the urban poor, has resulted in a significant increase in the size and number of slums or informal settlements. The urban poor face mounting pressures in these undeveloped urban spaces characterised by their high-density populations and low levels of economic opportunity. The challenge lies in how to focus attention on slums/informal settlements in a solution-orientated way. Parsons argues in the *Seven Myths of Slums* that if we are to start imagining a new human development trajectory, we should abandon the thought that slums should be eradicated, but rather start to think in terms of adequate shelter for all or sustainable human settlements (2010).

In the *State of the World: Our Urban Futures*, the World Watch Institute (2007) concludes with a chapter on fighting poverty and environment injustices with three key shifts that are needed to accommodate the growing urban poor population in conjunction with designing resilient and adaptive cities. These shifts are:

- To revise systems of funding resource flows that benefit the urban poor.
- To create systematic ways to collect data on poverty and environmental conditions and to measure conditions and positive outcomes.
- For those in positions of power to listen to the urban poor as constituents of the urban fabric.

Rose Molokoane from South Africa's Federation of the Urban Poor (FEDUP) eloquently expresses the sentiments that underlie the need for these shifts by stating that: "We are fed up of being the subject of the agenda. We are fed up with you not listening to us ... We are poor, but not hopeless ... The only thing we are concentrating on is how to organize ourselves. If communities are organized, they are a tool to address issues that are giving you double stress" (World Watch Institute, 2007:188–189).

2.2 Required shifts and emergent themes

These three shifts, reduced to themes, are used as focus areas in this literature review. The first shift, to revise the system that regulates resource flows through funding to the urban poor, is linked to capacity building – to create projects and institutions to manage resources through participation with the urban poor. The second shift, to create systems to collect data on poverty and environmental conditions, is linked to understanding – to formulate new ways of knowledge production to innovate for local conditions. The third shift, to find ways to address power relationships and bring the voices of the urban poor to the development agenda, is linked to engagement – to find ways of engaging with the urban poor to initiate a constructive political process of informal settlement development that leads towards the creation of sustainable human settlements.

To explore these themes, the literature review traces urbanisation patterns and the emergence of informal settlements along with the various stages of South African housing policy through the lens of three different types of knowledge. This is to provide the context for the study's focus on the informal settlement of Enkanini.

2.3 Urbanisation, upgrades and power

Given my research focus on a transitional informal settlement and my understanding that when "knowledge about a societally relevant problem field is uncertain, when the concrete nature of problems are disputed, and when there is a great deal at stake for those concerned by problems and involved in dealing with them" (Pohl & Hirsch Hadorn, 2007a:20), a transdisciplinary research framework is suitable. I have thus framed my literature review accordingly. This allows me to capture the various pertinent aspects and influences into my study that in more traditional methodologies would have been omitted.

This literature review is framed around three questions that require me to explore three forms of knowledge: systems, target and transformation knowledge. The three questions and their connection to the knowledge form are outlined in the table below.

Table 2: The three forms of knowledge

	Research questions
Systems knowledge	Questions about the genesis and possible development of a problem and about life-world interpretations of a problem.
Target knowledge	Questions related to determining and explaining the need for change, desired goals and better practices.
Transformation knowledge	Questions about technical, social, cultural, legal and other possible means of acting to transform existing practices and introduce desired ones.

Source: Pohl & Hirsch Hadorn (2007a:36)

These three knowledge forms, in turn, provide a frame for the literature review, which concentrates on urbanisation, settlement upgrading and power.

2.3.1 Systems knowledge

In order to answer questions about the origin and development of the problem and understand the real-world effect, I explored the evolution of urbanisation, the emergence of informal settlements and the policy response to this development in South Africa.

The evolution of urbanisation

We are experiencing the end of the Holocene epoch, which was a relatively stable climatic period, and entering the Anthropocene epoch, which is characterised by climatic changes caused by humans (Steffen, Crutzen & McNeill, 2007; Rockström, Steffen, Noone, Persson, Chapin III, Lambin, Lenton, Scheffer, Folke, Schellnhuber et al., 2009; Zalasiewicz, Williams, Steffen & Cruzen, 2010). The human population has increased from just under 1 billion in the 19th century to more than 6 billion in 2010 and it is expected to increase to 9 billion by 2050 (Zalasiewicz et al., 2010). Consequently the global mean temperature is rising due to the increased release of greenhouse gases, in particular the burning of fossil fuels to supply energy needs (IPCC [International Panel on Climate Change], 2007; Swilling & Annecke, 2012). These activities are responsible for climate change (IPCC, 2007), which is already negatively affecting ecosystems and global weather patterns; cities' infrastructure and residents are taking strain.

There have been four major socio-technical and ecological transitions within the past 2.6 million years. These are commonly known as the Palaeolithic, agricultural, urban and industrial revolutions. The Palaeolithic revolution (beginning 2.6 million years ago) is characterised by the emergent technology of stone tools crafted by hominids in the Afar region of Ethiopia (Semaw, Rogers, Quade, Renne, Butler, Dominguez-Rodrigo, Stout, Hart et al., 2003; University of Liverpool, 2011). This invention was accompanied by the ability to make fire. Archaeologists argue that this ability contributed to increasing brain size because as cooked meat was easier to chew jaw muscle size was gradually reduced thus increasing cranial cavity space, and brains were able to grapple with more complex notions due to receiving higher levels of nutrients from cooked meat (Wrangham & Conklin-Brittain, 2003; Clement, 2006). This, in turn, resulted in an enhanced socialising ability that enabled cooperation (Nowak & Highfield, 2012).

Some 10 000 to 13 000 years ago, following the glacial epoch of the Pleistocene (1.64 million ya to 10000 ya), Earth entered a stable climatic era known as the Holocene.

Fischer-Kowalski and Haberl (2007) characterise this period by its “colonization of nature” as humans began to change natural systems to benefit themselves through agricultural innovation. In doing so they altered ecosystems and increased net primary production of biomass (Haberl, Fischer-Kowalski, Krausmann, Martinez-Alier & Winiwarter, 2011). The increase in biomass produced through agriculture, animal husbandry and forestry increased the available energy consumption per capita (Haberl et al., 2011). This enabled settlement populations to increase and become more dense and permanent, which increased the consumptive rate of energy and material use (Haberl et al., 2011). The increase in numbers of people settling in concentrated regions signalled the start of the urban revolution.

This period is characterised by two major urbanisation waves. The first took place primarily in northern Europe and North America between 1750 and 1950 with the urban population in these regions increasing from 15 million to 423 million (United Nations, 2006). The second is referred to as the “New Urban Revolution” (United Nations Centre for Human Settlements, 2003) starting in 1950 and projected to last until 2030 (United Nations, 2006). The United Nations (2006) estimates that the urban population of Earth will increase to 3.9 billion people during this period. In the late-1700s we entered the industrial age, which is characterised by a marked rise in resource consumption and the accompanying release of atmospheric carbon. Scientists, through analysis of air trapped in ice cores from that period, demonstrate the rise in atmospheric carbon dioxide levels with the introduction of the mill in 1771 and the steam engine in 1784 (Crutzen, 2002; Perez, 2007). The preindustrial atmospheric carbon dioxide level was about 270–275 parts per million (ppm) and today it is 380ppm (IPCC, 2007). It has surpassed the boundary limit proposed by scientists such as Rockström et al. (2009). Carbon dioxide and other greenhouse gases contribute to global warming (IPCC, 2007). The consequences of the global mean temperature rising by 2 degrees Celsius include widespread environmental degradation and socio-economic instability (IPCC, 2007).

Haberl et al. argue that we are still transitioning from an agrarian society to an industrial society because industry still relies on agriculture, mining and raw material to fuel its growth and only a third of the global population lives in industrialised countries (2011).

However, if there are 9 billion people on Earth by 2050 and each consumes the same amount of energy of current residents of industrialised countries the entire biomass productive capability of photosynthetic plants would be consumed (Haberl et al., 2011).

One billion of the 3 billion urban dwellers in the world live in slums (World Watch Institute, 2007). A slum is understood as “a settlement made up of households that lack one or more of the following conditions: access to improved water, access to improved sanitation facilities (minimally, a pit latrine with a slab), sufficient living area (not more than three people sharing the same room), structural quality and durability of dwellings, and the security of tenure” (Swilling & Annecke, 2012:113). The world’s poor will be most affected by climate change as they lack the capacity to cope with these stresses (Department of Local Government and Housing, 2007).

Expanding informal settlements

The global share of the African urban population is expected to rise from 11.3% in 2010 to 20.2% in 2050, making African cities the second fastest growing cities in the world after Asian cities (UN Habitat, 2014). According to the United Nation-Habitat’s *State of the World’s Cities 2010/2011* report, the world slum population will increase by 6 million each year with African, Asian and Latin American cities experiencing the fastest increase of more than 115 000 people per week (UN Habitat, 2008 in Parsons, 2010). The same report estimates that 62% of all urbanites in sub-Saharan Africa live in slums and that by 2050 this will comprise 1.2 billion people (UN Habitat, 2008).

Despite the harsh living conditions of informal urban settlements, they offer an entry point for those looking to participate in the city’s economic opportunities whether they are from rural areas or other urban centres (United Nations Centre for Human Settlements, 2003). They are also often places of immense cultural diversity.

The South African policy response

Section 26 of South Africa’s Constitution states that “Everyone has the right to have access to adequate housing” (Government of South Africa, 1996:1255).

The South African Reconstruction and Development Programme (RDP), launched in 1994, aimed to address the backlog in service delivery, including housing, which had resulted from discriminatory apartheid policies.

Close on 3 million houses were built between 1994 and 2010 (Department of Human Settlements, 2010). However, the programme could not keep pace with the existing and increasing need during this period and the housing backlog increased from 1.5 million to 2.1 million people requiring housing (Bradlow et al., 2011 in Keller, 2012). In addition, the houses were built on the city peripheries further entrenching the marginalisation of the urban poor and excluding them from the city's economic opportunities (Department of Local Government and Housing, 2007). Programme outcomes were also defined in quantitative terms – number of people needing housing, budget allocations to buy land and cost of building using conventional techniques (Department of Local Government and Housing, 2007). Based on land prices and material costs for conventional construction, Del Mistro estimated that the housing backlog in the Western Cape would increase from 410 000 in 2006 to 804 000 units by 2040, not taking into account increased demand during the period (2007 in Department of Local Government and Housing, 2007).

As a result, government shifted its stance in 2004 and launched the Breaking New Ground policy that advocated developing “sustainable human settlements” through *in situ* (in place) upgrading (Department of Local Government and Housing, 2007; Pithouse, 2009). Section 24(b) of South Africa's Constitution places sustainable human settlements within a context of securing “ecologically sustainable development and use of natural resources while promoting justifiable economic and social development” (Department of Local Government and Housing, 2007:18). An *in situ* approach would minimise the disruption of existing community structures and preferably inhibit the relocation of inhabitants (Department of Human Settlements, 2009). As a result the Upgrading of Informal Settlements Programme was launched in 2004. This policy shift recognised that residents of informal settlements were active participants in their own community development; however it still relocated people to the urban peripheries and used conventional building techniques (Department of Local Government and Housing, 2007).

In addition, the top-down approach of the programme, led by government and driven by skilled engineers, excludes communities from participating in their own development (Swilling et al., 2013). It also demands new skills and capacity in local government for successful execution of the programme (Huchzermeyer, 2009).

The Western Cape provincial government compiled its own Sustainable Human Settlement Strategy as a roadmap to execute the above policy. This strategy embedded the notion of using incrementalism to address housing and service delivery challenges. The strategy notes that existing informal settlements can be incrementally upgraded *in situ* if a capital subsidy is released for the land and services (Department of Local Government and Housing, 2007). In addition, it notes that backyard tenancy should be formalised (Department of Local Government and Housing, 2007).

The Breaking New Ground policy and the Western Cape's Sustainable Human Settlement strategy both acknowledge that any move towards creating sustainable cities needs to take into account informal settlement upgrading and integration of these communities into the city with equal access to municipal infrastructure (Department of Local Government and Housing, 2007). The Western Cape's strategy further indicates a shift in focus to sustainable resource use, empowering residents and a more creative way of viewing the housing challenge (Department of Local Government and Housing, 2007).

South Africa's government, the Western Cape's in particular, has acknowledged that incrementalism and *in situ* upgrading are suitable tools with which to address the housing backlog. I explore how they are used, in what context and for what result in the next section.

2.3.2 Target knowledge

In order to determine and explain the need for change, the desired goals and best practice, I explored different approaches to upgrading through reviewing literature on incremental upgrading, co-production of knowledge and socio-technical systems.

Incremental upgrading

John Turner, an architect working in Peru's squatter settlements in the early 1950s, noted that slum dwellers had an intimate relationship with their environment and their social and physical needs, adapting their living spaces over time with innovative construction and creative social strategies (Davies, 2006). He was "mesmerized by the creative genius he discerned at work in squatter housing" and concluded that these creative strategies should be perceived as part of the solution, as opposed to part of the problem (Davies, 2006:71). Similarly, the Groupe CIAM Alger, a group of French architects and planners, noted that slum dwellers had an extraordinary ability to recognise the "'organic' relationship between the buildings and the site (reminiscent of the casbah), the flexibility of spaces to accommodate diverse functions, and the changing needs of the users" (Celik, 1997 in Davies, 2006:71).

This innate drive to help themselves and their evident organisational capacity was recognised in the 1970s by the World Bank, which began to support *in situ* incrementalism as a strategy for slum upgrades (Abbot, 2002; Davies, 2006). However, the lack of coherent state support for the upgrading process and the high interest rates demanded by the World Bank on loans effectively deepened the housing crisis (Peattie, 1987 in Davies, 2006:73). Datta and Jones (n.d. in Davies, 2006:72) argue that the World Bank did not consider that many slum dwellers made use of recycled and low-cost materials and that if constructing dwellings had to hire local artisans. Regardless, this was institutional recognition on a global scale that the upgrading process could be sped up if communities were organised and encouraged to participate in their own development (Dasgupta & Beard, 2007 in Swilling et al., 2013). The *Millennium Task Force Report* also expanded on the notion of the urban poor being active agents in their own development, as opposed to passive recipients and stressed the importance of including residents in planning processes through public negotiations (UN Millennium Project, 2005 in Pieterse, 2005:1,3).

However, there is still not a standardised approach to executing an incrementalist, community-driven response to upgrading (Abbot, 2002). Co-production of public services presents a possible way to encourage the active participation of citizens in their own development.

Co-production of public services

The notion of co-production first arose in the 1970s when Eleanor Ostrom described a situation in which community members assisted the police force in their duties by providing information that led to the arrest of criminals (Ostrom, 1978). Subsequently, Jockin Arputham, an Indian community organiser and activist, over the past 40 years has advanced the notion of co-production of public services in a context of slum development (Satterthwaite, 2008). Arputham organised slum dwellers into saving groups, which were then mobilised into federations to protest against service delivery failure and issues around recognition of land tenure (Satterthwaite, 2008). He articulated the notion that service delivery failure did not necessarily originate from an unwillingness on the part of the state to facilitate service delivery, but rather from a lack of capacity within state structures to implement effective service delivery (Satterthwaite, 2008). The federations' strategy accordingly shifted from a protest mentality to that of co-production of public services. Residents' inherent organisational capability and on-the-ground knowledge of their own needs could assist the state in addressing the issues around basic services provision, housing and security of tenure (Satterthwaite, 2008). These federations have evolved into the global organisation Slum/Shack Dwellers International that operates in more than 33 countries in Africa, Asia and Latin America (Slum/Shack Dwellers International, n.d.).

Co-production in the South African context

I have chosen to examine two strategies of co-production of public services in South Africa to highlight the engagement method; in other words, how was the community engaged with and who led the engagement? Engagement is a focus area of this study, as communities need to be ready for NGO intervention by having representative leaders and organisational structures. Co-production of knowledge cannot happen if communities are not ready. However, as indicated in section 5.3.3, an understanding of power relationships can initiate the co-production process for incremental upgrading even when these two determinants are missing.

The two examples are of initiatives run by Slum/Shack Dwellers International and the Violence Prevention through Urban Upgrading programme. These initiatives are run in different informal Cape Town settlements.

They have both proven successful in terms of successful co-production of public services between government and residents and they both highlight a necessary condition for initiation of a development process. This condition is the degree to which the organisational rationality in the community synchronises with the NGO's intentions and processes. Rationality in this sense is understood as the willingness and ability to reason with the NGO on how development should unfold and who should participate. Having representative leaderships and organisational structures normally indicates a high degree of rationality.

Organisation as a de facto condition

Organised communities are considered a *de facto* condition for upgrading and capacity building and co-production of public services with local government (Huchzermeyer, 2008; Mitlin, 2008; Satterthwaite, 2008; Bolnick & Bradlow, 2010). As a condition, it can be understood on two levels. Informal organisation exists on a community level where people are grouped in order to cope with their environment – characterised by minimal economic opportunities, minimal or no service delivery or proper shelter – or as spiritual groups, economic groups, such as stokvels (Department of Local Government and Housing, 2007) and street committees that mediate the informal real estate market and street-level planning (Oldfield, 2002; Lemanski, 2008). At this level, people can also be grouped according to political ideologies and they have identified leaders (Fieuw, 2011).

The rationality of these informal organisations may or may not synchronise with the interventionist organisation because of factors such as political volatility, mistrust of outsiders and demographic profiles, such as when the average age of the settlement, both of the settlement itself and its residents, is young.

For a NGO, formal organisation occurs when it identifies various informal groups and encourages them to present a leader representative of the entire group. This group is then formalised into a stakeholder group through which the NGO can begin mobilising (Krause, 2014).

Mobilisation process

The two organisations, Slum/Shack Dwellers International and the Violence Prevention through Urban Upgrading programme, both build on these types of formalised stakeholder groups. They, however, follow different mobilisation processes. These are explained briefly below.

Slum/Shack Dwellers International focuses on building bridges between local government and the relevant community groups or structures. It does by following “rituals”, a term it uses to explain the organisation’s core practices.

These rituals are as follows (SDI, n.d.):

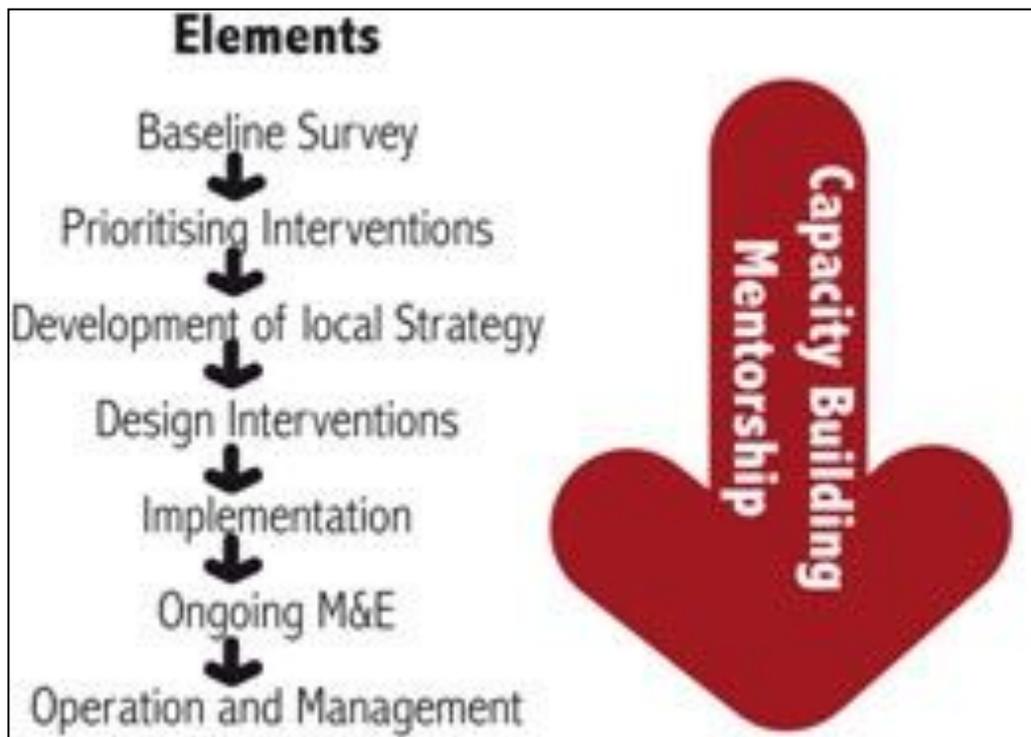
- Creating community-based savings schemes to fund development.
- Encouraging residents to actively participate in planning processes.
- Identifying community leaders to facilitate the upgrading process.
- Residents conducting spatial and demographic mapping.
- Compiling statistical charts for planning purposes (this is pivotal for engaging with local government). This data is represented in the format of global information system (GIS) mapping (UN, 2013).
- Drafting an action plan with the community and highlighting priorities.
- Exchanging the gained knowledge with other communities.
- Implementing the plan with the saved money and the gathered data under the leadership of emergent community members.

This process has proven successful in many informal settlements in South Africa when the communities were ready; i.e. they were easily or already organised in well-defined groups with a representative leadership structure.

The Violence Prevention through Urban Upgrading programme is a bilateral programme between the City of Cape Town and the German government that initiated a participatory development process in Khayelitsha, Cape Town (Miszewski, 2012).

Its methods are based on the United Nations-Habitat's and World Health Organisation's best-practice models of urban space design using participatory processes and by conducting interviews and survey for designing GIS maps to reduce crime and violence. The programme has established recreational parks and spaces for economic activities and it has landscaped public spaces in Khayelitsha's informal settlements (Miszewski, 2012). The method of community engagement is determined by the dynamics and "readiness" of community groups in terms of organised group structures and representative leadership (VPUU, n.d.). The mobilisation process is depicted in the figure below.

Figure 1: Violence Prevention through Urban Upgrading's process of engagement and capacity building



Source: VPUU, 2012

Key: M&E: Monitoring and evaluation

Engagement without organisation

The engagement methods described above are not suitable for communities that are not organised, have no real representative leadership structure and display high levels of political instability.

An alternative method is needed to engage with communities, or groups within them, that have not yet reached a level of organisation that resembles the aforementioned rationality or democracy (Chua, Boix-Mansilla & van Breda, 2012).

This is a departure from the notion that organisation is a condition for development. Introducing a socio-technical system in an informally organised settlement can possibly initiate the formation of groups capable of driving the co-production process.

Socio-technical systems

Socio-technical systems are defined as “... the linkages between elements necessary to fulfil societal functions” (Geels, 2004:900). These systems encompass the relationships between people, artefacts and the political, economic and social environment, including cultural meaning, knowledge, production and capital (Geels, 2004). Co-produced knowledge is vital in this regard to allow innovation to overcome local technical restraints and social barriers to acceptance of the innovation (Regeer & Bunders, 2009). All participants in socio-technical systems have a stake in contributing their knowledge to innovate and solve the society’s problem (Regeer & Bunders, 2009). Transdisciplinary research can initiate this process if the problem field is characterised by high levels of complexity calling for a restructuring of the research problem through the co-production of knowledge process.

The importance of innovation

Innovation, which occurs in all countries can drive economic growth and create jobs (Kraemer-Mbula & Wamae, 2010). Innovation is understood as improving products or processes, as well as creating new organisational methods in practices or relations (AU-NEPAD, 2010). It increasingly encompasses the study of systems within networks of organisations, corporations and governance (Geels, 2004).

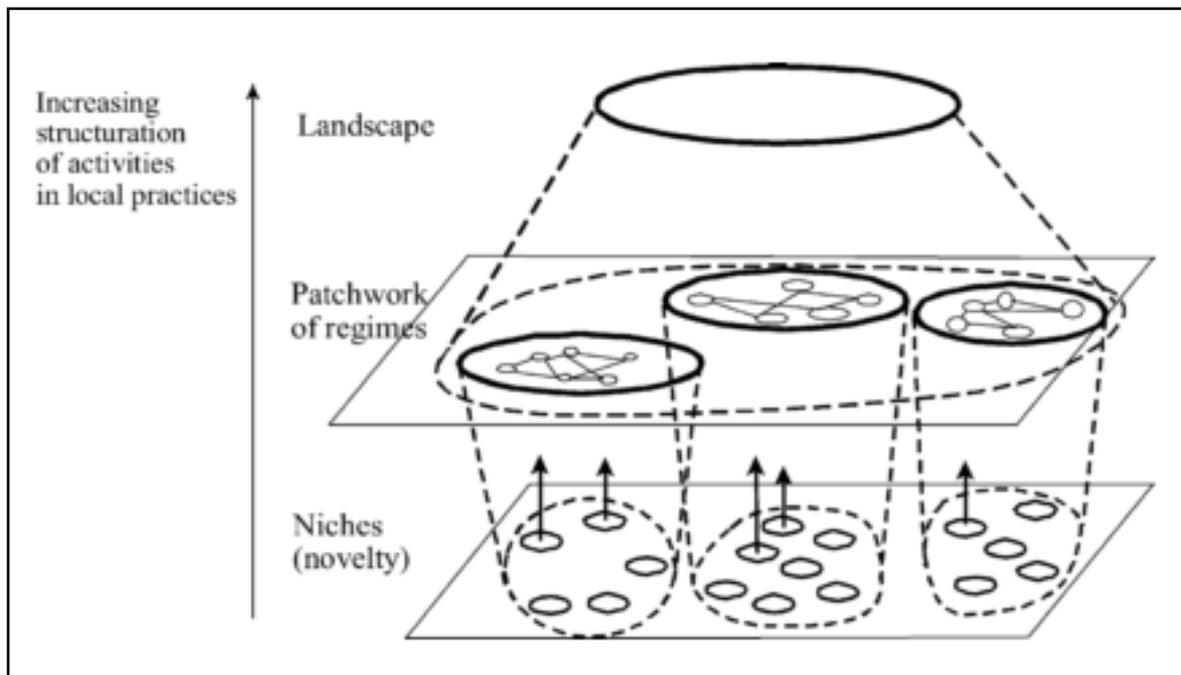
In addition, the limitations of viewing innovation only within the supply side have been overcome with the inclusion of demand-side innovation – the combination forms a socio-technical system (Geels, 2004). Innovation is different from invention, which is an initial creative process, in that it gets taken up by society through organisational and institutional arrangements (Swilling & Annecke, 2012).

There is no lack of innovation, but it is rarely applied to address needs such as poverty alleviation (Nelson, 1977).

The multi-level perspective

Geels' (2004) multi-perspective model incorporating niche innovations and the socio-technical regime and landscape is useful in the context of this study as it enables a spatial awareness of innovation trajectories and how political, cultural, economic and environmental conditions influence innovation uptake. This has implications for implementation strategies. The model is depicted below.

Figure 2: The multi-level perspective and the interactions between different levels



Source: Geels, 2007: 913.

The socio-technical regime is a stabilising trajectory for innovation pathways (Geels & Schot, 2007) in that it encapsulates the rules and norms that mediate the relationship between niche innovations and the socio-technical landscape, including the assimilation and distribution of artefacts through the political, technical, cultural, engineering and scientific regimes (Geels, 2004). These rules and norms are encapsulated within particular institutions that control the pathways of innovation between the niche and landscape levels (Regeer & Bunders, 2009).

The regime level creates rules and regulations (institutions) for social networks and organisations (Geels, 2004; Westley, Olsson, Folke, Homer-Dixon, Vredenburg, Loorbach, Thompson, Nilsson, Lambin, Sendzimir et al., 2011). It is here that technologies can be distributed in society through supply and demand. An example of a socio-technical regime is the set of engineering norms and standards that dictate the type of technology and materials used in construction and upgrades in South Africa.

Innovation occurs in niches, which act as “safe” spaces for new practices and technologies to develop away from market pressures and regimes that may hinder or skew the course of their development (Westley et al., 2011). The innovation can be tested or piloted within the niche level (Geels, 2004) and ones that resonate with the norms and behaviour of regimes will expand and succeed. Those that are incompatible will either be discarded or adapted to suit the market (Perez, 2007). If the market is exhausted or innovation potential has declined, then new innovations present an opportunity to influence and even change the regime (Perez, 2007).

The socio-technical landscape can be the physical environment, as well as the political, social and economic environment (Westley et al., 2011). According to Lawhon and Murphy, the landscape level therefore includes features such as “societal norms, values, geopolitics, and economic characteristics” (2011:8). An example of a socio-technical landscape is the focus on innovations that reduce carbon emissions due to the predicted threat of climate change. These innovations include renewable energies and housing construction that incorporates ecological design principles.

The multi-level perspective illustrates the different levels at which innovation occurs. Different knowledge sets also shape innovation. Tacit knowledge is explored in the following section.

Tacit knowledge and innovation

Individuals and institutions are limited in their decision-making ability by the amount of information available to them. The term “bounded rationality” is used to describe this notion (Simon, 1991).

Bounded rationality influences “codified knowledge” or our “knowing about the world” (Lundvall, 2007). Smaller and developing economies might struggle to attain the same level of knowledge as larger and developed economies that enjoy the use of “high” technologies and science-based economic activities (Lundvall, 2007; Kraemer-Mbula & Wamae, 2010). This reasoning can also be applied to micro-economic communities within countries that face limits in accessing relevant knowledge sets due to environmental constraints, such as inadequate transport systems and infrastructure, including electricity to power computers for Internet access.

Tacit knowledge, on the other hand, is inherent in every innovative individual or group. It is derived from experience and forms the base of sustained competitive advantage because it comes from within (Kraemer-Mbula & Wamae, 2010). Informal entrepreneurs and those with limited or no education or training can operate on high levels of tacit knowledge. Kraemer-Mbula and Wamae argue that the informal sector has a wealth of knowledge and experience that could aid innovation in both the formal and informal sector (2010). Tacit knowledge is also often knowledge that is not yet articulated (Haugaard, 2003 in Institute of Development Studies, 2009). If articulated, the knowledge-holder can express her/his views in a more objective way that could be evaluated through discourse (Haugaard, 2003). There is potential for innovation if such a method for articulating tacit knowledge could be devised and become an empowering process, as the contributor would become an innovator with entrepreneurial potential (Haugaard, 2003).

Situating innovation through socio-technical systems within a transdisciplinary framework provides a possible way to organise people around these systems, while initiating incremental upgrades, building capacity and empowering residents to engage with governments.

A transdisciplinary research framework

Transdisciplinarity as a research strategy emerged in the 1970s from the work of Jean Piaget, a Swiss psychologist and philosopher. He described transdisciplinarity as “between” and “across” the different disciplines transcending the limitations of interdisciplinarity (Nicolescu, 2007:18).

His epistemologically-driven goal was to unify all disciplines by blurring the boundaries between them (Nicolescu, 2007). The Austrian-born astrophysicist Erich Jantsch took this notion further and described it as a set of coordinating axioms, which represent all disciplines in order to reach a common goal (Nicolescu, 2007; Jahn, 2008). Nicolescu contended that both Piaget and Jantsch still bound transdisciplinarity to a framework within a closed system within the scientific community thus excluding general society from playing a constitutive role in the research process (Nicolescu, 2007). This realisation led to Nicolescu (2007) advocating to take transdisciplinarity “beyond” all disciplines opening up space for public participation and co-creation in the research process.

Science was no longer an objective endeavour that analysed the researched subject. The object/subject distinction was no longer valid on the dissemination of research results since both have simultaneous effects and consequences upon each other. Nicolescu’s experiences as a particle physicist aided him in this realisation because in the study of quantum mechanics the observer, or research subject, influences the experimental outcome of the researched object or particle (Nicolescu, 2007). This realisation, in conjunction with the work of others, such as Capra (1997), had significant consequences for the social sciences in that the social scientist could no longer claim to be separate from the context or environment in which s/he conducted research. Complexity theorist Edgar Morin expanded this notion further by emphasising that the researcher’s lived experiences were valuable in a context of complex problems, which cannot be addressed by a discipline-only approach (Montouri, 2013). Transdisciplinarity eventually became a concept that not only blurred the boundaries between disciplines, but also a medium through which the general public could participate in identifying and solving the research problem.

As a research methodology it needed to include public input and also observe the passive effects of the research process and its participants on the research space (Nicolescu, 2007).

It is a research methodology that can allow co-produced new knowledge to emerge from the research process. This new knowledge is conceptualised in a specific mode different to other knowledge modes.

Co-production of new knowledge

Given the context of this study in an informal settlement with groups that have a particular contextual rationality and face diverse challenges, co-production of new knowledge within a transdisciplinary framework offers a way to move beyond traditional academic discipline approaches and include the residents in identifying the research problems and contributing towards solving them. Transdisciplinary research is geared towards solving real-world problems (Regeer & Bunders, 2009). Transdisciplinarity places particular emphasis on three modes of knowledge production. These are outlined in the table below.

Table 3: The role of scientific knowledge development in three modes

	Relationship between science and practice	Presumed role of scientific knowledge development	Type of knowledge
Mode 0	SEPARATE Science and society are separate from one another.	AUTONOMOUS More scientific knowledge leads to more progress.	Monodisciplinary knowledge. Emphasis on sciences.
Mode 1	COOPERATION Co-production between science and society. No change in working methods of either.	INSTRUMENTAL Development of policy-relevant knowledge leads to the resolution of societal problems and stimulates the economy. Harmonising activities.	Mono-, multi- and interdisciplinary knowledge. Natural and social sciences.
Mode 2	CO-PRODUCTION Practice and science both actively seek the best way to structure and manage complex change processes.	TRANSDISCIPLINARY Scientific knowledge (mono-, multi-, and inter-disciplinary) is part of the joint solution process AND the process is part of scientific knowledge development.	Mono-, multi- and interdisciplinary knowledge. Also experiential knowledge.

Source: Regeer & Bunders (2009)

Mode 0, typified by scientific knowledge detached from societal input, came under scrutiny once it became apparent that science had played a leading role in enabling resource depletion and had contributed to climate change by designing extractive technologies.

Mode 1, which emerged in the 1970s, is typified by enhanced cooperation between science and society (Regeer & Bunders, 2009) with science increasingly geared towards solving societal problems, although still not focused on pressing needs. In Mode 2, which incorporates a transdisciplinary approach, society is actively involved in identifying and formulating the research problem through the co-production of new knowledge. This opened up space for context-specific innovations to emerge (Regeer & Bunders, 2009).

It is important to note that the three modes build on each other and are not exclusive. Reductionism does have a role to play regarding certain research problems.

Transdisciplinarity and incremental upgrading

Transdisciplinarity can support incremental upgrading strategies by co-producing the concepts and physical manifestation of socio-technical systems. As a research methodology it incorporates tacit knowledge into the formulation of the research problem. There is a set of common principles used as guidelines when initiating a transdisciplinary research process to avoid the “overload” that can result from taking diversity into account, gearing research towards problem-solving and the perceived common good by actors involved in the research process (Pohl & Hirsch Hadorn, 2007b).

The set of principles takes into account contextual factors, the need for knowledge and identifying actors, as well as the need to integrate different knowledge and expertise from professional, academic and the public into the research design (Pohl & Hirsch Hadorn, 2007a). In addition, it incorporates the need to develop reflexivity through a recursive process (Pohl & Hirsch Hadorn, 2007a).

Identifying actors and forming stakeholder groups is of primary importance in transdisciplinary research design as co-production of knowledge is based on the merger of scientific and non-scientific knowledge. Different stakeholder groups need to identify a common good and reach consensus on execution of the research process so that all relevant actors benefit. It is challenging to work with politically unstable communities that do not have well-defined groups or the level of rationality that synchronises with organised intervention.

As discovered in this study, an engagement strategy informed by an understanding of contextual power dynamics can transcend this limitation.

Power/knowledge

Lawhon and Murphy (2011) critique socio-technical transitions theory (especially in relation to Geels' multi-level perspective) because it does not take into account power dynamics. Socio-technical transitions are technocratically driven by particular actors with particular agendas (Lawhon & Murphy, 2011). More studies are needed to highlight points of conflict and complementarity at the different levels of transition. In addition, elite actors often overshadow the participatory aspect of knowledge creation and innovation. Lawhon and Murphy (2011:9) note that:

... conceptualization of knowledge as an objective truth and a desire to derive legitimacy from westernized knowledge-claims rather than democratic principles. Needed is not only an expansion of the range of participants and knowledges deemed relevant for transition management decision-making processes, but also a broader reconsideration of what knowledge is, where and how it is constructed, and what it means for the long-term development of a socio-technical system.

They also critique the fact that socio-technical system study is limited to case studies drawn primarily from the global North and that the case studies of the global South require a different approach (Lawhon & Murphy, 2011). Finally they note that conflict and contestation are inherent in decision-making processes and that contesting groups can lobby for their own interests to be included in the development strategy and process (Lawhon & Murphy, 2011). Studies need therefore to identify the selective pressures to be included in the development strategy and process (Lawhon & Murphy, 2011).

The co-production of knowledge within a transdisciplinary research framework does enable a deeper understanding of context, but fails to acknowledge power dynamics that influence the identification of stakeholders to initiate the co-production process. These dynamics are inherent in the research process because groups contest each other's knowledge sets.

The strongest group is likely to “win” and their knowledge set dominate the research process and outcome (Foucault, 1997 in Chilisa, 2012). Chilisa thus introduces indigenous research methodologies to situate knowledge production within a particular context (2012).

Power and knowledge are not exclusive. The transdisciplinary researcher willing to engage with a community that has its own rationality and knowledge sets must understand the existing power–knowledge nexus. To engage with informal settlement communities means exploring the various technical, social, cultural, legal and other possible means of acting to transform existing practices and introduce desired new ones. This requires transformation knowledge.

2.3.3 Transformation knowledge

In order to understand how power dynamics influence the research space, I explored the notion of power from three modes: domination, empowerment and power as a matrix. I investigated awareness of these three modes from the perspective of government and that of civil society. All three modes are prevalent in any process of upgrading informal settlements where local government and residents are in a constant power struggle over basic service delivery. This section also provides information on certain “power tools” that can be used during development processes.

Three modes of power

It is difficult to derive a universal understanding of what is meant by power. Gaventa (2003:12) recommends that “when writing about power, think about what is meant by power and how, specifically, it applies to the case study in question.” I explored these three modes because understanding them would assist in formulation of a research methodology, building capacity within the research participants and identifying an engagement method within the research space. This methodology is constructed in chapter 3.

Power as domination

Lukes, in his 2005 book *Power: A radical view*, states explicitly that power is a dominating force in the sense that it is “power over”.

He analysed power in its visible, invisible and hidden form (Lukes, 2005; Institute of Development Studies, 2009). Power is visible when the forces of power are observable, for example, decision-making power held in a political arena and executed through policy to change behavioural patterns. Lukes stressed that power is actually most dominant when it is “least observable” (2005:1).

An example of the exercise of this type of power is when things do not happen, for example, when a political system prevents civil society from entering the political debate (Lukes, 2005). Gaventa (1980) expands on this type of power noting that the dominated may become pacified or powerless. Tilly explores this notion of powerlessness and why the dominated do not revolt to uncover an important characteristic of the powerless – they lack the resources to effectively withstand the powerful (1991 in Lukes, 2005:10). Gaventa therefore makes an important point that when researching power it is as important to focus on those who do not participate in struggles for power (2003).

Lukes (2005) outlines three dimensions of power: pluralism; embracement of coercion, force and manipulation; and unawareness.

Pluralism describes a context in which different groups are able to balance each other's power (Lukes, 2005). Power is distributed equally among contesting groups who are able to lobby for change or contest policies. In this context, power can be measured (Lukes, 2005). Citizens can contest power through utilising a democratic vote. Power is also observable through conflict, such as protest (Lukes, 2005) and is visible. However, because power imbalances are not always visible, the notion of pluralism may be a utopian ideal (Lukes, 2005). Bachrach and Baratz (1970 in Lukes, 2005) also note that pluralism disregards the fact that power can be used to divert focus to non-controversial matters and instead highlight matters that are in the interests of an elite.

A second dimension is when power “embraces coercion, influence, authority, force and manipulation” (Lukes, 2005:21).

In this sense, power includes “non-decisions” where demands for change are kept out of the political arena and certain voices are not allowed to be heard. In this form, power can function overtly or covertly, but it still demands observable conflict as a measurement (Lukes, 2005). Lukes notes that power does not always depend on conflict, even when it is unobserved (2005).

The third dimension is power that shapes people’s perceptions, preferences and cognition without their awareness. For Lukes (2005) this is the most insidious form of power. In this scenario the dominated may not resist or contest power, but accept their condition as normal (Lukes, 2005). Latent conflict may exist as the real interests of the dominated are suppressed (Lukes, 2005). Hinson and Healey refer to prevalent institutions that govern meaning: “religious institutions, the media, television, mass consumer culture, popular ideas about government and about workers and bosses” and have the ability to suppress real interests (2003 in Institute of Development Studies, 2008:12).

Sadan highlights the challenge of researching and analysing this invisible expression of power and latent power that may never surface as there is no way to quantify the unobservable (1997). She calls for a new methodology that can expose the systems that inhibit the “appearance of claims” and “frustrate their transformation into political issues” (Sadan, 1997:42). She further underlines the need for a study that takes into account the historical and social factors that shape consciousness and understanding of a given problem (Sadan, 1997).

Power as transformative agent

The perspective of power as a transforming medium is prevalent in development studies, specifically in participatory action research where both the researcher and participants are changed by the experience. In this perspective, power is analysed in how it is expressed (VeneKlasen & Miller, 2002). Expressing power “with”, “to” and “within” allows one to sketch the directional flow of power among individuals and groups and can enable empowerment of the dominated. There are practical tools for using power to empower people (International Institute for Environment and Development, 2004 in Gaventa, 2003).

These tools can be used to influence policy and institutional and organisational development. Chilisa (2012) constructed a research methodology termed a post-colonial indigenous paradigm that has a particular set of processes, values and ontology. The aim is to empower the “colonised other” (the oppressed and marginalised) and sensitise the researcher to be aware of power imbalances and shape those that influence the research process and outcome (Chilisa, 2012).

This methodology forms part of the theoretical framework of this study and is expanded on in chapter 3.

Power in expression

VeneKlasen and Miller (2002) focus on developing a positive view that can bring about change. Power expressed in this way is conceived of as agency, “something people hold and use in relation with each other” (Institute of Development Studies, 2009). Power is expressed as “power with” – collaboration, solidarity and building collective transformative capacity, “power to” – the unique potential of each individual to benefit society through mutual support, and “power within” – self-worth and self-knowledge granting the capacity to imagine and have hope for a better future (VeneKlasen & Miller, 2002:39).

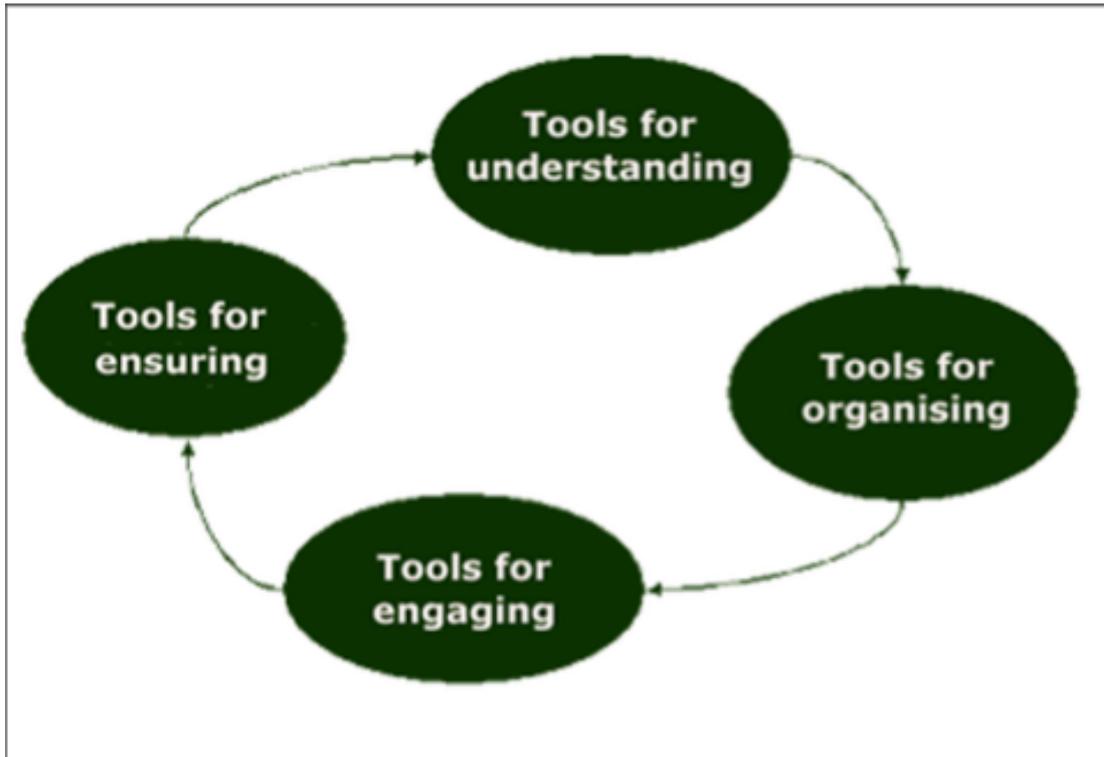
It is clear that there is a need to constructively engage with the notion of power when wanting to change a particular social field, especially in development work. The following “power tools” are useful for engaging with organisational and project dynamics and as methods for policy deliberation.

Power tools

The International Institute for Environment and Development constructed a set of tools that community development practitioners, researchers and activists can use to deliberate policy, influence development trajectories and analyse mission statements, programme aims and project outcomes (2004). These tools can be also be used by community members to map out the power dynamics in their empowerment process. The tools are designed for environmental resource management, but can be adapted for application in a context of informal settlement upgrades. The tools are designed for use in marginalised communities that have tacit, but lack articulated knowledge.

I have chosen to expand on two of the 26 tools: “doing policy work” and “stakeholder influence mapping”. These two are part of the ongoing action and reflection research cycle (see the following figure), in which all 26 tools are embedded in different sectors. The cycle allows for outcomes to be tested and groups tools according to the need of the researcher, practitioner or community member.

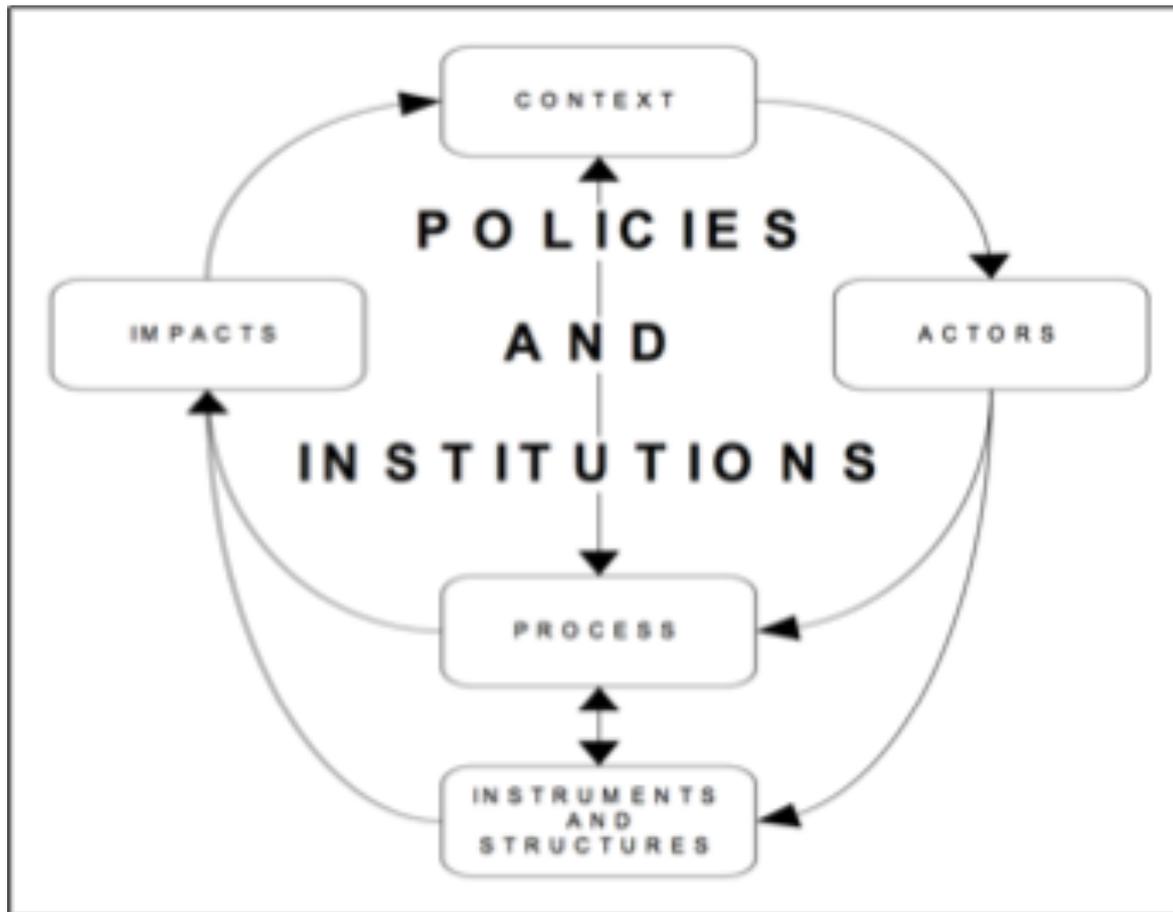
Figure 3: Ongoing action and reflection research cycle



Source: International Institute for Environment and Development (2005)

Tool 1: Doing policy work

Practitioners, researchers and community members can employ different strategies to influence policy and institutions. Gaventa (2003) highlights strategies that are derived from the following figure.

Figure 4: Doing policy work

Source: *International Institute for Environment and Development (2005)*

Practitioners and researchers can identify actors by giving them specific character names to situate them in a particular strategic path to deliberate policy. These characters are “the crafty coordinator, the wise old-timer, the spark/enthusiast, the godparent, the donor, the faithful team worker, the maverick, the political obstacle and the saboteur” (International Institute for Environment and Development, 2004 in Gaventa, 2003:17). Once these characters are identified, they can be analysed from the vantage point of two sets of influences.

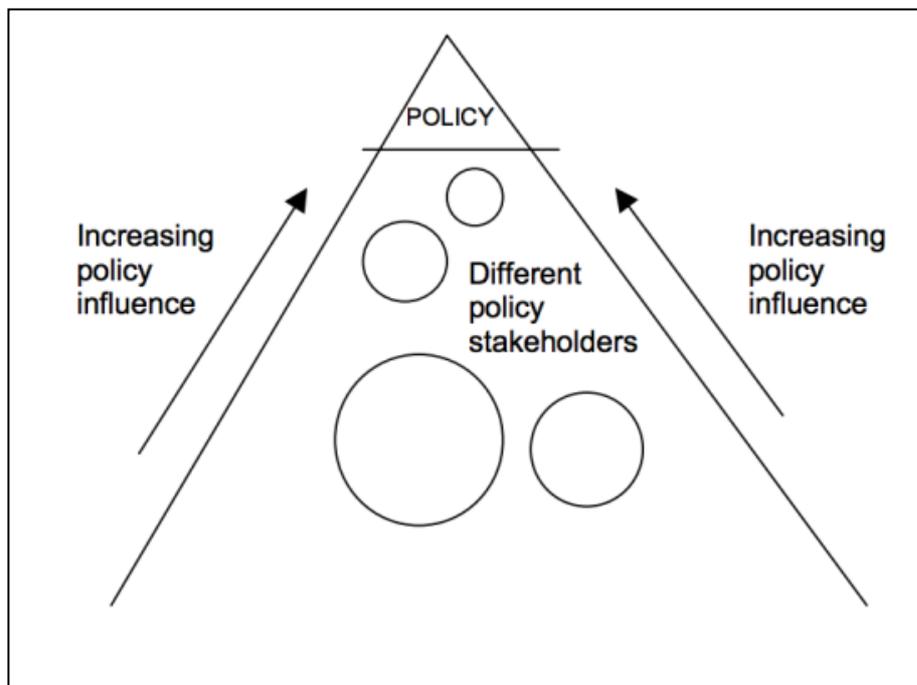
One is “Group/organisational factors, such as mandates, rules, norms, functions and institutional culture”, and the other is “Individual motivation factors, such as ideological predispositions, pursuit of political objectives, position and control of resources...” (International Institute for Environment and Development, 2004 in Gaventa, 2003:17).

Once these strategies are identified with specific actors and related influences, then practitioners can devise an action plan on how to approach these actors in order to research the envisaged outcome.

Tool 2: Stakeholder influence mapping

This tool provides guidelines for analysing the stakeholder network to determine who holds power and where it originates. “Stakeholder power can be understood as the extent to which stakeholders are able to persuade or coerce others into making decisions, and following certain courses of action” (International Institute for Environment and Development, 2004 in Gaventa, 2003). Stakeholders may also include informal actors, including those, for example, with personal relationships with influential politicians (International Institute for Environment and Development, 2004 in Gaventa, 2003). The International Institute for Environment and Development (2004) provides illustrations to map out the stakeholder network based on the influence held by each. The blueprint for this type of map follows.

Figure 5: Stakeholder influence pyramid



Source: *International Institute for Environment and Development (2005:7)*

This blueprint is used to map out stakeholder decision-making power over time.

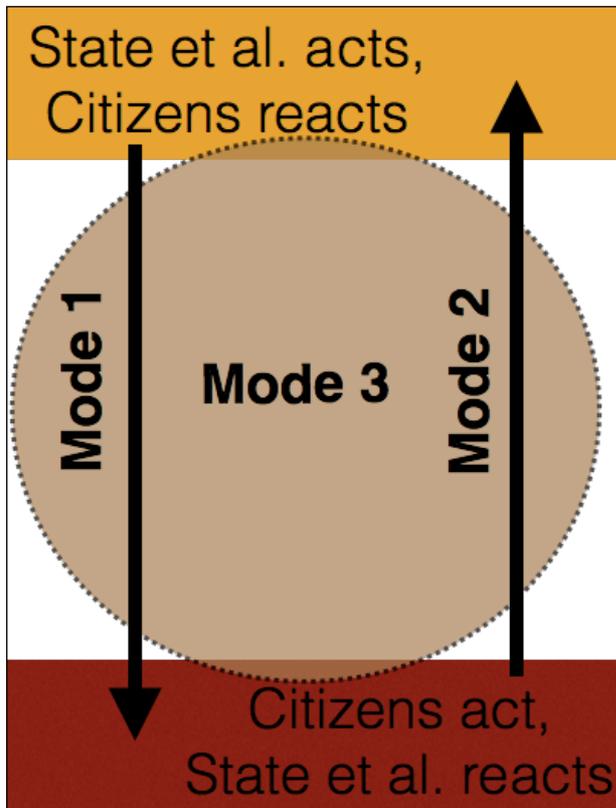
The bigger the circle representing the stakeholder, the more members it has and the closer the circle to the apex, the more influence the stakeholder will have on policy outcomes. A few pyramids can be used in chronological order and at the end of the exercise these are combined to see changes over time and identify trends. The process is facilitated in a workshop format with different participants.

Gaventa concludes on the use of power tools noting that just as the power of discourses can shape actors and organisations, so too can actors, in their use of power tools, shape discourses to suite their own outcomes (2003).

Power as matrix

The following figure provides a relationship model of three modes of power. In Mode 1, power is perceived as domination wielded by those with political, economic, institutional, scientific and religious power. Mode 2 represents civil society where power is expressed as transformation through acts of empowerment and in Mode 3 power is perceived as a matrix in which roles may shift between the first and second modes with some entities co-existing in either mode depending on context.

This ability to co-exist in different modes or shift the locus of power highlights how the pervasive nature of power and how it can change in form and expression dependent on the relationships that holds, expresses and articulates it. Power is everywhere since it is not an object to be wielded, possessed or created (Foucault, 1997 in Lukes, 2005).

Figure 6: Relationship model of the three modes of power

Source: Author

Three concepts of the power matrix

Power as a matrix is characterised by three concepts. The first relates to power relationships within the actor-network. This network includes both living and non-living “actors” because people, technology, concepts and opinions also influence the relationship (Latour, 2005). All are continually shaped within the network through their active participation in the research and development process (Latour, 2005). The second refers to the way of thinking of particular groups within the matrix as different stakeholders will hold different worldviews, assumptions and practices.

The disciplinary background of the researcher also affects her or his thought style (Pohl et al., 2010). The research facilitator needs to make these different styles of thought explicit to all stakeholders as different groups will have different desired outcomes or agendas (Pohl et al., 2010). This requires an awareness of power in its relational form.

The transdisciplinary researcher needs to mediate between these sometimes competing interests to find common ground prior to initiating a process of problem-solving-orientated research.

The third concept relates to the social boundaries created by actors as participants in the power matrix. Hayward (1998) develops a spatial approach of relational power by referring to the construction of social boundaries. Actors shape these boundaries to acquire the right to participate or to define and shape the space within which they choose to participate (Hayward, 1998 in Institute of Development Studies, 2009). The process of defining these boundaries provides a critical view of the power dynamic and provides space for deliberation and strategising on how to dismantle hegemonic power structures through empowerment and capacity building.

Metaphorical and concrete expressions

Power can then be situated in both metaphorical and concrete expressions. Cornwall describes power in terms of its spatial characteristics to illustrate the relationships between actors within the participatory development network (2002). She describes spaces in both metaphorical terms – the spaces that are filled with discourse, deliberation and negotiations where opportunities for engagement are perceived or conceived – and in concrete terms such as the lived places where power is contested and where citizens can enter and animate these political spaces (2002). The actors within these spaces may represent government, civil society and the intermediaries in between, such as civil society organisations, the private sector and policy research institutions.

Cornwall looks at participation through the notion of spaces because this approach allows a discussion of power relationships as opposed to viewing them through a set of predefined groups, institutions and movements. She asks “who speaks for and about whom” by looking at sites of participation with specific connotations of politics, culture and history (Cornwall, 2002). Actor groups in participatory development interact with the spaces by creating, reshaping or open possibilities to contend within the political arena (Cornwall, 2002). Lefebvre states that actors and their particular histories produce spaces that open up possibilities for new actions with both enabling and blocking consequences (1991 in Cornwall, 2002).

Cornwall also refers to the Foucaultian notion of “heterotopias” where the rules of interaction are changed and replaced with new ways of action (Foucault, 1986 in Cornwall, 2002:7). The powerful also create spaces for the public, although, this may then make the spaces for engagement by the non-invitees illegitimate by neutralising their efforts to be heard (Cornwall, 2002).

When spaces are reshaped, actors will move into them to reconfigure the *status quo* through voicing their opinions. The reshaping of spaces also occurs in instances of policy deliberation where the public, through voicing their opinions, reshape policy realisation. The reshaping of spaces also creates the opportunity for participants to reposition themselves within the actor network, which was previously dominated by traditional governance and old structures and to open possibilities within the old structures for new levels of participation (Cornwall, 2002).

Spaces are opened for participation through invite whereby the opinions, discourses and deliberation of the public can be brought into the political arena. The Habermas notion of the public sphere is considered a space that is opened since different institutions open the possibility for deliberate democracy through citizen engagement (Habermas, 1984 in Cornwall, 2002:4). Cornwall proceeds to describe the spaces in terms of four clusters of engagement. The first is an institutionalised form of engagement with state representatives of functions (Cornwall, 2002). These spaces are open by invite and can exclude certain individuals or groups from deliberations on decision-making processes (Cornwall, 2002). The second cluster is in the political arena filled by transient institutions.

These are temporarily opened spaces (once-off meetings, workshops or events) for spaces such as policy deliberation (Cornwall, 2002). These are spaces appropriate for participatory rural appraisal that encompasses a multitude of approaches to include those normally excluded from the planning process (Chilisa, 2012).

Cornwall contends that these spaces are generally created to gather public opinion, such as through voting (2002). These spaces may actually also serve as spaces to conduct market research on specific policies (Cornwall, 2002).

The third cluster deals with spaces created by citizen representative bodies, such as NGOs, parastatals and private interests (Cornwall, 2002). Citizens enter these spaces once mobilised and they can choose to stay or leave. Participation in these types of spaces is therefore seen as an act of identification as citizens are not labelled according to their demographic profile (Cornwall, 2002). The last cluster relates to movement in spaces, such as protests, actions or brief moments in time. They are “spaces of appearance” in that the collective participation bestows a collective identity on participants for a brief time. These spaces are increasingly delegitimised by institutional bodies that are attempting to direct the plurality of approaches into their preferred channels of participation (Cornwall, 2002).

The nature of the space influences the level and nature of participation. This is also shaped by power dynamics and brings to the fore the importance of understanding the notions of identity, agency and power (Cornwall, 2002). These shape engagement strategies within the political development process. The actual site of participation then plays an important role in understanding and mediating power differentials between practitioners, researchers and research participants.

2.4 Conclusion

This literature review has traced urbanisation patterns and the emergence of informal settlements, which the state perhaps lacks the capacity to service and upgrade. The various stages of housing policy in South Africa were described to provide a context for the informal settlement of Enkanini, the focus area of this study.

Different forms of knowledge were examined to explain the emergence of co-produced knowledge and this was expanded on in a framework of transdisciplinary research. This type of research has the potential to overcome the lack of explicit knowledge in informal settlements, but take advantage of implicit knowledge. However, it faces challenges when confronted with a research context that is not formally organised.

Hence, notions of power were examined to gain insight into how to mediate power differentials. Two useful tools were outlined in terms of enabling policy deliberation and mapping of organisational and institutional structures.

Situating power in a spatial dimension enables an understanding of how the space the research is conducted in can influence power dynamics, enable capacity building, co-production of new knowledge, as well as co-production of public services.

Chapter 3: The methodological triad and co-arising

“To study knowledge and development without attention to space and politics would be to ignore important ways in which development is contested and knowledge acts as a strategy in development.”

(McFarlane, 2004:18)

3.1 Introduction

I combined three methodologies (transdisciplinary, indigenous and reflexive research) into a framework through which to analyse the data, experiences, theories and practices of this research study. Combining various approaches can substantiate the research findings derived from complex social phenomena and enable the researcher to sidestep the possibility of “bending” findings in order to fit the theory and allow the research findings to “stand above” the theory (Yachkaschi, 2008:39).

In the process of combining methodological approaches, the need for a conceptual tool emerged with which to navigate the interdependency of theory and practice, cause and effect, the relational aspect of knowledge and being and the non-linearity of the research process. In effect, the tool, coined in this study as “co-arising” acts as a guide to the complexity of the research context and content. I found it imperative to construct “co-arising” because having been in the research space for three years and played many roles in that space I struggled to separate data and analysis, object and subject (mode 0 knowledge) and the boundaries between researcher and companion. The notion of co-arising helped me understand these dualities as part of the engagement strategy, navigate the complexities and observe the potential for capacity building.

As the following methodological framework shows, co-production of knowledge through transdisciplinary research includes contributions from non-scientists; indigenous research recognises local knowledge as equal to scientific knowledge for capacity building; and reflexive research places the researcher as an actor in the research space. This methodological triad supports co-arising as a medium through which I hoped to be able to overcome the struggle with dualities.

I describe the potential and shortcomings of the three methodologies in this chapter and discuss the notion of co-arising.

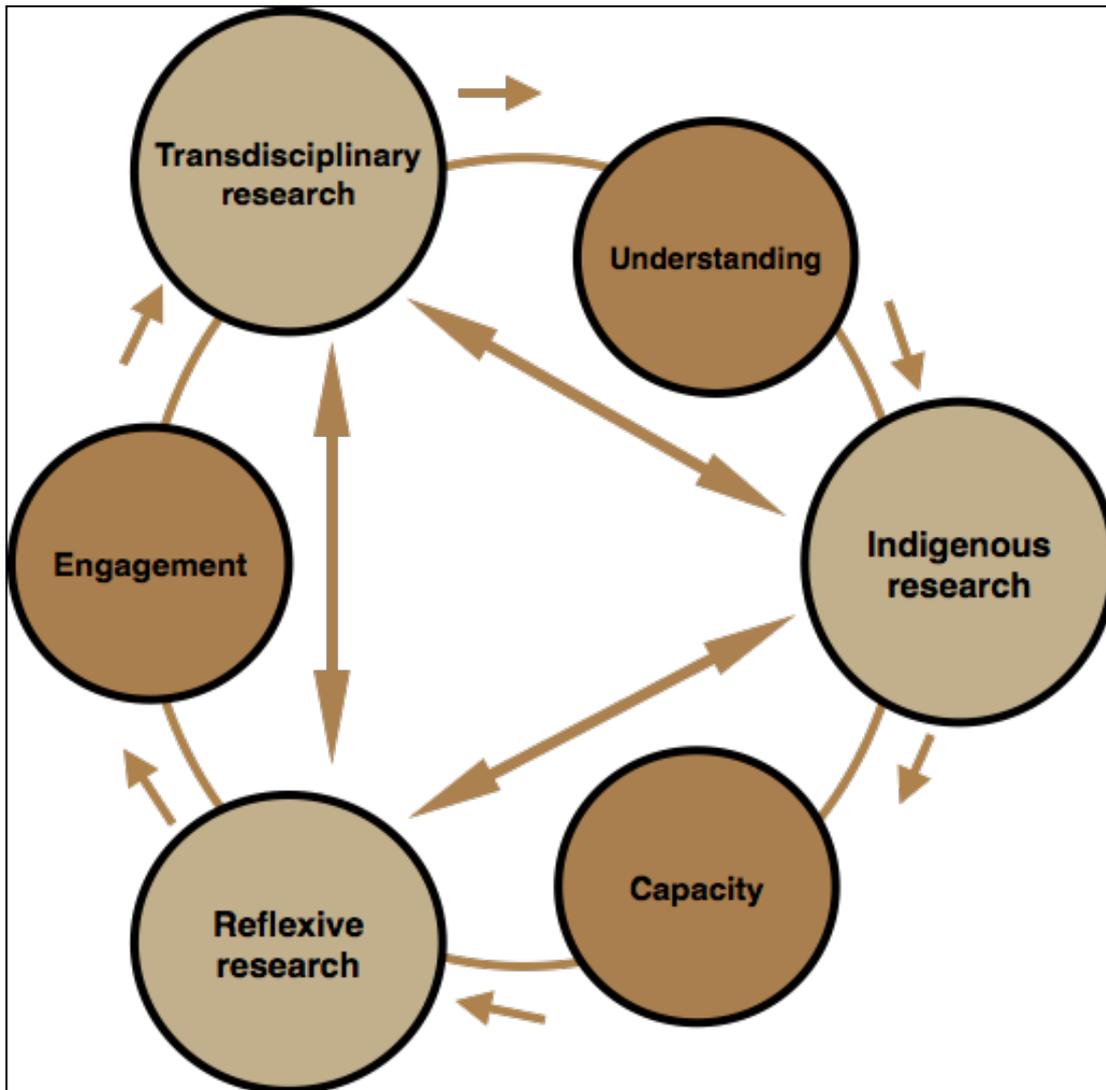
3.2 The interdependent methodological triad

I chose these three methodologies as each contributed to uncovering particular aspects of the study; in effect, each allowed me to explore a pertinent theme. Transdisciplinary research is linked to the theme of understanding through the process of co-producing knowledge. Indigenous research relates to capacity building by creating an awareness of power from both a critical and transformational perspective. Reflexive research allows for an exploration of engagement as researchers are required to become aware of their effect on the research space and their influence on the research outcome.

The three methodologies are interdependent and form a symbiotic and mutually reinforcing relationship. Grbich explains that a qualitative research strategy can include a host of different methodologies with an “epistemological location” (2007 in Yin, 2011:18) that draws from their philosophical underpinnings, constraints and opportunities to find a “viable middle ground” (Gubrium & Holstein, 1998 in Yin, 2011:18). In this study, the “middle ground” location is the notion of co-arising, which forms the methodological framework applied during the research process.

The interdependent methodological triad is depicted in the following figure. The two-way arrows in the figure indicate the supportive links between each. For example, transdisciplinary research supports both indigenous and reflexive research through its well-defined method of co-production.

Figure 7: The interdependent methodological triad



Source: Author

The following sections outline the strengths, weaknesses and contributions to the study made by each methodology.

3.2.1 Transdisciplinary research

Transdisciplinary research methodologies result in new understandings of the world that are derived from co-produced new knowledge. This new knowledge transcends prior thought modes, which were considered objective and axiomatic. This research methodology attempts to overcome the limitations of mono-discipline scientific approaches and generate research that produces contextually relevant societal knowledge in collaboration with societal actors.

The conditions, process, epistemology, values, contribution and limitation of transdisciplinary research are outlined below.

Conditions for use

Transdisciplinary research is useful when knowledge about a societal problem field is uncertain (Pohl & Hirsch Hadorn, 2007a; Funtowicz & Ravetz, 1991 in Hirsch Hadorn et al., 2008), when the concrete nature of the problem is disputed and when there is a great deal at stake for those affected by the problem (Pohl & Hirsch Hadorn, 2007a). Laws et al. identify sustainable development as a problem field because it represents both practical and conceptual challenges (2004 in Scholz, Lang, Walter, Wiek & Stauffacher, 2006). In addition, Funtowicz and Ravetz note that this need is at the core of “post-normal” science implying the need for alternative scientific approaches (1993 in Hirsch Hadorn, Biber-Klem, Grossenbacher-Mansuy, Hoffman-Rlem, Joye, Pohl, Wiesmann & Zemp, 2008).

This methodology is able to grasp complexity, embrace both real-world and scientific perceptions of problems and link abstract and case-specific knowledge, as well as develop knowledge and practices to promote what is perceived to be the common good (Pohl & Hirsch Hadorn, 2007b). Brent refers to this common good as the values and practices that a group hold in the context of research and development (2012). Pohl and Hirsch Hadorn ascribe the common good as an ethical principle (2007b). This is discussed further under *Value systems* in this section.

It is also useful when researchers are faced with unstructured problems, such as those with high levels of complexity that cannot be addressed in mono-, multi- or interdisciplinary frameworks. Urbanisation and the resultant growth of informal settlements is such a problem field because it encompasses environmental, social and economic forces. Regeer and Bunders further note that single organisations and institutions with their own particular paradigmatic criteria need to formulate new actions and strategies outside of their respective paradigms when confronted with unstructured problems (2009). Addressing such problems therefore embraces a process of learning (Regeer & Bunders, 2009).

The research process

There are three discrete phases to transdisciplinary research that are not necessarily followed chronologically because there may be a need for recursive techniques in which the researcher and participants go back and reflexively reanalyse a step (Pohl & Hirsh Hadorn, 2007a). Recursiveness allows for the research process to be adapted by constantly testing concepts and methods (Pohl & Hirsh Hadorn, 2007a). Reflexivity allows the researcher to constantly test her/his own assumptions and theories. The three phases are (Pohl & Hirsh Hadorn, 2007a):

- Identifying and structuring the problem
- Analysing the problem
- Using the results to address a societal problem and contribute to better understanding.

Epistemology of transdisciplinary research

As previously noted, research produces knowledge in three different modes. Mode 2 produces knowledge that is non-hierarchical, which places scientific and societal knowledge on equal footing (Regeer & Bunders, 2009). Knowledge in this mode can be controversial and contradictory because it is not always possible to separate out opinions, ideas and facts (Regeer & Bunders, 2009). Knowledge is therefore socially constructed and cannot be “black-boxed” (Latour & Woolgar, 1979 in Regeer & Bunders, 2009:55) thus separating the data from the actors that constructed and formulated meaning from it. A relational view of knowledge challenges the traditional view of knowledge separate from society and knowledge production, in the context of transdisciplinary research is “with”, rather than “for” society (Swilling et al., 2013).

Value system

Transdisciplinary research promotes what is perceived as the common good. Researchers and research participants must reach consensus on what the common good is in the particular problem field (Pohl & Hirsh Hadorn, 2007b). The definition of the common good can therefore become a research question on its own in transdisciplinary research (Pohl & Hirsh Hadorn, 2007b).

In order to facilitate a democratic process to reach consensus among stakeholders, transdisciplinary research follows a set of principles or values. These are (Pohl & Hirsch Hadorn, 2007a:21):

- To reduce complexity by specifying the need for knowledge and identifying those involved.
- Developing knowledge aimed to solve real-world contextual problems using empirical knowledge in combination with input from the community.
- Aiming for integration through being open to encounters.
- Developing reflexivity through recursiveness.

Transdisciplinary research's contribution

Transdisciplinary research enables an understanding of a societal problem field that could not have been reached using a mono-discipline approach. This is achieved by incorporating non-scientific knowledge or experiential knowledge into the design framework through the notion of the co-production of knowledge (Regeer & Bunders, 2009).

Limits to this method

Primarily formulated in the global North, transdisciplinary research provides for a universal language for complex issues, but it fails to take power dynamics into account. This is problematic in a country such as South Africa with its unique history of oppression and discrimination under the apartheid regime that entrenched inequality along racial and class lines. This inequality has been further entrenched during the transition to a neo-liberal capitalism economy and engagement in the global market (Arrighi, Aschoff & Scully, 2010).

Practising transdisciplinary research in the South African context faces two primary challenges, both experienced during this study. These are that identifying stakeholders is problematic as they often attempt to use their influence to contest for political power on the municipal, organisational and community-leadership level (Wiggins et al., 2004 in Pohl et al., 2010:271).

This effectively politicises the co-production of knowledge process and the result can be an undemocratic representation of stakeholders. It is a particular issue when working in communities that do not have representative or “formal” leadership structures. In addition, as coloured and black Africans have historically been marginalised from active participation in development projects, there is a gap of understanding between stakeholders and a lack of an agreeable “language” (Chua et al., 2010). Stakeholders need to be ready to engage prior to implementation of incremental upgrading processes (VPUU, n.d.)

In conclusion on transdisciplinary research

While the transdisciplinary framework provides for flexibility and a tool with which to explore complex problems, its historical Northern origin is not entirely applicable in the South African context. While the methodology emphasises the inclusion of non-scientists in the research process, it must be questioned whether it facilitates the entry of non-academic or uneducated non-scientists. Can this practice be adapted in South Africa, with its historical and entrenched social and economic inequities and resultant low numbers of higher-education graduates, to contribute to a Southern perspective on transdisciplinary research that works with indigenous knowledge?

3.2.2 Indigenous research

Indigenous methodology¹ aims to empower and build capacity in people. It is structured to bring about a better understanding of assumptions and perspectives among the researcher and researched (Chilisa, 2012:13) by releasing the “captive mind” and enabling new ideas, ways of thinking and lifestyles.

The captive mind can be defined as an uncritical imitation of Western scientific research paradigms (Alatas, 2004 in Chilisa, 2012:7) and its release opens up the potential to move to a post-colonial and indigenous way of doing research (Chilisa, 2012).

¹ Bagele Chilisa, Associate Prof. at the University of Botswana, her country of origin, formulated indigenous research methodologies. For practical purposes, indigenous research methodologies and indigenous research can be used interchangeably whereby both terms relate to the work of Prof. Chilisa. This outline is taken from her book titled *Indigenous Research Methodologies* (2012).

The research process is indigenised by including ethnophilosophy, indigenous knowledge systems, stories, philosophical sagacity (knowledge of community sages) and other language frameworks (Alatas, 2014 in Chilisa, 2012:7).

It also incorporates local phenomena to define research issues and creates local theories and methodologies, which can be integrated with Western theories. It is created in the multiple, connecting realities of the living and non-living and the cosmos and the environment. It is axiomatically constructed by Ubuntu ethics² and epistemologically constructed around relational knowledge. By drawing from other research paradigms such as positivism (discovering scientific laws for universal application), interpretation (to understand and describe human nature) and transformative research (to empower people to change society radically) the indigenous research paradigm acknowledges a multitude of research approaches (Chilisa, 2011). It can be qualitative and quantitative in nature as data can be verified through triangulation and prolonged field experience, among other techniques (Chilisa, 2011).

Conditions for indigenous research

Indigenous research is used when inequality and marginalisation of a group is apparent and they have no “voice” in a research space dominated by Western methodologies and colonising epistemologies (Chilisa, 2012:XV). Groups that experience this type of treatment include women, the formerly colonised, minorities, the historically and economically oppressed, the disabled and indigenous people (Chilisa 2012:XV). These groups are collectively referred to as the colonised “other” and they are often found in so-called developing and under-developing countries (Chilisa 2012:12). It is premised on capacity building among research participants to enable active participation in the entire research process (Chilisa, 2012).

² Ubuntu ethics, according to Desmond Tutu “is the very essence of being human” since a person with Ubuntu is available to others, affirms others and is also diminished when others are diminished through oppression and humiliation for s/he belongs to a greater whole (Tutu, 1999 in Chilisa, 2012:22).

Indigenous research process

There are two stages to indigenous research. The first is a critical “decolonisation” process to release the captive mind and the second is participatory action research aimed at transforming the researcher and researched. These two stages often facilitate the shift from researcher and researched to activist (Chilisa, 2012).

These two stages are outlined briefly below.

Stage 1: Decolonisation process

There are five phases that participants of this exercise go through. These are (Laenui, 2000 in Chilisa, 2012:15):

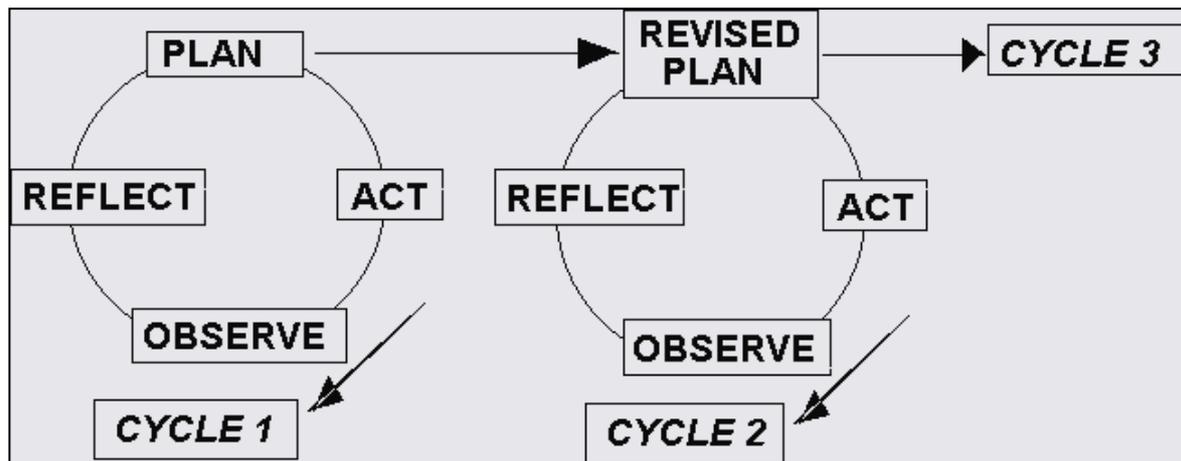
- **Rediscovery and recovery:** Create awareness of history to enable participants to define their own context in the research outcomes.
- **Mourning:** Lament the hurts of the past to start the healing process.
- **Dreaming:** Evoke memories and explore histories, cultures and indigenous knowledge systems in a facilitated process to imagine a better future. This is known as appreciative enquiry.
- **Commitment:** Commit the research to change and accept the challenge to bring in the voices of the colonised other. This applies to the researcher and it is at this stage that the role of the research project is defined as well as the researcher’s role in the community.
- **Action:** Undertake participatory action research encompassing empowerment and capacity building in the process.

Stage 2: Participatory action research

Participatory action research engages the colonised other in a collective inquiry process aimed at empowering participants in various aspects of their lives (Chilisa, 2012). It can be used to reverse the knowledge flow that normally travels from the global North to the South (Chambers, 1997). Through this process the colonised other becomes the co-researcher and collaborates throughout the research process (Chilisa, 2012).

The following figure indicates the repetitive cycles of this methodology in which six principles are embedded. These are planning a change, acting and observing the process and consequence of change, observing, reflecting on the process and consequences, replanning, acting and observing again.

Figure 8: The basic action research cycle



Source: Carr & Kemmis, (1986)

Indigenous research epistemology

Chilisa notes that “Epistemology enquires into the nature of reality and truth” (2012:21). Western knowledge systems perceive knowledge as an object to be gained or owned in contrast to indigenous knowledge systems that perceive it as relational and constituted between all that exists in creation (Wilson, 2008 in Chilisa, 2012:21). Chilisa puts forward that the two are not exclusive and outlines four paradigms from which the researcher can choose to conduct her/his research. The first is the positivist paradigm, which aims to find generalisable universal laws and perceives knowledge as objective, verifiable and observable (Chilisa, 2012). This is reflected in Mode 0 (table 3) in which science and society are seen as separate entities. The second is the interpretive paradigm in which knowledge is perceived as subjective and focuses on a particular subject looking for generalisable laws within multiple socially constructed realities (Chilisa, 2012).

Truth is thus dependent on context. The transformative paradigm views knowledge as dialectic, adaptable and able to offer a critical perspective on practice and custom (Chilisa, 2012).

A multiplicity of critical responses to gender, race, rights, justice, culture, politics and disability values shapes realities and truth is informed by theories that unmask illusions. The last is the indigenous research paradigm in which knowledge is viewed as relational and socially constructed (Chilisa, 2012). Truth is informed by these multiple relations (Chilisa, 2012).

Value system

This research methodology rests on the premise that “ethics and value beliefs that define relations and responsibilities of researchers to the researched should be addressed before ontological and epistemological questions and should drive the research process from formulation of research proposal to dissemination of findings” (Chilisa, 2012:20). The emphasis on relations is expanded on briefly below.

Relational ontology

According to Chilisa (2012:20) “Ontology is the body of knowledge that deals with the essential characteristics of what it means to exist.” This is best captured in the philosophy of Ubuntu – “I am we; I am because we are: we are because I am” (Goduka, 2000 in Chilisa, 2012:21). There is therefore a common responsibility towards other human and non-human beings.

Relational epistemology

The relational aspect of knowledge points towards the researcher’s responsibility and accountability to the researched (Wilson, 2008 in Chilisa, 2012:21). Many communities may have their own sets of taboos and traditions and Chilisa (2012) recommends that communities have the opportunity to discuss and formulate their own research knowledge systems, become researchers themselves and decide on whether they can be written about, what can be written and how it should be written (Chilisa, 2012).

Relational axiology

Axiology is value analysis to understand their meaning, purpose, characteristics and influence on the daily life (Chilisa, 2012: 21). It is built on the principles of relational accountability (the researcher is accountable for relations), relational representation (how the researcher listens, acknowledges, pays attention and allows the voices of others to emerge), reciprocal appropriation (research benefits should go to the researcher and the community) and rights and regulations (how ownership of the research process and produced knowledge is accorded) (Chilisa, 2012).

Regarding the last, the researcher should be guided by Ubuntu ethics and view her/himself as a reflection of the researched (Chilisa, 2012).

Indigenous research's contribution

Indigenous research builds capacity and awareness of power dynamics in both the researcher and the researched, while expanding the scientific knowledge base. It draws from both Western and indigenous research methodologies to bring the world-view of the researched to centre-stage. Importantly for this study, it highlights the importance of problematising research as a power struggle between the researcher and the researched (Chilisa, 2012) and within the researched as multiple knowledge sets contest for ownership of the context, direction and outcome of the research (Foucault, 1977 in Chilisa, 2012:7).

Limits to this method

While Chilisa (2012) highlights the necessary ethical principles for engaging in participatory action research with the colonised other, she does not address a situation where the researcher is foreign (for example, not from southern Africa) or is not representative of the colonised other (de Goede, 2013).

In conclusion on indigenous research

The contribution that this research methodology offers to this study is invaluable, situated as it is in a context of unequal power relations with stakeholder groups comprising various colonised others.

Chilisa's (2012) call on researchers to decolonise their research frameworks and base research on a relational ethical value system to transform and build capability in the researcher and the researched is critical. However, this methodology does not address how a researcher overcomes radical differences in worldview to the researched. This needs to be done by adopting a reflexive approach to the work.

3.2.3 Reflexive research

Reflexive research³ provides the researcher a means of engaging with the research space and its actors. As a methodology, it starts from the premise that all empirical data results from the researcher's interpretation of facts, consequently there is no distinction between subject and object (Alvesson & Sköldbberg, 2000).

The researcher must be aware of the research community, broader society, her/his own intellectual and cultural traditions and theoretical assumptions, as well as that of the researched and the central importance of language and narrative within a given research context (Alvesson & Sköldbberg, 2000). It does not provide an overarching method to apply to a qualitative research study, but rather informs researchers in their own chosen approaches to the research project (Czarniawska, 2009).

Conditions for reflexive research

Reflexivity is a practice and, as such, does not depend on a particular set of conditions for initiation. Social scientists employ reflexivity to generate a self-awareness of the socio-political character, the context-dependent character of language and the dependence of empirical observations and data on interpretation within a particular field (Czarniawska, 2009). As a method of interpretation, it is concerned with adding new knowledge to a particular social field and geared towards influencing that field by analysing power dynamics, structures and institutions (Gaventa, 2003). Practising reflexivity lends credibility to the research outcome by providing a framework encompassing and attempting to balance the four scientific philosophies outlined in the reflexive research process below as levels (Alvesson & Sköldbberg, 2000).

³ Reflexive research is mainly drawn from the work of Alvesson and Sköldbberg in their book titled *Reflexive Methodology* (2000).

It also assists with a central research methodological problem in that it helps put data, findings and analysis into perspective by paying attention to the rhetorical, political and interpretive nature of empirical research (Alvesson & Sköldbberg, 2000).

Reflexive research process

The practice of reflexivity encompasses four levels, as opposed to the level-specific nature of reflection. Reflection is to think “about the conditions for what is one doing, investigating the way in which the theoretical, cultural and political context of individual and intellectual affects interaction with whatever is being researched, often in ways difficult to become conscious of” (Alvesson & Sköldbberg, 2000:246). Reflexivity is an extension of this process aimed at “seeing and pointing something out” that is normally hidden (Alvesson & Sköldbberg, 2000).

The four levels are outlined briefly.

Data-orientated methods

Grounded theory, ethnomethodology and inductive ethnography are examples of data-orientated methods in that a logical path is followed to process empirical data. The focus is on systematic and techniques (Alvesson & Sköldbberg, 2000).

Hermeneutics

At this level method and theory cannot be disengaged as assumptions influence interpretation and representation of data (Alvesson & Sköldbberg, 2000). Reflecting in this manner provides the researcher with the tools to gain and illuminate insights that might otherwise have been rejected (Alvesson & Sköldbberg, 2000).

Critical theory

Critical theory is based on the premise that no study is politically neutral because of the pervasive character of power relations (Alvesson & Sköldbberg, 2000).

Research can therefore only support or negate the political-ideological characteristics of the research space (Alvesson & Sköldbberg, 2000).

Post-structuralism and post-modernism

At this level of reflexivity, the researcher becomes aware of her/his influence on and perhaps authority over the researched. A plurality of voices needs to be taken into account, which is contextually relevant and informed by a critical outlook on the social histories of the context (Alvesson & Sköldbberg, 2000). This approach disregards any grand narratives that form axiomatic theories for the reflexive process (Lyotard, 1979 in Yaschkashi, 2008:44).

Reflexive research epistemology

When we reflect, we try to ponder upon the premises for our thoughts, our observations and our use of language ... the core of reflection (reflexivity) consists of an interest in the way we construct ourselves socially while also constructing objects ('out there') in our research. For without construction, and without a constructing and constructed self, there is no meaning.

(Alvesson & Sköldbberg, 2000:246).

Knowledge in reflexive research is socially constructed and therefore dependent on the interpretive, political-ideological and rhetorical characteristics of the social space (Alvesson & Sköldbberg, 2000). The views of the researcher result from her/his own interpretations of his/her assumptions, beliefs and ideologies (Alvesson & Sköldbberg, 2000). Data is thus the sum of interpretations.

A clear distinction is made between the robust and objectivist view of knowledge and the consciousness and experience-orientated interpretive view of knowledge (Alvesson & Sköldbberg, 2000).

Value system

Reflexive research is not based on a particular value system as it is set on the researcher's perceptions based on her/his own interpretation of the data.

It aims to be an ethically and morally neutral method that allows the researcher to construct a value system based on the empirical findings interpreted through the reflexive research process. It attempts to encompass the views of the researched into interpretation of the data.

Reflexive research's contribution

This research methodology provides a way for the researcher to understand how s/he contributes, distorts or changes the research space through enabling an understanding of her/his own assumptions, beliefs and prejudices. It can be used in conjunction with other methodologies and is most effective as a lens through which to view the nature of qualitative methodologies (Czarniawska, 2009).

Limits to this method

An over-reliance on reflexive research can isolate the researcher from the dynamics of the socio-political space and engender the risk of the empirical findings being neglected or under-stated (Alvesson & Sköldberg, 2000). In extreme cases, the researcher runs the risk of falling into the trap of narcissistic self-centredness that contradicts the very purpose of using this methodology (Alvesson & Sköldberg, 2000). It is thus crucial that the socio-political realm of the research space remains centre-stage (Alvesson & Sköldberg, 2000).

In addition, reflexive research does not provide a set of tools to reflect and interpret the research space from a practical perspective (Alvesson & Sköldberg, 2000). Swilling notes that reflexivity can benefit from the practical methodologies, particularly the co-production of knowledge in transdisciplinary research (Swilling, 2012). In this study, transdisciplinary research is used to compensate for this weakness of reflexive research.

In conclusion on reflexive research

Reflexive research assists the researcher to engage with research findings, different methodologies and the research space, which encompasses both the object and the subject of the research study. It enables the researcher to become conscious of misleading facts, hidden truths and underlying assumptions on theoretical and practical levels.

The three methodologies discussed above complement each other's limitations and enhance each other's strengths. For this reason, they have been compiled as a triad of supporting methodologies.

3.2.4 Concluding on the methodological triad

The table below illustrates a summarised version of the contribution, limits and convergences of the three methodological approaches.

Table 4: The contribution, limits and convergence of the interdependent methodological triad

Methodology	Theme	Limits	Convergences
Transdisciplinary research	Understanding	Limited capacity to recognise power dynamics.	Merging theory and practice. Social construction of knowledge.
Indigenous research	Capacity	Limited advice on how to engage with the research space as an outsider.	Working with and for society. Recursive research process.
Reflexive research	Engagement	Limited practical tools on how to engage with the research space.	A constructive and pragmatic research process.

Source: Author

There is a logical flow from the approach of transdisciplinarity to incorporating indigenous research and reflexivity with each one compensating for the others' limitations. By using all three of these methodologies in the study a mechanism emerged that is constitutive of this interdependency. The convergences are indicated in the following table.

Table 5: Convergences of the interdependent triad

Convergence	Transdisciplinary research	Indigenous research	Reflexive research
Theory is merged with practice.	Knowledge co-creation is orientated towards finding solutions.	Indigenising knowledge highlights contextually relevant problems.	Facts and assumptions are not independent from practice.
Working with and for society (relational knowledge).	Knowledge is socially constructed.	Knowledge is socially constructed.	Knowledge is socially constructed.
The research process is recursive.	Embodies recursiveness as a principle.	Embodies recursiveness as a strategy.	Embodies recursiveness as an ongoing action.
Construction and pragmatism in research process.	Co-production leads to new knowledge for implementation.	Action research confronts a societal issue through the indigenous knowledge paradigm.	Interpretation constructs language for pragmatic use in the research space.

Source: Author

Out of this process of finding the convergences required to navigate the complexities of the research space – an informal settlement with unstructured leadership and a range of power dynamics – the notion of co-arising emerged.

3.3 Notion of interdependent co-arising

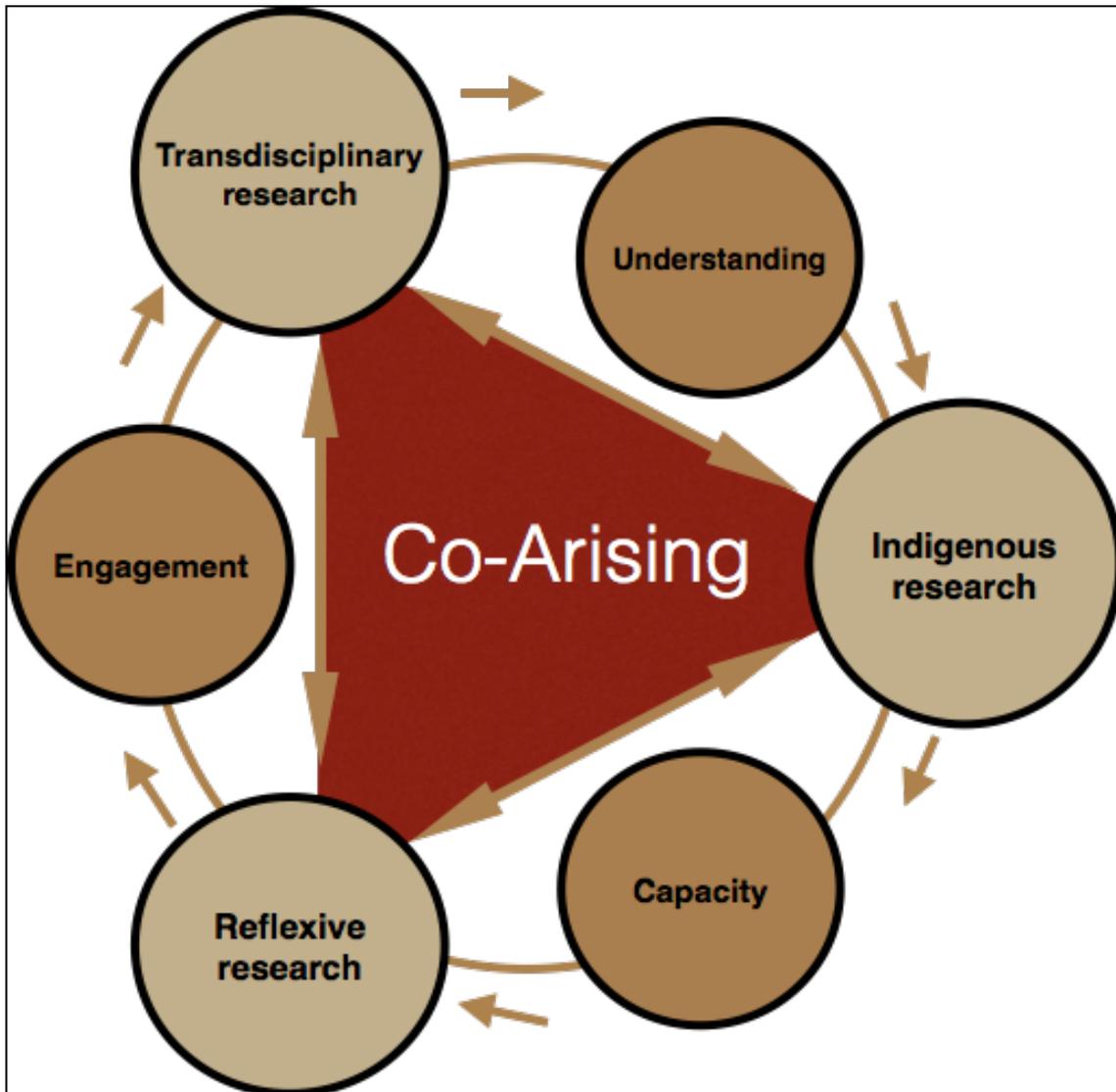
The notion of interdependent co-arising originated from the teachings of the Buddha. Macy (1990 in Bajracharya, 2010:2) explains it as:

... how an individual gets trapped into vicious cycles of suffering and how one can convert the vicious cycles into the virtuous ones. The cause of suffering and its remedy are expressed in terms of mutually interdependent web of cause and effect. The standard form of the causality is: "When this is, that is. From the arising of this, that arises. When this is not, that is not. From the ceasing of this, that ceases.

The term (referred to only as co-arising in this study) has been used in the context of the global polycrisis by systems, complexity and transdisciplinary thinkers. Arturo Escobar, a professor in Anthropology specialising in sustainable transitions, uses the term to explain the interconnectedness and interdependency of humans with nature (2011) and Arun Bajracharya (2010) links the term to the endogenous perspective (working within the system), cause and effect feedback loops (recursiveness), non-linearity (circular or spiral dialectics), experiential learning and complexity – all aspects of systems theory.

For the purposes of this study, the notion of co-arising links the three methodologies in interdependent relations to enable the constructed framework to generate results from experience, co-produced knowledge, theory and literature. This framework is used to analyse the case study – the research centre in Enkanini – which is presented in chapter 5. Co-arising as the linked ground between the methodologies and the themes of engagement, understanding and capacity is depicted in the following figure.

Figure 9: Co-arising at the nexus of the methodological triad



Source: Author

The following explains the convergences between the triad and the notion of co-arising, as informed by Bajracharya's commensuration of the term with systems theory.

Table 6: Convergences between the methodological triad and co-arising

The methodological triad	System theory and co-arising	Convergence of the methodological triad with co-arising
Merging theory and practice.	Experiential learning	Merging theory and practice is an act of learning as theory is applied and changed or corroborated based on practical outcomes.
Relational aspect of knowledge; working with and for society.	Endogenous perspective	Relational knowledge is build on endogenous perspectives because it draws from the context or system within which knowledge is produced. Society also contributes through their endogenous perspectives.
Research process is recursive.	Cause and effect feedback loops, non-linearity	The logical circularity of the triad is commensurate with non-linearity and feedback loops.
Construction and pragmatism in research process.	Endogenous perspective	Language and concept construction is an endogenous process that builds on the research space.

Source: Author

3.4 Concluding chapter 3

This chapter outlined the methodological approach taken to the study. While the broader research study in Enkanini is located within a transdisciplinary research framework, I combined this with two others – indigenous research and reflexive research – to enable me to overcome the limitations of transdisciplinary research in the particular research space of Enkanini.

Transdisciplinary research, while suited to a complex research space and geared towards including the researched as co-researchers in the co-production of knowledge for innovation, is of limited use in this study as it does not take power dynamics into account, a vital determinant of successful community engagement in South Africa.

In addition, a pre-condition for co-creation of knowledge within this research methodology is an existing or easily created stakeholder network. This was not the case in Enkanini, which is characterised by its lack of representative structures. However, indigenous research places power dynamics and relationships centre-stage to any research process and emphasises capacity building as a core outcome of the process. Its contribution is limited in that there is no practical framework within which to operate if the researcher and researched are from very different backgrounds. This is ameliorated by reflexive research that acknowledges that the researcher's own sets of knowledge, assumptions and prejudices affect the research process and outcomes. Using reflexive research in a balanced way to avoid becoming isolated from the research space or too inward-looking provides the benefit of deepening understanding of the researcher as actor.

In this dialectic attempt to find a methodological framework that was appropriate to the context of Enkanini, the notion of co-arising emerged as the convergence of each methodology's contribution.

Chapter 4: The community engagement programme in Enkanini

4.1 Introduction

This chapter provides a case study of the community engagement project in Enkanini, part of a broader Community Engagement Programme funded by the National Research Foundation. This project is both the framework in which this study was conducted and, to a certain extent, the research space.

It is divided into two sections with the first providing a background to the programme and the identified characteristics that made Enkanini a suitable choice of location for researching “what the upgrading of informal settlements means from the perspective of the ‘average’ shack dweller”, along with a research timeline and stakeholder network.

The second part narrates the story of Nobuhle Ntsokota, one of the first settlers in this location in 2006, told in her own words through an opening vignette and quotations and paraphrased passages. As Yin (2011:233) notes, “a common kind of narrative data would take the form of quotations and paraphrased passages, representing your study participants’ descriptions of their own lives, actions, and views. In qualitative research, even these briefer descriptions serve as an important form of data.” This narrative is backed by a fuller description of the unfolding events in which Nobuhle’s paraphrased passages are used as opening quotes in each section focused on government or NGO intervention.

4.2 The project

As noted in the introduction to this study, the National Research Foundation funded a three-year community engagement project to initiate a development process that would alleviate the pressures experienced by informal settlement residents in Stellenbosch. Led by the Sustainability Institute, under the auspices of the TsamaHub (n.d.), an initiative of the Stellenbosch University’s Hope Project, a group of postgraduate diploma, Mphil and PhD students formed the Enkanini group, (now known as the Transitions Collective), which focused on informal settlement upgrading.

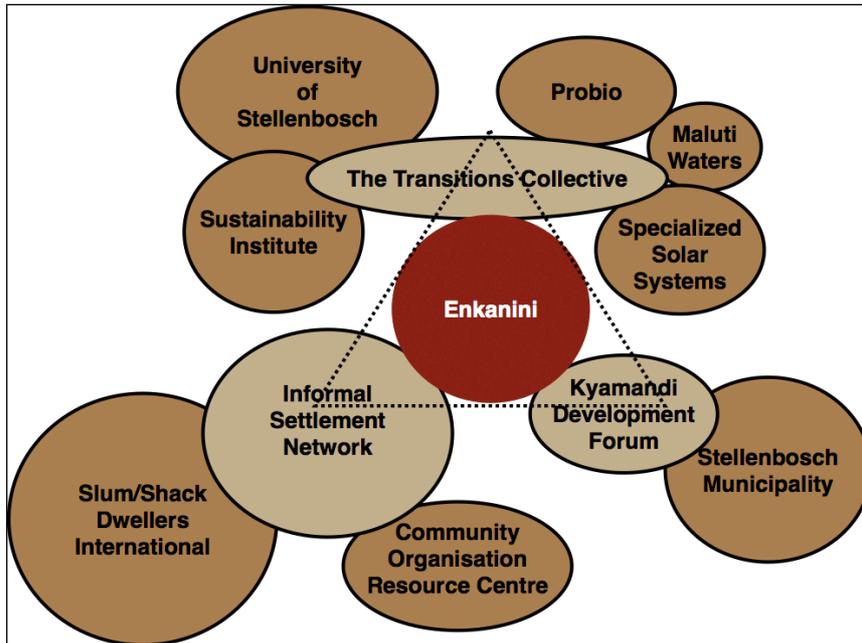
They aimed to facilitate new conceptual debates around community engagement in South Africa, to produce new forms of knowledge in this area and to develop capacity both within researchers and research participants (National Research Foundation, 2012). The collective worked within a transdisciplinary research framework to design a research strategy that would introduce problem-solving strategies and institutions through the co-production of new knowledge for innovation. The long-term goal of the Transitions Collective rests on the premise that Enkanini is a community in emergence, constitutive of the town of Stellenbosch. The long-term goal to develop Enkanini as a sustainable human settlement is supported on three levels:

- There is continuity in the research process, as when researchers exit the system they are replaced by the next generation. The group comprises post-graduate diploma, masters and PhD students.
- Co-researchers are drawn from the community and remunerated for their participation and trained in the process.
- Research activities can evolve into projects that provide benefits for residents with the potential for local job creation in terms of supplying and maintaining the services produced.

4.3 Stakeholder network

There are three primary stakeholder groups operating in Enkanini. These are the Transitions Collective, the Kayamandi Development Forum and the Informal Settlement Network. These stakeholder groups and their affiliated member organisations are depicted in the following figure.

Figure 10: The Enkanini stakeholder network



Source: Author

The sub-groups indicated in the figure above do not engage directly with the Enkanini settlement, but do influence it through their respective representative organisations. This figure has been compiled from the stakeholder influencing mapping tool described in section 2.3.3 and it illustrates the influences of power towards a particular goal, organisation or community (International Institute for Environment and Development, 2004). The groups and their capacity to engage with the settlement are explained further below.

Enkanini as depicted in red in the above figure, represents the apex and goal of the stakeholder influence pyramid. The goal of the upgrading process is to establish Enkanini as a sustainable human settlement. The relative size of the bubbles represents the amount of members in the particular stakeholder group and their proximity to the red apex represents the amount of influence they currently have towards the realisation of this goal (this illustration should be viewed as a pyramid from the top down. The red circle is the highest point with the three corners representing the groups followed by their subgroups on the lowest level.

4.3.1 Kayamandi Development Forum

The Stellenbosch Municipality created this forum in January 2012 as a medium through which to engage with community representatives from different jurisdictions on developmental matters (Davidson, 2012). Representatives include ward councillors, street committees, church leaders and other prominent organisations from the different communities in Kayamandi, which encompasses Ward 12. Ward 12 includes Snake Valley, Zone 1, Thubelitsha and Enkanini. Residents of the greater Kayamandi area are engaged through a community centre, home to the Kayamandi Economic Tourism Corridor, along with small businesses, a meeting hall and an office for the councillor.

4.3.2 The Informal Settlement Network

Slum/Shack Dwellers International works with local federations, such as the Informal Settlement Network, through the Cape Town-based Community Organisation Resource Centre. This is a NGO that facilitates engagements between community-based organisations and government (Community Organisation Resource Centre, 2012). Representatives from the centre arranged with leaders of an informal settlement network in Langrug, Franschhoek that they would engage with Enkanini's residents and organise a meeting asking Enkanini residents to volunteer to take an enumeration of the settlement in order to compile a demographic profile.

The enumeration is viewed as an opportunity to identify actors from Enkanani that could initiate a mobilisation process. Stellenbosch Municipality has signed a memorandum of understanding with Slum/Shack Dwellers International, the first municipality in South Africa to do so, in order to use the organisation's methodological framework to enable grassroots participatory development. This relationship is managed within the Langrug Informal Settlements Network structures (SDI, 2013), as its chair person, who is involved in leadership of the greater Stellenbosch municipal area, resides there. There is also an emphasis on national exchanges between settlements within this network (SDI, 2013).

4.3.3 The Transitions Collective

The primary aim of the Transitions Collective is to upgrade Enkanini incrementally to facilitate it becoming a sustainable human settlement through interventions focused on basic energy, waste and sanitation infrastructure and dwellings. Researchers from the Sustainability Institute come from wide range of academic backgrounds, including economics, anthropology, natural sciences, accounting and engineering, and they work with co-researchers who have emerged from among Enkanini's residents. They are based at the Enkanini Research Centre (previously known as the "church"). The collective acts as an intermediary between the University of Stellenbosch, the Sustainability Institute, private businesses and the Enkanini community. It also engages with local government around policy issues. Private business is included to enable the opportunity to market potential outcomes of the co-production of knowledge process. Businesses include Maluti Water, Specialised Solar Solutions and Probio and they have implemented and tested new products and benefitted from the behavioural feedback based on research findings. These businesses were also able to provide expert knowledge to researchers on appropriate technologies for the Enkanini context.

The collective has implemented a series of projects in Enkanini grounded in Regeer and Bunder's (2009) "community of practice" theory – that each project creates its own meaning and knowledge by being implemented. These projects fall under the auspices of the Community Engagement Programme. A brief overview of the current projects is given below.

The Bokashi Project, spearheaded by the research of Vanessa von der Heyde, managed organic waste of 100 households. Participants collect their organic kitchen waste in plastic buckets, which are inoculated with effective microorganisms that accelerate the composting process of the organic material. The composted material is then worked into food gardens. Von der Heyde brought in the expertise of Probio, the manufacturer of Bokashi effective microorganisms, who also donate the product to the project. The project was undertaken in close collaboration with Stellenbosch Municipality and was the first project they had undertaken in Enkanini that had not met with political resistance (Swilling et al., 2013; von der Heyde, 2013).

The Sanitation Project, driven by the work of Lauren Tavener-Smith, installed five grey-water flush toilets connected to an anaerobic biogas digester that produces gas for cooking purposes. Twenty households participated in the project and paid a small fee to cover the maintenance, repair and operating costs. Tavener-Smith worked with Maluti Water, an engineering firm specialising in sanitation and drainage systems. Her work indicated that users were willing to pay for sanitation services, which opens up the possibility for implementation of alternative sanitation systems that are far less costly than conventional ones (Swilling et al., 2013; Tavener-Smith, forthcoming).

Andreas Keller conducted research on energy components focusing on energy poverty, which entailed exploring alternative energy strategies to meet electricity demands and improve dwellings with ecological design to increase indoor thermal comfort (the temperature range that falls within comfortable living conditions) for incremental upgrading (2012). During this process he designed a dwelling (known as the iShack) that uses ecological design to provide a temperate space and solar energy to provide for three lights, an outside motion sensor and cellphone charger (Keller, 2012). He worked with Specialised Solar Systems for the design (Keller, 2012; Swilling et al., 2012; Swilling et al., 2013). The iShack concept was funded in June 2012 by the Gates Foundation and a pilot study implemented with 100 households. Subsequently this project has received R17 million from the South African government's Green Fund to bring it to scale and install another 1 500 solar-home systems. On 30 May, 2013, the project influenced the Stellenbosch Municipality's Indigent Policy in that the council resolved to provide solar electricity for non-grid connected informal households (Community Organisation Resource Centre, 2013).

The Enkanini Research Centre was established in September 2013 to ensure the longevity of the upgrading process. Constructing the centre served as a "learning by doing" process through which the participants learnt ecological design principles. It also serves as a prototype that residents can copy and implement themselves. The centre functions as a Sustainability Institute satellite research facility and acts as an engagement space between researchers and residents to initiate a co-production of knowledge process.

I oversaw the construction process of the centre and worked with the Transitions Collective to establish it as a voluntary association. The centre embodies the central themes of this study: method of engagement, co-production of knowledge processes and capacity-building.

Within the three-year research process, researchers identified four participants as having influence in the community and the capacity to carry on with the co-production of knowledge process. The biographies of the three participants, who became co-researchers, are presented below.

4.3.4 Participants

Full biographies can be found on the Transitions Collective's website (www.transitionscollective.co.za). The summaries here have been included to add a personal perspective to the narrative of this study and indicate the extent that these participants became change agents. In addition, the biography of Madiba Galada, written by the researcher, has been included to juxtapose his involvement with the Transitions Collective.

Yondela Tyawa

Yondela Tyawa is 30 years old and was born in the Eastern Cape. He matriculated in 2004 from Zola Secondary School in Cape Town, went on to study cooking at False Bay College in Khayelitsha and graduated with an assistant chef diploma. He moved to Enkanini in 2010 to be closer to the Spier Hotel where he worked for five years. He lives with his girlfriend Nandi in Enkanini. Galada, a local resident, introduced Yondela to a group of students from the University of Stellenbosch. Together they met up regularly with the students for informal brainstorming sessions about Enkanini. Through this process, Yondela became a co-researcher and has played a key role in the interactions between the students and the Enkanini residents.

He currently translates from English to isiXhosa in most research meetings and coordinates contact between research participants and researchers. He notes that his work as a co-researcher has exposed him to a bigger world and to the sustainability issues that affect residents of informal settlements.

He would like to further his own fieldwork skills and deal with sustainability challenges (Transitions Collective, 2013). Yondela is currently the custodian of the Enkanini Research Centre Association overseeing building maintenance. He established a catering business that provides food and drinks to visitors and conducts tours through the settlement. He has also successfully applied for a municipal tender to manage waste collection in Enkanini. He represents the street committees in engagements with the municipality.

Sylvia Sileji

Sylvia is 33 years old and from Ngqeleni in the Eastern Cape. She matriculated in 1999 and moved to the Western Cape where she worked as a caregiver for several years. Her encounters with students led to her being co-opted as a co-researcher and as a link between the researchers and the community. She has been involved in designing and implementing food waste, energy and sanitation projects and assisted in surveying and interviewing Enkanini residents, thereby gaining action research experience. She has met local and international researchers and travelled around South Africa for her co-research work.

Sylvia hopes that her work will not only improve her life, but also those of her fellow residents in Enkanini, as well as those living in other informal settlements (Transitions Collective, 2013). Sylvia currently lives in Kraaifontein and has enrolled in a nursing college. She was the Enkanini Research Community Association's first secretary and assisted in the design phase.

Victor Mthelo

Victor is 29 years old and is from Mount Fletcher in the Eastern Cape. He did not matriculate and came to the Western Cape in 2004 where he stayed in Kayamandi hostels. His diverse job experience includes work as a painter and landscaper, a reservist in the Community Service Centre of the South African Police Service, a security officer, and a volunteer of the Kayamandi neighbourhood watch programme. Upon injuring his eye he found it difficult to get a job and thus moved to Enkanini in 2011 because living costs were cheaper.

There he met Andreas Keller and became involved in research focused on ecological shack design and alternative electricity options. He was one of the first co-researchers in this project and his role has unfolded as the scope of the project increased. Victor successfully applied for the position of hub operator with the iShack Project in March 2013 and he oversees a team of five other hub operators that install, maintain and repair solar home systems. He received training for this from Specialised Solar Systems. Victor notes that being part of the research group has changed the way he views the challenges of living in an informal settlement because he now knows of the alternative options open to residents. He believes this is just the start of improving living conditions in his community and in others around the country (Transitions Collective, 2013).

Madiba Galada

Galada, as he is commonly referred to, is 34 years old and comes from Nqunqo in the Eastern Cape. He resides in Zone O, Kayamandi. He is a qualified electrician and is currently contracted to work at Origin Wineries. He is also a priest at the local church. Galada lived in Enkanini for six years where he met Andreas Keller and became involved in his project. Together with other residents from the settlement they built the iShack for Nosango Plaatjie and he helped install seven other solar systems. I met him during this process and we began travelling to the Eastern Cape during December holidays to investigate what kinds of developments could be applied to rural areas.

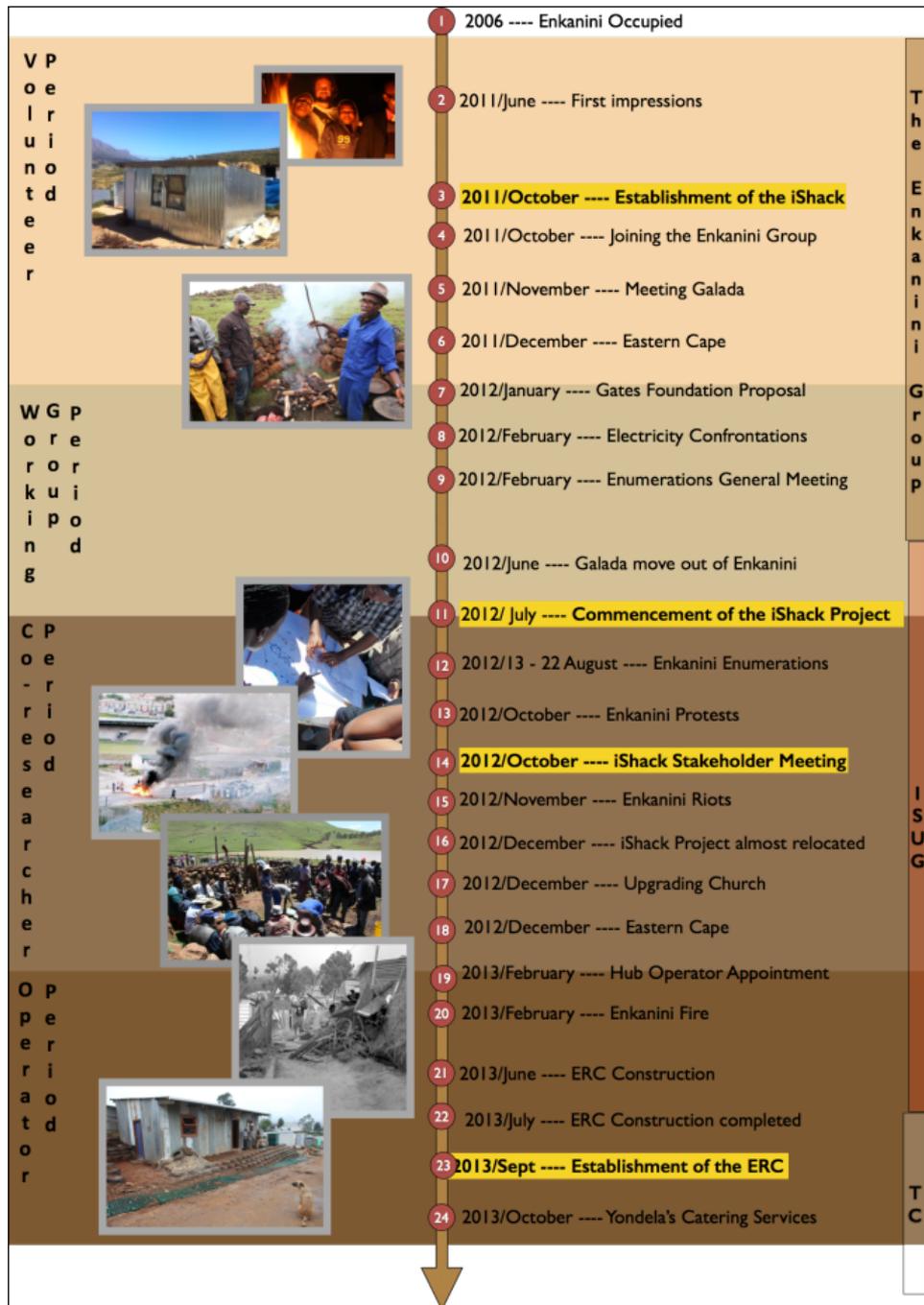
Galada consults for the research group on any matters pertaining to informal settlement upgrading. He is a valuable asset to the group with his keen sense of the micro-politics within the community and on technical and social-organisation matters (Transitions Collective, 2013). Galada currently lives in the neighbouring area of Thubelitcha.

Research timeline

A research timeline is presented below that indicates the overlapping events, phases and shifts during this three-year period. The shift in title, and perception, of the role of the residents that participated in the project is given on the left of the historical timelines.

On the right of this figure the changes in name for the Enkanini group through the transitioning process from researchers to networkers to project administrators is outlined. Throughout the next section, numbers in brackets, for example (timeline: 1), refer back to the timeline to provide a historical perspective to the narrative.

Figure 11: Historical timeline of events



Source: Author

Key: ISUG – Informal Settlements Upgrading Group; TC – Transitions Collective

4.4 Case study characteristics

Enkanini was viewed as an excellent research space to expose students to the field of urban development, in particular the field of informal settlement upgrading. As the space threw up complex challenges, research called for a context-specific methodology and so it is conducted within a transdisciplinary framework. The characteristics are briefly explored below and are representative of aspects that sustainable development practitioners around the world will need to grapple with in their work. Reflexivity is applied to highlight how the characteristics were identified – through ethnography grounded in experience and observation; applying meaning to events and actions; applying critical thinking to unmask the relations of power; and bringing the plurality of voices into the study.

4.4.1 An illegal settlement

Enkanini is an illegal settlement with an existing eviction court order. This relates to power as domination (outlined in chapter 2) in that unequal power relations can lead to conflict (Lukes, 2005), as exemplified by Enkanini's protests for service delivery. In addition, the space of Enkanini is "opened" representing the fourth cluster of "spaces of appearance" that exist as fleeting moments through protests and so on (Cornwall, 2002).

The poor can create these spaces to create alternatives and challenge their conditions. This influences the research-related activities undertaken in this space on both technological and political levels. Lawhon and Murphy (2011) question the effect that politics has on niche innovations and how power shapes the way in which demand for a technology is created within a socio-technical system.

Using reflexive research, I became aware of the technological and political influence of research as I was an actor with influence as a researcher in this context. Domination first needs to be understood before it can be transformed. An attempt at transforming it is exemplified by creating new spaces through the Enkanini Research Centre to acknowledge these dynamics and by giving research participants the title of co-researchers.

Technological implementations, such as solar home systems, dwellings and sanitation infrastructure, need to be semi-permanent so that they can be dismantled if necessary with minimum financial risk – in the event of evictions or relocation. This restricts design options, which must focus on using earth or recycled material that can be reconstituted into the environment or re-used and solar systems that are easy to uninstall. However, the technologies must also be able to become embedded and permanent without needing to be redesigned or reimplemented. The notion of incrementalism is to start small with minimal effect and design and innovate as the environment (social, political and environmental) changes, adapting accordingly to avoid making the previous step redundant. Transdisciplinary research's second principle of achieving effectiveness through contextualisation is pertinent to this, as knowledge creation is context-specific demanding a solution to life-world problems that is informed by experiential knowledge (Pohl & Hirsch Hadorn, 2007a).

Researchers in effect become semi-activists as they navigate through the challenging political terrain bridging the formal (epitomised by Stellenbosch Municipality) and informal (co-researchers and Enkanini residents) to both engage in policy debate at a high level and increase the scope of the project to other communities and, at the same time, co-produce strategies with the co-researchers that provide immediate benefits to residents. This speaks to the different transdisciplinary roles that mediate between facilitation, intermediating and reflexivity. The project effectively reinforces an illegal occupation of land. Spaces were created where previously there were none (Cornwall, 2002). Transdisciplinary research provides for the method of co-production of knowledge, while indigenous research forces the researcher to focus on participatory action research as a transformative methodology and to address the political space with active strategies to bring about change with actors being empowered through the research process (Chilisa, 2012).

4.4.2 An unmobilised community

Enkanini has no formalised leadership structure that can engage with government or NGOs. The specific methodology of these groups revolves around participation, which can only occur if a solid and representative leadership structure is in place that allows a democratic development process to unfold.

Cornwall refers to NGO-facilitated development as the third cluster of institutionalised spaces for participation (2002). Participants join these spaces because they want to; if they do not participate then these spaces can also deepen exclusion as certain voices are effectively silenced by the robust institutional voice of the NGO (Cornwall, 2002).

The project has unfolded at the individual and household level, which exposes researchers to the political and organisational dynamics within Enkanini. This is power viewed as a matrix as researchers and co-researchers can never escape the dynamics that influence knowledge production. Indigenous research through participatory action research gives a voice to the co-researchers and empowers them to be agents of change. Residents viewed co-researchers with suspicion until it was clear that they were not “leaders” wanting to co-opt the upgrading process. This emphasises the importance of titles and definition of roles as a political strategy to ensure that the research process unfolds, as opposed to being inhibited or even ending.

The political dynamic is an example of the first two dimensions of power. Enkaninians cannot deliberate on upgrading matters as their space is “illegal”; this is an example of non-decision making power found in dimension two. Choosing to join the NGO and be grouped according to their institutional practices would be a reflection of Cornwall’s third cluster.

This gives rise to the critical nature of engagement methods, which is a focus area of this study and expanded on in chapter 3.

4.4.3 An underdeveloped community

There are technical constraints to service delivery in Enkanini. The settlement is not electrified and the steep topography of the site makes implementing conventional service delivery infrastructure problematic and requiring high levels of investment, which the municipality may not be able to recover. Other constraints include the low ratios of taps and toilets to residents (outlined in chapter 1) and minimal waste-collection facilities.

These constraints formed the transdisciplinary problem field that was initiated firstly through the iShack, then the waste and sanitation projects and finally the establishment of the Enkanini Research Centre.

However, because of these constraints Enkanini is in a position to leapfrog conventional electricity supply by adapting renewable energies in the face of escalating electricity prices on the one hand and decreasing costs for solar technologies on the other (Swilling et al., 2012). In addition, a window of opportunity exists to test alternative service delivery technologies through the Transitions Collective's projects.

4.4.4 A local community

Enkanini is the closest informal settlement to the Sustainability Institute, making it also “our” informal settlement just as the institute is Enkanini's institute. This recognition of Enkanini as within the locality confers identity on its residents. This way of thinking incorporates the notion that informal settlements should be accepted as part of the urban landscape as a means to accommodate urbanisation. It reflects grounded theory's ability to accept the pragmatic realities that define a particular setting and allowing researchers to be action orientated. This is not to imply that people should have to live in informal settlements, characterised by low levels of basic service delivery, but rather that the focus should be on upgrading these settlements to sustainable settlements that are recognised formally as neighbourhoods – this also enables identity. For the researchers working in the Transitions Collective the practical benefit is that the settlement is only a few minute's drive away.

The above-mentioned characteristics demand a research methodology that is geared towards producing problem-solving outcomes and it is therefore framed within a transdisciplinary paradigm. The complex challenges defy standardised approaches that are practiced through universalised engagement methods. The methodological triad confirms that knowledge is socially constructed. Universalised knowledge sets inform engagement methods through the rituals of mobilisation. Employing co-arising in instances where standardised engagement does not work may generate new strategies through socially constructed knowledge.

The following section describes how standardised approaches have not worked in Enkanini.

4.5 An unfolding process

4.5.1 A narrative: Nobuhle's story

This is the story of Nobuhle Ntsokota who was one of the first to move onto the land now known as Enkanini in 2006. The story is told in her own words.

In 2006, we moved to an open area next to Kayamandi. We were 47 families living there when the Stellenbosch Municipality came and gave us a letter that said we should move because a school would be built on this land. The letter also said that we should move to a place that was marked with white lines where we could stay for three months after which we should relocate to Klapmuts, another town that is far away. So we went to Klapmuts to have a look, but it was not OK because there was a lot of water [flooded]. We decided to stay [in Enkanini].

Then, during the night, especially over weekends, people broke through the fence from Kayamandi's side to build their houses outside of the marked area. This is the when people started to call this place Enkanini, which means "taken by force", because the people build their houses outside of the demarcated area.

Then the municipality brought in security guards to stop people from building more houses, and even destroying them if no one was inside. The municipality then gave us another letter that reminded us that we had, this time, only one month to move. No one moved, nothing happened and so the municipality ignored us and the years went by and more and more people came to live in Enkanini.

Our first needs were electricity, water and toilets. The municipality gave us taps and [portable] toilets, but it was not enough for all the households.

Some of the street leaders, I don't know them, went to the municipality to get electricity.

The municipality said that they do not know how many people were living in Enkanini so they had to do enumerations [a census]. We received numbers on our houses but we still did not get electricity. The Municipality promised us electricity.

The municipality then arranged a meeting at the Corridor with the Kayamandi Forum and with the people from Enkanini. The Forum said that we need someone from Enkanini on the forum so we can discuss electricity. I don't know the forum. Some people from Enkanini started to toyi toyi [singing and dancing at public protests], I do not go to toyi toyi; I am scared; people can destroy things. We do have committees, but the committee of Kayamandi does not like Enkanini, because they are violent. When the fire came, the Forum was not there to help us, only you, the Sustainability Institute and the municipality came [this is an acknowledgement that Enkanini does not acknowledge the Kayamandi Development Forum as their representative body, as they do not perform the functions they are meant to].

(Ntsokota, personal communication)

Nobuhle's story encapsulates many of the facets and dynamics that play out in Enkanini regarding development issues. Some of these have been expanded on below. Each section is headed by a pertinent extract from her story.

4.5.2 Municipal intervention

In 2006, we moved to an open area next to Kayamandi. We were 47 families living there when the Stellenbosch Municipality came and gave us a letter that said we should move because a school would be built on this land.

(Ntsokota, personal communication)

In 2006, the Stellenbosch Municipality intervened with a court order for the eviction of the original 47 households and other families that had settled outside of the original demarcated area (timeline: 1).

The court order has never been enforced and today the settlement has increased to about 4 500 residents according to an informal enumeration undertaken by 2012 (Community Organisation Resource Centre, 2012) and about 8 000 according to residents. It has been noted that this annexure of land possibly formed part of a political strategy driven by the African National Congress (South Africa's largest and ruling party) to gain a bigger foothold in their main opposition's, the Democratic Alliance, territory (Wessels, 2012).

To stop the settlement from growing, Stellenbosch Municipality placed security personnel in guard towers on the periphery to watch for shacks being erected and, if necessary, report this to the demolition crew who would arrive on quad bikes to demolish it. Enkaninians had only a small window of opportunity, mostly at night, to construct their shacks before the quad bikes arrived. Once completed and living inside, the occupant is protected by South Africa's constitution, which states that "No one may be evicted from their home, or have their home demolished, without an order of court made after considering all the relevant circumstances. No legislation may permit arbitrary evictions" (Government of South Africa, 1996:9).

Stellenbosch Municipality found itself in a difficult position with pressure coming from the Stellenbosch Ratepayers Association and private business located close to Enkanini to remove the settlers and the settler's human right to basic services. Even if Enkanini was be recognised as a legitimate settlement, conventional infrastructural interventions, such as grid-connected electricity, will be compromised by the steep gradient of the location thus making it difficult to construct power lines and thereby reducing cost-recovery potential (Tavener-Smith, 2012). To date, Stellenbosch Municipality has built eight ablution blocks with 10 toilets and four taps in each, constructed a road through the settlement and constructed seven concrete waste skips. This is, however, insufficient to meet the high and increasing demand for services.

Drains block frequently – there is one toilet for 54 residents, water is difficult to access – there is one tap for 140 people, and shacks often catch on fire (see box 1) (timeline: 20). In addition, attempting to access these services at night is problematic with no street lights.

Box 1: Enkanini Fire

A fire broke out on a Thursday evening in February 2012 because someone left a candle unattended. The shack caught fire and the flames quickly jumped the road, apparently via the informal electricity connections. The fire spread to about 35 shacks burning most to the ground. Observers noted that the fire spread quickly because the heat from one shack would heat up the wooden frames of a neighbouring one leading to an internal combustion process.

The Stellenbosch fire brigade was unable to get close to the blaze as residents had piled their saved possessions in the road. The fire truck attempted to go around and re-enter from the top of the settlement, but were once again blocked by household possessions. Enkanini residents tried to stop the fire with water drawn from the four taps at the nearby ablution facility. The flow rates of these taps are not even enough to handle the everyday washing demands of residents.

A photographer and myself arrived on the scene on Friday morning with wooden poles, screws and tools to find a depressing scene of charred beds, contorted zinc and an old Singer sewing machine watched over by darkening skies that threatened rain.

Nevertheless, there was an observable sense of camaraderie between residents and people ran to and fro lending a hand where needed. Our co-researcher, Yondela, who had lost his shack in the blaze, has already moved into the research centre with his girlfriend Nandi for temporary shelter while they rebuilt their shack. The Stellenbosch Municipality provided the victims of the fire with 3x3 metre zinc sheets, six poles each and plastic sheeting as part of the emergency-housing starter kit. We returned on Saturday morning with more materials and met with Wiseman Ndamase, a housing officer from the municipality. Wiseman brought food parcels for the victims and Yondela coordinated the distribution to make sure that no-one was left out. He noted that most of the food was beyond its printed expiry date. Most of the shacks had already been rebuilt by Saturday.

The following observations can be made from this experience:

Residents are more prone to the risk of fire as they use candles and paraffin for lighting and cooking in the absence of electricity. Informal electricity cables contributed to the spread of the fire. Solar-powered energy can reduce this risk.

The material from which shacks are made facilitated the fire as neighbouring shacks combusted. Using materials such as isotherm that provides an internal insulation up to 700°C Celsius would reduce this risk. A community emergency response plan would have allowed the fire trucks to reach the blaze and prevented further devastation. A fire standpipe dedicated to fire fighting would have been useful. The density of shacks and their spatial orientation contributes to the community being at higher risk of fire. (Wessels, email correspondence).

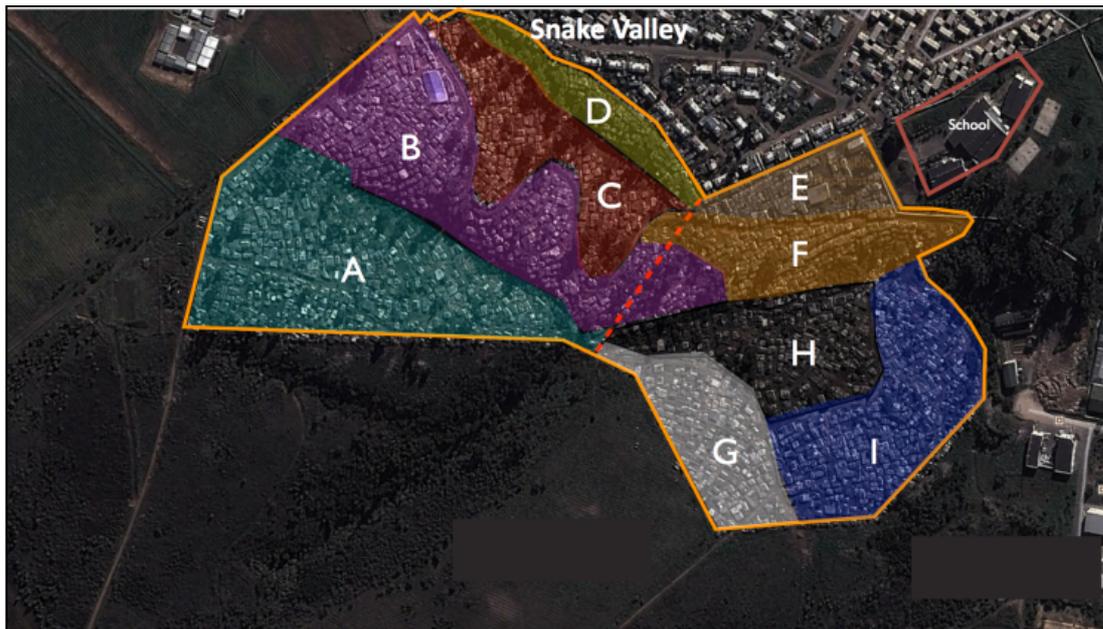
Since 2006 different groups have emerged to face the challenges posed by living in an informal settlement. These include street committees, churches, stokvels (saving groups), animist groups, gyms, communal garden organisations and crèches. Solutions have been innovative and adaptive to the particular location. Examples include building water furrows, reinforcing terraces with shopping trolleys, waterproofing their shacks with advertisements, holding canvasses fast with beer bottle caps uses as washers, carving steps out of the slopes and constructing dwellings from the ever-increasing mountain of waste on the municipal dumpsite a few kilometres away.

Residents have also increasingly taken governance into their own hands, either on an individual level or through street committees. They demarcate space for new arrivals, solve disputes (albeit it with vigilantism), pool funds to co-invest in infrastructural improvements (water pipes, illegal electricity connections) and approve new enterprises, such as the Somalian-owned spaza shops (Wessels, Enkanini field notes). However, there is no unified leadership body that represents the entire settlement.

4.5.3 Intervention by non-governmental organisations

The municipality said that they do not know how many people were living in Enkanini so they had to do enumerations. We received numbers on our houses, but we still did not get electricity. The municipality promised us electricity. (Ntsokota, personal communication)

The enumeration process was completed in August 2012 and the results were compiled into a map indicating shack numbers and the different sections of the settlement. This provided the basis for leaders to emerge representative of the community (timeline: 12). The following figure provides a visual representation of these sections.

Map 2: Enkanini divided into nine sections

Source: Google Earth

Stellenbosch Municipality approached the Sustainability Institute to work with Slum/Shack Dwellers International to provide solar power to residents as an interim measure. The institute already had a prior memorandum of understanding with the organisation around the iShack Project following the facilitated funding from the Gates Foundation in 2012 (Arendse, 2013). The partnership would benefit both organisations as Slum/Shack Dwellers International would access an immediate technological solution for the communities it worked in and the institute would have a vehicle to engage with settlements across the country to roll out its initiative.

Despite the strong relationships that researchers had with Enkanini residents, the initiation of the project on an institutional level affected how the relationships between researchers, and their co-researchers, were perceived. As the focus shifted from research to project implementation, a beneficiary selection process had to be designed as well as decisions made as to who would install, maintain and operate the system. Leaders of Enkanini, representatives from Stellenbosch Municipality and the core group working on the iShack Project met (timeline: 14) and the stage was set for a transdisciplinary engagement and open discussion about the stakeholder network for the project (Wessels, iShack Project meeting minutes). This is turning point 2 expanded on in chapter 5.

However, the purpose of the meeting was shifted into a forum for community members to vent their frustrations against the municipality and it emerged that the community did not want the iShack Project rolled out as this would delay or inhibit grid electrification, along with other much-needed services, such as better roads, drainage and a crèche. It became a conduit for the political agendas of the Informal Settlement Network leaders. Enkanini was clearly not ready to start a process of upgrading through NGO intervention. This was turning point 3, expanded on chapter 5. This community expression was borne out by subsequent events, outlined in the following section.

4.5.4 Confrontations

Some people from Enkanini started to toyi toyi. I do not go to toyi toyi, I am scared, and people can destroy things. We do have committees but the committee of Kayamandi does not like Enkanini, because they are violent.
(Ntsokota, personal communication)

Violent confrontation broke out between those living in the top part of Enkanini and residents from the adjacent neighbourhood of Snake Valley in February, 2012 (timeline: 8). The apparent cause of the conflict was that the “electricity barons” in Snake Valley had cut off the electricity supply to the Enkaninians. These electricity barons have their own grid-connected Eskom prepaid meter boxes and they illegally connect a line charging R200 per connection and a R50 monthly rental fee. However, the electricity baron cannot control the supply beyond her/his house as clients may run further cables from their connection. If too much demand is placed on a single line the prepaid metre trips and disconnects the entire informal network (Galada & Tyawa, personal communications).

Map 3: Enkanini – a divided community



Source: Google Earth

In addition, Enkaninians tap electricity from the poles distributing power to Snake Valley residents creating a conflict of interest between the two communities. The result is frequent black-outs in the area. In February 2012, these tensions were escalated when residents from Snake Valley cut down an electricity pole to prevent the Enkaninians from tapping into the power supply. The police were forced to interfere (Galada & Tyawa, personal communications).

Stellenbosch Municipality approached Slum/Shack Dwellers International at this point to ask them to mobilise Enkanini and generate a household enumeration report so that the municipality could obtain a demographical outline and begin a constructive negotiation process with community leaders.

Slum/Shack Dwellers International facilitated a meeting that month through their local federation, the Community Organisation Resource Centre and the Stellenbosch Informal Settlement Network (timeline: 9). Representatives of the Kayamandi Development Forum and Enkanini residents attended the meeting held at the Kayamandi Corridor and elected volunteers to drive the enumeration process.

The aim was to subsequently elect leaders that could facilitate the long-term upgrading process that would possibly lead to the settlement becoming a formal residential zone. This would then open up the possibility for installing grid electricity infrastructure. It is not yet clear how this aligns with the court order for eviction, which is still in place.

The enumeration was conducted in August 2012 and in the months following the Enkanini Informal Settlement Network was established and negotiations were underway between Stellenbosch Municipality, the iShack Project's core group of researchers and Slum/Shack Dwellers International, through their local representatives to implement the iShack Project on a settlement level. However, the Enkanini Informal Settlement Network expected electrification of the settlement to begin soon after completion of the enumeration. They protested outside of municipal buildings demanding to see the mayor (timeline: 13). A representative listened to the organisation's demands. Box 2 outlines an important event in the negotiation process.

Box 2. Meeting the leaders of the Enkanini Informal Settlement Network

In October 2013, Mandla, the leader of the Enkanini Informal Settlement Network, invited Prof. Mark Swilling and myself to visit him in his shack in the top part of Enkanini. His was a fairly large shack in comparison to those around him because he used to run a small spaza shop from it and on occasion a shebeen. Mandla had used to connect illegally to the municipal water pump for this power, until Stellenbosch Municipality disconnected the lines as they were causing water shortages. Prof. Swilling and Mandla shared a connection in that Swilling had collaborated with the Langa community near Port Elizabeth to develop the area in the 1980s as part of a civil rights movement and this was Mandla's home town. We were joined by the vice-chairman of the organisation, the secretary and two other representatives.

Mandla highlighted the need to move residents living in the flood zone, the need for a crèche and for electrification of the settlement. He produced the enumeration report and a print-out of a website home page for a tour company offering tours through Enkanini. Mandla noted that this was an attempt for outsiders to exploit the community and that they had raised this issue with Stellenbosch Municipality.

He also stated that they were still waiting on the feedback meeting that was scheduled to take place between the network and Stellenbosch Municipality about their trip to see the solar systems in place in Sedgefield's informal settlement. Mandla said that the organisation would "go to war" if this meeting did not happen.

He threatened to remove all of the electricity connections of neighbouring businesses in the Plankenburg industrial area because it seemed irrational that if electricity can be made available on the borders of Enkanini it could not be available in the settlement itself. Mandla could not give a direct answer to Prof. Swilling's query as to what they would do after they had destroyed the electricity connections, other than that Stellenbosch Municipality would then take them seriously. Prof. Swilling told Mandla to think about consequences, in particular the expectations of his followers once they had worked hard and exposed themselves to risk. They might expect something tangible in return. He proposed that the network draw up a manifesto that stipulated their demands and how these could be met through collaboration with Stellenbosch Municipality. Swilling offered the help of researchers to design the manifesto. Mandla agreed to this plan of action and said he would contact us to draft this document. The meeting adjourned.

However, following this meeting, the network launched a visible campaign to draw the attention of Stellenbosch Municipality. They accessed illegal electricity connections from the water pump, which eventually overloaded, shut down and left the entire settlement without water for a few days. The municipality took down all of the cables to the reservoir and laid them underground to prevent illegal access. As a result, the top part of Enkanini could not access electricity and a mob, led by Mandla, proceeded down the hill to the bottom part of the settlement (Tyawa, personal communication). It is clear that Mandla initiated the following confrontations, even though he was not present during them.

As the mob descended they destroyed the illegal connections providing electricity to the bottom part, ripping out informal electrical wires and burning down a shack of a resident accused of being an *impimpi* (someone who leaks information to another group, in this case to the Kayamandi Development Forum). This individual had facilitated the first municipal attempts at upgrading acting as the community representative and had been accused of highjacking resources for himself leaving the community unserved. In this instance he was suspected of leaking information about the illegal connections to the forum that was believed to have mobilised the police force (Mthelo, personal communication). At the time of writing the Informal Settlement Network was still highly suspicious of the forum and no Enkaninians sit on the committee.

The mob then proceeded towards the industrial area of Plankenburg (timeline: 15) where they vandalised PG Glass, smashing windows and burning the building down, smashed the windows of a nearby chemical company and destroyed the computers and furniture in a shop selling 4x4s. They marched through the streets and burnt tyres eventually ending in the Kayamandi Corridor where they smashed road-facing windows. The police, accompanied by the riot police, shut the mob down and made 15 arrests (van Heerden, 2012). This event, according to Slum/Shack Dwellers International set the community back 12 months from achieving their goals (Fieuw, personal communication).

There were subsequent rumours that the Kayamandi Development Forum had hired two ex-uMkhonto weSisze⁴ veterans to murder Mandla and he was forced to flee for his life. This marked the end of the facilitated engagement strategy initiated and facilitated by the Slum/Shack Dwellers International and the Sustainability Institute. The Sustainability Institute had to reconsider Enkanini as a viable space in which to test the iShack concept (timeline: 16). The risks of testing a not-yet fully developed concept in a highly volatile and politicised space, marked by vandalism, protest and vigilantism, were high. The relatively fragile nature of the concept could not absorb the complexities of the settlement context.

4.5.5 Researcher intervention

When the fire came, the forum was not there to help us; only you, the Sustainability Institute and the municipality came.

(Ntsokota, personal communication)

Laurens Maritz began engaging with Enkanini in 2012 through a NGO, Rights to the City, which focused on including the urban poor. Maritz gained access to the community through an influential woman Mama Matshaya who ran a soup kitchen from her home with assistance from a NGO. Maritz and his wife eventually gained permission to construct their own shack on her premises and lived there for about a year. Maritz used his experiences as a case study when studying at the Sustainability Institute and Enkanini subsequently provided opportunities for a range of different postgraduate diploma case studies related to sustainable development and MPhil and PhD studies, run under the Community Engagement Programme and funded by the National Research Foundation.

Some researchers gained entry into community life by painting shacks to establish their good intentions. One stayed a month in the settlement to understand the social organisation of Enkaninians. This initial group of researchers, under the leadership of Lauren Tavener-Smith, became the Enkanini Group.

⁴ uMkhonto weSisze was the militant wing of the African National Congress during the apartheid struggle (SA History, n.d.).

I enrolled for the Ecological Design for Community Building as part of my course work at the Sustainability Institute in 2011 and focused in my group work and assignment on informal settlement upgrading. Prof. Swilling provided the group with an overview of the settlement and tasked them with exploring the relationship between the settlement and Stellenbosch Municipality. We explored the living constraints faced by residents and focused on local innovations that emerged as adaptive strategies and immersed ourselves in the community. This experience of participant observation in an attempt to “demystify” informal settlement life has provided an enduring method for this three-year study (timeline: 2).

I was subsequently invited to become part of the Enkanini group in 2011 and my first task was to demolish the old shack of Nosango Plaatjie, the first recipient of the iShack (timeline: 4). It was during this process that I met Madiba Galada and began a long and deep relationship that has affected the shape and outcomes of this study. In December 2011, Galada and I embarked on our first visit to his home of origin in the Eastern Cape called Nyamankulu to explore the urban/rural nexus (timeline: 6).

4.5.6 Introducing the iShack Project

Following the invitation from the Gates Foundation in 2011 to submit a proposal for funding, the need arose to establish a working group comprising volunteer residents and initiate a co-production of knowledge process to assist researchers in designing an institutional model that would embed the iShack concept in the settlement.

As the stakeholder identification process had been derailed due to the political volatility of the community and the funds were about to come through, the Enkanini research group selected individuals through their own channels to begin brainstorming the challenge. The emergent model envisaged hub operators that would run their own businesses supplying energy through solar technology.

Researchers brought in experts and professionals to the brainstorming sessions with local residents. Galada was asked to help select volunteers given his in-depth knowledge of the community. He proceeded to select four individuals: Yondela Tyawa, Victor Mthelo, Sylvia Sileji and Sizimpiwe Mgophe.

These four formed the basis of the Working Group that met with the Transitions Collective weekly to test the iShack concept through a co-produced knowledge process in that the experiences of the volunteers would feed into an institutional design derived from theory and professional inputs.

The volunteers contributed technical knowledge through their perspectives on how informal settlement dwellers would go about their daily lives that provided insight to affordability levels for the service, the frequencies of job opportunities, the annual migration to the Eastern Cape and minimum payments that residents could contribute among other insights that contributed significantly to the institutional design of the iShack Project.

More importantly, the Working Group highlighted the political dynamics of the settlement, which is characterised by a quick turnover of leaders. They noted that a community-wide engagement would not benefit the project as negotiations would be derailed because residents were not well versed in discourse development, for example rezoning. The normative response from a community with minimum services is to obtain services first (such as electricity), and then the process of rezoning can happen.

Galada introduced the term “quiet development” to explain the strategy that he and Keller had used when constructing the first iShack (Keller, 2012) (Turning point 1, expanded on in chapter 5) (timeline: 3). Quiet development builds on the tenets of incrementalism by starting small and working with individuals when implementation is still in the testing phase to minimise the exposure risk of the technology if it fails. Quiet development is also a strategy that depoliticises potential upgrading strategies as it avoids the risk that the process is hijacked to benefit certain groups or individuals, particularly in communities that do not have overarching, democratic leadership. Galada had selected the first beneficiary of the first iShack, a woman living in deplorable conditions with three children (Keller, 2012).

4.5.7 Installing the prototype solar systems

There are two types of solar systems. System B has three inside lights, an outside motion sensor and a cellphone charger.

This system had already been piloted and was perceived as the entry-level system that could be launched through the roll out of the iShack Project. System A, a second-level solar-home system included points for a fridge, television, DVD player and five indoor LED lights, two outdoor motion sensors and a cellphone charger. This system needed to be tested against the solar radiation available in Enkanini and user behaviour.

The Transitions Collective decided to test both systems in the church, which had become its meeting place, to start upgrading this facility and to showcase the potential to the community. This plan was approved and the systems were installed during the December holidays, a high-risk period in terms of vandalism and theft. It was also a test of the seriousness of the threats made by the Informal Settlement Network leaders against the project.

This plan was disrupted as Yondela Tyawa, who had been nominated to stay in the church over this period, had to go back to the Eastern Cape on a family matter. System A was installed in the dwelling of co-researcher Victor Mthelo and System B in his brother's house in the top part of Enkanini. This was also seen as a way to perceive the potential risk of installing in this area because the protests had originated here.

4.6 Defining the research space

Working Group meetings were held in Galada's shack. As time went by, the need to build a dedicated research space emerged and was concretised when Galada moved out of the community (timeline: 10). Galada arranged an alternative meeting space for the group in another shack often used as church. This location became known simply as the "church". While the geographical space for innovation shifted, the tempo at which new ideas were shared and constituted into co-produced new knowledge sets that provided the foundation for implementation did not. The space was also enough to conduct workshops with residents willing to test the first steps of the co-produced strategies.

This location became the drop-off point for waste collected by those involved in the Bokashi project and the first sign that marked the building was thus “Bokashi Drop Off”. The wording of the sign was reached by consensus as it would be first definer of the space’s function and cast the first impression on passersby. It was considered important to hold the impression of a public space that would later evolve into a community research centre.

It was decided to solidify the church as the interactive space between the groups (timeline: 17). In practical terms, the church would also provide a testing space for the new technologies, such as ecological design using earth materials, biogas generation through an interconnected toilet system and solar technologies.

Groups used the church on a weekly basis to brainstorm project designs and for meetings between the Transitions Collective and visiting academics and media. Over six months the church began to form an identity of its own derived from its function. This identity was further enhanced by discussions between groups on what kind of spaces it should hold. It was decided that there should be a meeting area, a living area for a caretaker and a kitchen. The meeting area could house a dormitory for sleepovers, an office space and a demonstration space to showcase research activities and outputs. In addition there should be an outdoor space for food gardening. Yondela offered himself as caretaker and caterer.

The original structure was demolished in May 2013 and construction for the new centre began in June (timeline: 21) and lasted two months. A voluntary association was institutionalised with a member-drafted constitution to ensure the sustainability of the space. In addition, in 2013 a code of conduct was drafted to solidify the vision and mission of the now-named Enkanini Research Centre Association: “our mission is to improve the livelihoods of informal dwellers by establishing the Enkanini Research Centre, which aims to make a substantial contribution to theoretical, practical and applied research on informal settlement upgrading” (Enkanini Research Centre Association, 2013). This is turning point 4, which is expanded on in chapter 5. The Stellenbosch University, through National Research Foundation funds, donated R70 000 to cover the construction costs and the legal fees for the drafting of the constitution.

The Informal Settlements Upgrade Group renamed itself as the Transitions Collective at this point (timeline: 23).

4.7 Conclusion

This chapter provided a case study of the community engagement project in Enkanini to describe the research space and context. A background to the programme is provided along with the identified characteristics that made it a suitable choice of research location for the study's purposes. These included that it was local, unmobilised, underdeveloped and illegal.

The primary stakeholder groups in the settlement (the Transitions Collective, the Kayamandi Development Forum and the Informal Settlement Network) were described and the biographies of four research participants that have been pivotal to the study given. The research timeline indicates the overlapping events, phases and shifts that occurred in this three-year study (2011–2014).

The second part of the chapter focuses on a narrative provided by Nobuhle Ntsokota, one of the first settlers in the area in 2006. This is done to personalise the case study and remind us that social research cannot lose sight of the real-world context of the study. The unfolding story of the settlement follows divided into intervention periods by the Stellenbosch Municipality, NGOs and finally the researchers. The contestation over service delivery and resultant protests are described to indicate the volatility of the study context and highlight power dynamics that play out on the household, settlement and town levels. The chapter concludes by introducing the iShack Project and defining the research space – the church.

Chapter 5: Analysis of turning points

5.1 Introduction

Given the complexities of the research space – an informal and illegal settlement with no formalised or representative leadership structures that was politically volatile due to inadequate access to basic service delivery infrastructure – a different way of thinking about the research process was required. On the premise that knowledge is produced in diverse ways, that power influences relationships and that space is contested and mediated on both physical and conceptual levels, I composed a methodological triad, which offered an interactive strength as each compensated for the weaknesses of the other. This allowed me a methodological framework through which to compile the data and a philosophical lens for the study.

Each of the methodologies used provided a unique contribution to the study. Transdisciplinary research enabled an understanding of the complexities of the research space with a focus on co-production of knowledge processes. Indigenous research locates researchers within a power matrix with the potential for capacity building – in both the researcher and the researched. Reflexive research allows for the influence of rhetoric, power and personal interpretation of empirical findings to be taken into account providing a way in which to engage with the research space. These three contributions (understanding, capacity building and engagement) are collectively referred to as co-arising in this study.

However, given the qualitative nature of the study concerned as it was with “collecting and analysing information in as many formats, chiefly non-numeric, as possible” (Blaxter et al. 2008 in Muller, 2008:16) it was not possible to analyse using statistical data sets or by compiling survey responses as would have been possible in a quantitative study (Holliday, 2002 in Muller, 2008:16). Grounded theory provided a solution as to the best way to analyse the data.

5.2 Grounded theory and “open coding”

Grounded theory is premised on the notion that pre-conditions shape the research process and outcome and that to minimise this interference, the researcher should allow theories to emerge from the “ground” during the research process (Bryant & Charmaz, 2007). In effect, grounded theory allows the data to illuminate certain themes or strands that can be used to build a theory (Yachskaschi, 2008).

Alvesson and Sköldbberg critique grounded theory on coding as there is a risk of repeating data and following a pre-scientific world of “common-sense ponderings” (2000:33). They also acknowledge the contribution of allowing researchers to construct their own theories to explain data. They propose a middle ground by combining grounded theory with interpretation and reflexion (2000).

Yin (2011) notes that using grounded theory is not an either/or scenario as the coding associated with it can be used throughout the study or at certain parts for a specific purpose. It has been used as a tool in this study to help conceptualise data sets that were derived from the identified turning points into manageable codes representative of a series or category of data. It is also useful as it is based on comparative analysis of data sets derived from empirical observation. These comparisons highlight themes that were pertinent in the study and that force the researcher to ground his ideas and intuitions on this empirical data (Charmaz, 2008).

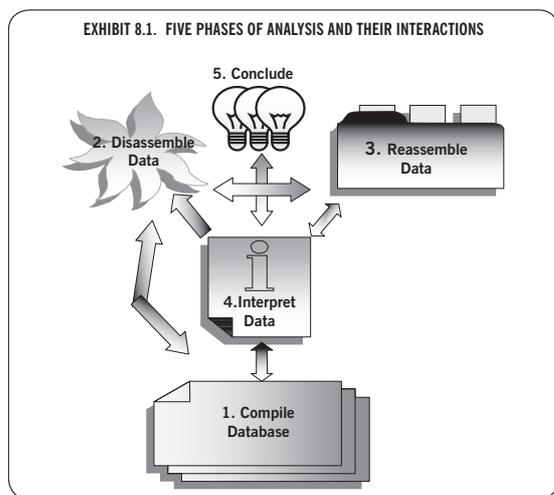
5.2.1 The coding process

“Process coding” is useful when analysing data derived from a series of interactions that have evolved over time (Corgin, 1998 in Yin, 2011:187). However, this study used “open coding” to inductively narrow the empirical findings to key themes. This is the coding process particular to grounded theory and it allows the code to emerge from the text, as opposed to imposing a code (theory) on the text (Charmaz, 2008). The analysis presented in this chapter is derived from the five phases proposed by Yin (2011).

5.2.2 Yin's five phases of analysis

These phases are compiling data, disassembling of data, reassembling of data, interpreting the data and concluding (Yin, 2011). Data was compiled during the research process and the research outcomes are presented in chapter 6. This chapter focuses on the disassembling, reassembling and interpreting analysis phases. The figure below illustrates the iterative and recursive fashion in which these five phases have been conceptualised in this study.

Figure 12: Yin's five phases of analysis



Source: Yin (2011:178)

These five phases unfold in a parallel process to memo writing, which occurs as separate function to test assumptions and the constructed codes – it is especially relevant in the dissemination phase as the constructed codes can be tested in a separate data sheet; however it can be used throughout the study (Yin, 2011). Memos were written during data capturing through participant observation, during meetings and conferences, brainstorming sessions and during journal writing.

Each of Yin's (2011) phases is briefly described below.

Compiling the data

Data was derived from field experience, a literature review, notes and a personal journal and was arranged into a database.

Disassembling the data

Data sets were drawn from the database and, using grounded theory, were coded to assemble smaller and more manageable units, which were representative of the text.

Reassembling the data The codes from the previous stage were reassembled through software programmes (Keynote and MAXQDA) in a format that highlights connections and disjunctions.

Interpreting the data

The reassembled codes are rearranged to bring forth new interpretations of the data. Disassembling and reassembling can reoccur in this stage to test data accuracy.

Analysing the data

A data representation of the study outcomes is compiled.

Before outlining the coding method and the outcomes obtained, the four turning points are described below, as well as their interpretation as bifurcations.

5.3 Interpreting turning points as bifurcations

A turning point is the beginning of a new translation that changes the meaning and outcome of a narrative (Latour, 2005). An actor's passions, opinions and attitudes change and diverge during the research process influencing the research outcome (Latour, 2005). This shift is known as a bifurcation point. Montouri, in reference to Morin, builds on the notion of the bifurcation point as one that represents a build up of tension or following a period of turbulence, which causes a reorganisation of the system, after which the course of potential options is changed (Montouri, 2008).

Morin and Kern align the notion of bifurcation with concepts such as: "discontinuity, nonlinearity, disequilibrium, "chaotic" behavior (sic)" that describe the uncertainties and challenges that arise in a changing world demanding a new way of thinking (Morin & Kern, 1999). Muller, focused on the development-planning arena, notes that crisis can be interpreted as "... bifurcation points or phase transitions, where system (sic) can move into a higher form of order, or disintegrate into total chaos" (2010:8).

The relationship between order and disorder must then be interpreted against the context of the situation because order, in a particular context, can also be problematic. Muller (2008) uses the example of government's normative response to providing houses by destroying informal dwellings and replacing them with formal structure – thus creating “order” out of “disorder”. However, the costs may be too high for government to meet the housing demand or the structures too small or placed in unsuitable locations for economic activities – such as urban peripheries. In this context, order is an inappropriate response to the challenge.

The advantage of interpreting turning points as bifurcations is that it opens space for alternatives to emerge, for power to shift and for learning to take place. The following section analyses four turning points in Enkanini's history to explore how power can be shifted from government to citizens through the co-production of knowledge process. The results of this analysis are presented in chapter 6. The four turning points are:

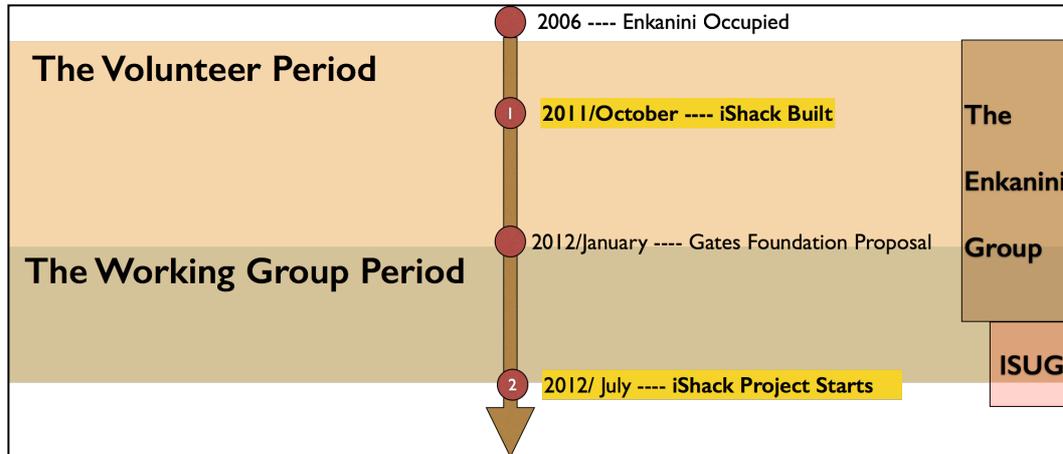
- The establishment of the iShack
- The start of the iShack Project
- The iShack stakeholder meeting
- The establishment of the Enkanini Research Centre.

Each point highlights a particular aspect of power. The bifurcation of each is illustrated in three phases. Firstly, the “problem” is generated by prior tensions in the research space; secondly, a “response” is then initiated by the research group that, thirdly, generates a new “challenge”. The final turning point, the establishment of the Enkanini Research Centre, is an active bifurcation informed by the learning processes of the last three points. Being a bifurcation itself, this turning point generated a new set of challenges.

The problem, response and generated challenge for each are outlined below and each is represented on the accompanying research timeline.

5.3.1 The establishment of the iShack

Figure 13: Research timeline for establishing the iShack Project



Source: Author

Key: ISUG – Informal Settlement Upgrading Group

The problem

There were two pre-existing “problems”. The first was the initial attempt made by Slum/Shack Dwellers International to engage with the Enkanini community in May 2011. The second was the need for academic researchers to initiate a transdisciplinary co-production process by implementing socio-technical systems as solutions to real-life challenges.

The first attempt by Slum/Shack Dwellers International to mobilise the community through volunteers occurred in the start of 2011. However, this was also the run-up to the national elections. Contestations around power, both inside communities as political parties canvas for votes and on provincial and national levels, are common during election “season”.

An intervention by an international organisation, such as Slum/Shack Dwellers International, during this period could easily be appropriated by those claiming to be representative of the community, while actually seeking to further their own agendas by raising their local profile in the hope of a political appointment as local councillor.

In addition, the organisation ran the risk of being linked with a particular political party as part of an electioneering strategy, as opposed to the grassroots movement that it is, with a strong focus on community involvement in any process.

The organisation withdrew due to political volatility and Enkaninians had to wait for a further two years before they re-approached the community.

In 2011, the Sustainability Institute tasked researchers with establishing a transdisciplinary research process that would lead to co-production of knowledge in Enkanini. However, Stellenbosch Municipality cautioned the so-called “Enkanini group” of researchers not to engage with the community as they were politically volatile and posed a threat to the safety of the researchers and that there was a risk that the research could be politicised (Keller, 2012). Transdisciplinary research requires the identification of stakeholders to ensure that a collaborative and consensual common good is established. Due to this obstacle, researchers had to establish direct relationships with residents (Swilling, 2013) by various means. These included running a visible art campaign by painting shacks and, for some, staying in the settlement for prolonged periods of time. The researcher of the Enkanini group, Andreas Keller, noted that he had to test his theoretical assumptions in a real-life setting to enable co-production of knowledge (Keller, 2012) and he, therefore, established the iShack.

The response

Implementing the iShack (described in section 4.3.3) was the first starting point for engaging with the community by means of a socio-technical system. The concept generated a series of responses that addressed the aforementioned problems.

It effectively acted as an engagement strategy for the researchers and also for NGOs, such as the Gates Foundation, to later fund the scaling-up of this initiative (this is described more fully in section 5.3.2).

In the initial stages, community volunteers assisted researchers in setting up and administering the iShack, as well as sanitation and waste projects. These transitioned into co-production opportunities – both for public services and for new knowledge. Following the Gates Foundation’s invitation to submit a funding proposal

in January 2012, researchers, volunteers and experts (solar energy, waste and sanitation private businesses) brainstormed the institutional design of what would become the iShack Project.

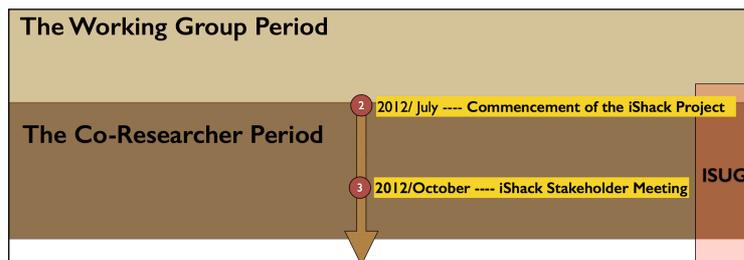
It was at this point that relationships were solidified between researchers and community volunteers and the group began a learning process encompassing facilitated dialogue, conceptual thinking and government development processes. The Enkanini group decided to refer to the volunteers as the Working Group, as they needed a collective name for a group comprised of members serving different functions. The name would also eliminate confusion around their roles and belay false expectations by expanding their roles as not only focused on the iShack Project, but also on the waste and sanitation projects. The two groups began to engage with other settlements, private businesses and organisations through field visits to explore alternative methods of operating waste and sanitation systems. The Enkanini group changed its name to the Informal Settlement Upgrading Group (and later to the Transitions Collective). A stakeholder network had been created that stretched beyond the boundaries of the settlement.

The challenge

The success of the initiative, however, highlighted the need for a local stakeholder group that was representative of the community, as the Transitions Collective engaged only on an individual level with members of the Working Group. Slum/Shack Dwellers International would facilitate this process through their particular engagement practices (see section 2.3.2 for more detail on this).

5.3.2 Commencement of the iShack Project

Figure 14: Research timeline for commencing the iShack Project



Source: Author

Key: ISUG – Informal Settlement Upgrading Group

The problem

It took nearly six months from the initial application to the Gates Foundation in January 2012 until July 2012 to receive the final confirmation that the funding was approved. During this period the group had explored various institutional designs for the project. An aspect of which was how the members of the Working Group would be accommodated. It was initially suggested that they could become hub operators – barefoot solar engineers running their own enterprises and making an income from providing solar electricity services to the community. However, the project partnered with Slum/Shack Dwellers association and so had to follow the organisation's democratic mobilisation rituals in selecting hub operators.

Galada, a prominent community figure and a Stellenbosch Informal Settlement Network representative at that time, had been asked by the Transitions Collective to identify possible hub operators who were also members of the network. Enkanini did not have its own Informal Settlement Network at this time as the enumeration process had just begin with a general meeting held to find volunteers to administer the enumeration. Those on the list would possibly become community leaders and even hub operators.

Galada had introduced Yondela, Victor, Sylvia and Siziphiwe as possible hub operators. They claimed to have attended the first enumeration meeting and had volunteered as administrators.

However, the uncertainty around whether they would become hub operators was highlighted at group meetings, as they might not meet the required criteria – being selected through a community-wide Slum/Shack Dwellers International-facilitated procedure (Enkanini Working Group meeting, 2012). The four were invaluable in testing the assumptions on how much beneficiaries could or would be willing to pay for solar services and ownership structures of the solar assets, among other aspects. Group meetings were open dialogues with expertise drawn from the four from their lived experience in the settlement on demographic profiles, practical constraints

regarding the lay-out of shacks and community perceptions of solar versus grid electricity. The group of four noted the risk of the project being politicised and stressed that beneficiaries should be carefully chosen.

It emerged that these four were not on the volunteer list for administrating the enumeration and this was confirmed by David Carolisson, the deputy-director of the informal settlements department at Stellenbosch Municipality and the municipal representative of the enumeration process. The four were surprised and arranged a meeting with Carolisson to find out why the list had been changed during the second meeting, which they had not attended. However, this meeting never happened and the groups continued to work together to brainstorm institutional arrangements.

The context changed with the advent of the funding as the iShack Project had, according to their partnership agreement, to comply with Slum/Shack Dwellers International's processes for selecting hub operators and beneficiaries. This included establishing an Enkanini Informal Settlement Network to allow leadership to emerge and elect the potential hub operators and beneficiaries. This had several implications for the Working Group.

They felt they had lost ownership in the project and were no longer needed to support the project's research and development needs for the next stage. They felt exploited as they had worked for the initiative and possibly would not become hub operators. They felt that the Informal Settlements Upgrade Group had used them for their local knowledge and that they would not benefit. They felt concerned that the project's selection process, as facilitated through Slum/Shack Dwellers International, would become politicised. The organisation's engagement with Stellenbosch Municipality had resulted in it being distrusted to a large degree casting doubts on those who would end up driving the enumeration process.

In effect, the Working Group had been under the impression that they were part of the project, from initial research to research outcome – a viable project with a robust institutional model to drive it. The researchers did not make this clear to them in the beginning of the process, perhaps because they themselves did not understand the difference between research and project processes.

The response

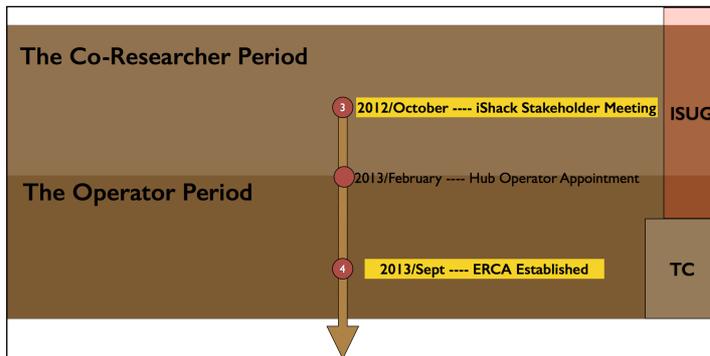
The Transitions Collective, in response, solidified its relationship with the Working Group by identifying roles and changing the name of the function from research participants in co-production of the iShack Project to that of co-researchers, who participate in all the undertaken research activities. This shifted the emphasis back to research.

Being the iShack Project field coordinator and member of the Transitions Collective, I was responsible for mediating engagement between the groups and logging the hours supplied to the project by co-researchers. They were then remunerated for their work and continued to assist in market-related strategies and by facilitating workshops to launch the project to the wider community. Those working in the sanitation and waste projects were remunerated with funds from the National Research Foundation. This provided a clear distinction between research and the project.

The challenge

As the members of the Working Group were now co-researchers and received remuneration for their efforts, the project needed to identify hub operators and beneficiaries. This would entail a Slum/Shack Dwellers International-facilitated process.

5.3.3 iShack Project stakeholder meeting

Figure 15: Research timeline for the iShack Project stakeholder meeting

Source: Author

Key: ISUG – Informal Settlement Upgrading Group; TC – Transitions Collective

The problem

A stakeholder meeting was held in October 2012 to identify and establish a stakeholder network for the iShack Project. However, the meeting became a space for the leader of the then-established Enkanini Informal Settlement Network, Mandla Mzesibe, to vent their frustrations about the lack of basic service delivery in the settlement. He made it clear that the community rejected the notion of solar systems as a means of electrifying the settlements because other needs had to be addressed first. These included establishing a crèche, relocating residents living in the flood zones and putting pressure on the municipality to provide grid electricity. In effect, rolling out solar systems was perceived as a pacification strategy to prevent protests about lack of service delivery.

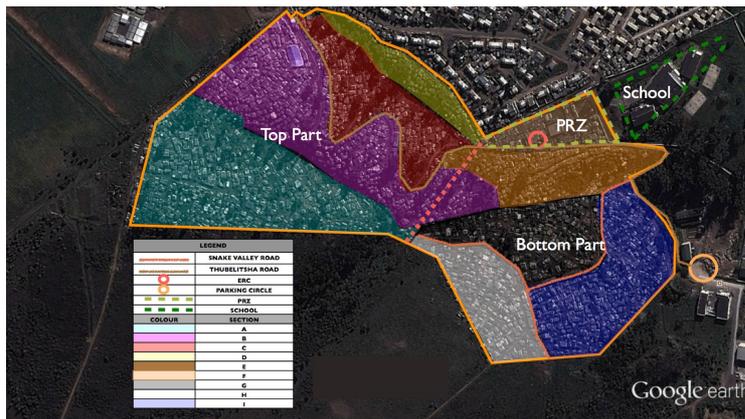
However, a meeting I had in October 2012 with Mandla indicated the presence of a deeper power play. I accompanied him to the bottom part of Enkanini to meet with residents in the crèche and members of the street committees. He asked me to present the iShack Project to those present. Those present seemed interested in the concept of solar-powered systems being an incremental and intermediate step to electrification. What became clear is that Mandla, while protesting the use of solar systems in the top part of the settlement where it was perceived as a pacification strategy, also needed to gain support from residents in the bottom part in order to be representative of the entire community and consolidate his position of power.

Effectively, solar was perceived as symbol and contestation was not around whether it was functional or useful. It was viewed as a tool to wield against the municipality,

gaining them access to meetings and providing a focal point for protests. This reflexion indicates power as matrix: power constitutes knowledge and objects depending on how it is manifested through a particular object, person or idea.

See the map below for a delineated top and bottom part of Enkanini.

Map 4: Enkanini divided into a top and bottom part



Source: Google Earth, 2013

The differences in attitude of those who live in the top and bottom part of Enkanini can possibly be explained by the following factors.

A part of Enkanini (within the bottom part) is possibly zoned residential land (indicated as “PRZ” in map 4). This is according to Carolisson from Stellenbosch Municipality. It is not clear what implications this has for the residents of the settlement’s bottom part. This land was originally demarcated for 47 families, some of whom reside in Enkanini, including Nobuhle. If offered legal tenure, it is likely that the priorities of those in the bottom part will shift to align with a more conservative

political outlook further fragmenting the existing divide between the top and bottom parts. Existing tensions revolve around access to electricity in that the bottom part has well-established informal connections with the electricity barons. Residents of this section have also been here longer and are better established with stronger social ties. They are less prone to conflict, protest or riot and less of them have participated in the enumeration process than residents of the top part. These residents drove the mobilisation efforts around the enumeration and comprise most of the listed volunteers to administer the enumeration. The four initial volunteers of Galada, Tjawa and Mthelo who have become co-researchers hail from the bottom part and share a long-term vision for upgrading the settlement.

This is possibly why they were removed from the list as they were not from the top part, which was driven by more extreme and different political motivations.

The iShack Project core group wanted to move the project to Langrug, an informal settlement of Franschhoek because of the increasing conflict and confrontations taking place in the community and because it was becoming clear that the leaders of the Informal Settlements Network were not representative of the entire community. However, this desire was overruled. The Systems A and B that were installed over the over the December holidays had proved that Enkanini could manage the iShack Project without the threat of vandalism or the settlement rejecting the project. The core group was tasked with finding another strategy to implement the project in Enkanini on a settlement-wide level without the standardised NGO engagement approach.

The response

The core group responded to the problem of a hostile market, ongoing conflict and lack of representative leadership by following an active, market-orientated approach. This decision represents a departure from the normative approach of selecting beneficiaries through a democratic mobilisation process to a more individualist approach of allowing self-selection to occur through active marketing. The following image depicts the first marketing material handed to Enkanini residents in mid- 2013.

Figure 16: iShack Project information sheet

Improved Shack with Solar and Design
SILL - Sustainability Institute Innovation Lab

Special Pilot Offer!
"Improve your shack in the iShack Project with solar electricity for **ONLY R100 per month** and a once off **R150 joining fee**"

The iShack Solar Package:
For R100/month or **R30/week** you get:

- 2 inside lights
- 1 outside security spotlight
- cellphone charger
- solar panel and battery to generate and store the power from the sun **AND**

Extras:
for **R80/month for 12 months** or **R800 once off payment** you buy a

- DVD player at R336
- Radio at R240
- Extra lights (lasts 20 yrs) plus switch at R216 each
- 42cm LED TV**

"Receive regular maintenance and services by a trained operator from your community"

The iShack Project will also be offering other improvements for your shack in the future, such as:

- Insulation material in walls and ceiling with
- inside wall sheeting and
- better water proofing

"Your shack will be warmer in winter and cooler in summer"

Please see the back for details...

Source: Author

Dissemination of this marketing material illustrated a departure from conceiving iShack users as beneficiaries to recognising them as clients. This shift towards a business model reliant on clients marked the beginnings of a disassociation with the iShack stakeholder network that included the Stellenbosch Municipality and Slum/Shack Dwellers International; although the relationship is ongoing. The commercialisation of the project moved it from a development organisation focused on community engagement and dependent on a representative leadership structure.

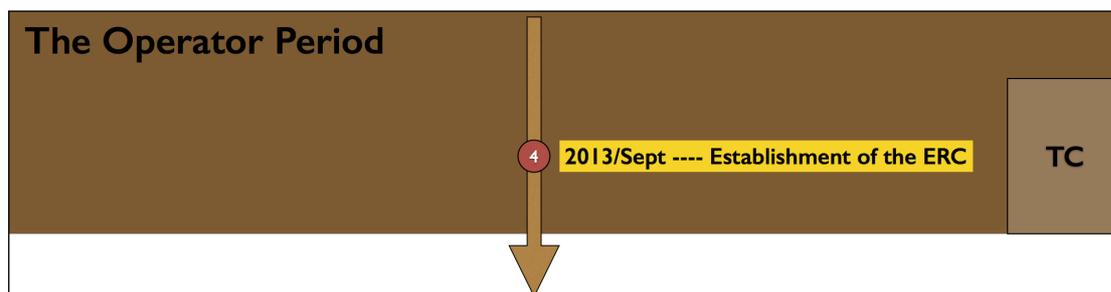
The challenges

The original intent of the project was to engage the informal settlement of Enkanini in a process of incremental upgrades through a transdisciplinary socio-technical approach, with an emphasis on co-production of knowledge. Commercialisation of the project and the opportunity to roll it out on a community-wide scale demands innovative research and development, including a focus on ecological design for affordable thermal comfort, sanitation systems that use minimal water and an effective waste management system. These would then need to be institutionalised in a robust model that encompassed training of local operators to ensure sustainability of the technology and model.

As a result of the Transition Collective’s experiences and the insights gained while establishing and implementing the project, it seemed logical to establish a research centre within the settlement. The centre would act as a point of engagement and enable capacity building and the co-production of knowledge for innovation in this field. It is the last turning point identified by this study within the demarked research period.

5.3.4 The establishment of the Enkanini Research Centre Association

Figure 17: Research timeline for establishing the Enkanini Research Centre Association



Source: Author

Key: TC – Transitions Collective

The problem

This final turning point is a culmination of the problems, responses and challenges outlined in the first three. The inability to effectively engage with the settlement through representative structures in turning point one to researchers engaging directly with residents and as individuals. The centre provides a space that accommodates both relations – individual and community. The centre also provides a space to showcase socio-technological innovations.

The tensions that arose in turning point two around the role of community participants in research was clarified by making them co-researchers and remunerating them for their time. However, this speaks to the tentative nature of the relationship between those with power (researchers) and those without (research participants). The centre is “owned” effectively by the community as all have access to its services and it is run by co-researchers who have a stake in maintaining it and enhancing its value to the community. In addition, it provides a space for capacity building through skills training, workshops and meetings.

The response

The centre constitutes an attempt to continue with implementation of socio-technical systems as innovation strategies within a transdisciplinary framework. These are to directly alleviate service-delivery constraints within the community. This process of organising users around a tangible technology initiates a series of institutional arrangements that are co-produced and managed by co-researchers. Furthermore, the partnership with Slum/Shack Dwellers International may induce socio-technical systems as engagement strategies, using a transdisciplinary problem-solving approach, in other settlements.

The establishment of the centre, as a physical institution, solidifies the relationships between researchers and research participants through entitlement as co-researchers. In this process roles are clearly defined, expectations are spelled out and co-researchers are remunerated accordingly. In addition, it acts as a space to exhibit prototype technologies such as solar systems, biogas generation, ecological design, pour flush toilets and food gardening to recycle household organic waste. Users actively test these prototype technologies that generate data for research purposes through monitoring and evaluation. This process opens the potential for innovations in technical design as informed by user feedback.

It can also provide a mediating function by being an information space on current and planned development for Enkanini, particularly given the relationship and access that most researchers enjoy with Stellenbosch Municipality and the ongoing outcomes of research conducted in the settlement. The centre can offer settlement leaders professional services, such as compiling documents, manifestos and official statements/complaints/invitations when they choose to engage with the municipality.

The challenge

Given the expanding role of the centre, it needs to increase its co-researcher base as some of the original co-researchers have relocated to other settlements or been absorbed into the iShack Project. In addition, the centre needs to build capacity to act as a service delivery vehicle for the realisation of tested technologies with sound institutional models that can tender to local government and consult with developmental organisations on matters pertaining to upgrading.

5.4 The emergent results from the “open” coding process

A visual representation of the coding process is provided here to illustrate how broad data sets emerged, such as “pacification strategy” (highlighted in yellow), “solar electricity was used as a symbol”, “active participation” and “developing skills”. Words and phrases derived from memos, notes and semi-structured interviews are coded and recoded to allow for comparison and elimination of repetition.

Rigour is ensured in the process by checking and rechecking the accuracy of the data continuously, ensuring that the analysis is as thorough as possible and watching for bias introduced by the researcher’s own values (Yin, 2011). When reassembling the data, care was taken to watch for similar and dissimilar items in the data and to question why this was so, being aware of “negative instances” where valid data might be inadvertently excluded, being on guard against assuming that data that appears similar in the broader research space is the same in the particular context of the study and employing “rival thinking” to test assumptions made in other cases before drawing a conclusion based on a limited number of cases (Yin, 2011).

5.4.1 Visual representation of the coding process

The following figures demonstrate the steps taken in the coding process. These steps are outlined below.

Step 1: Drawing data sets from text (figure 18)

Step 2: Comparing level 1 codes under each turning point (figure 19)

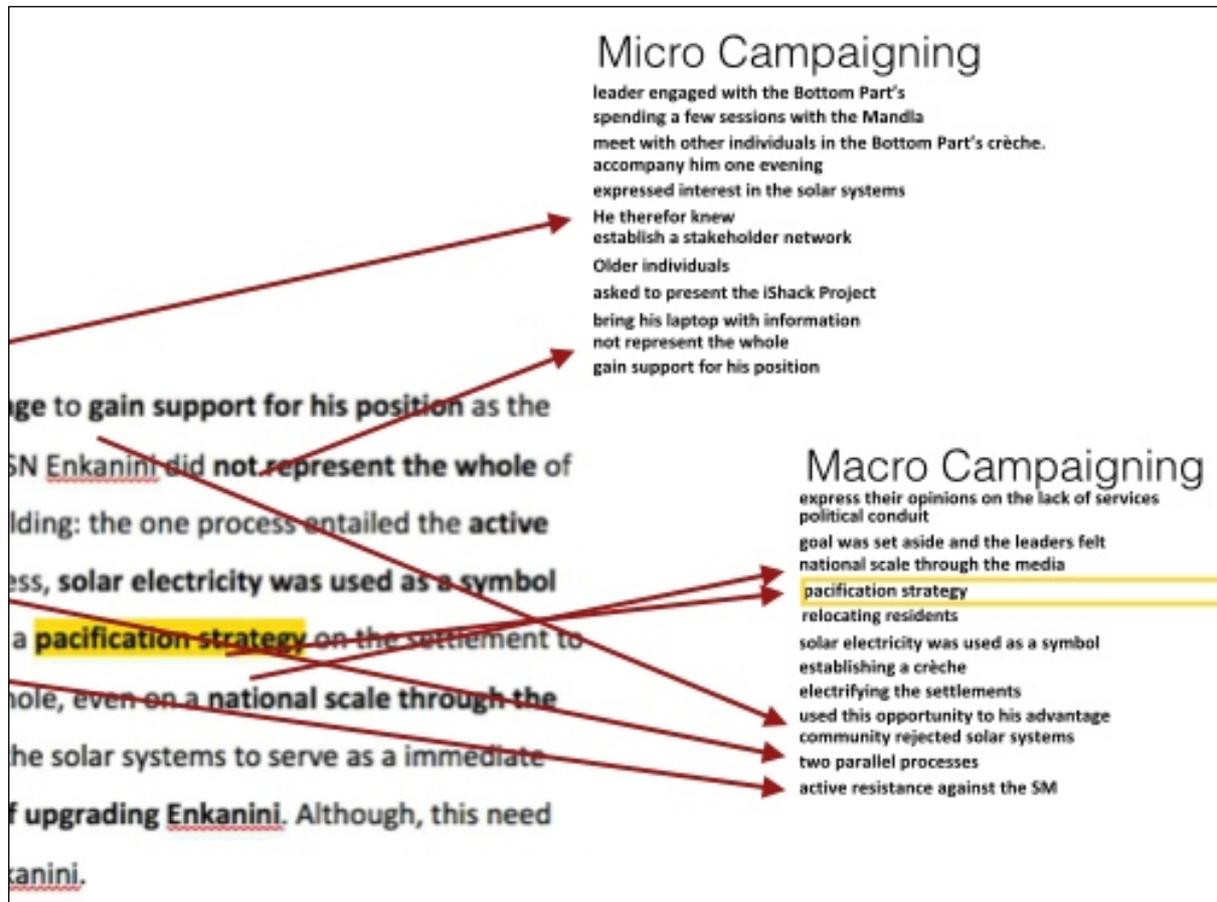
Step 3: Coding comparisons (figure 20)

Step 4: Level 2 coding (figure 21)

Step 5: Level 3 coding (figure 22)

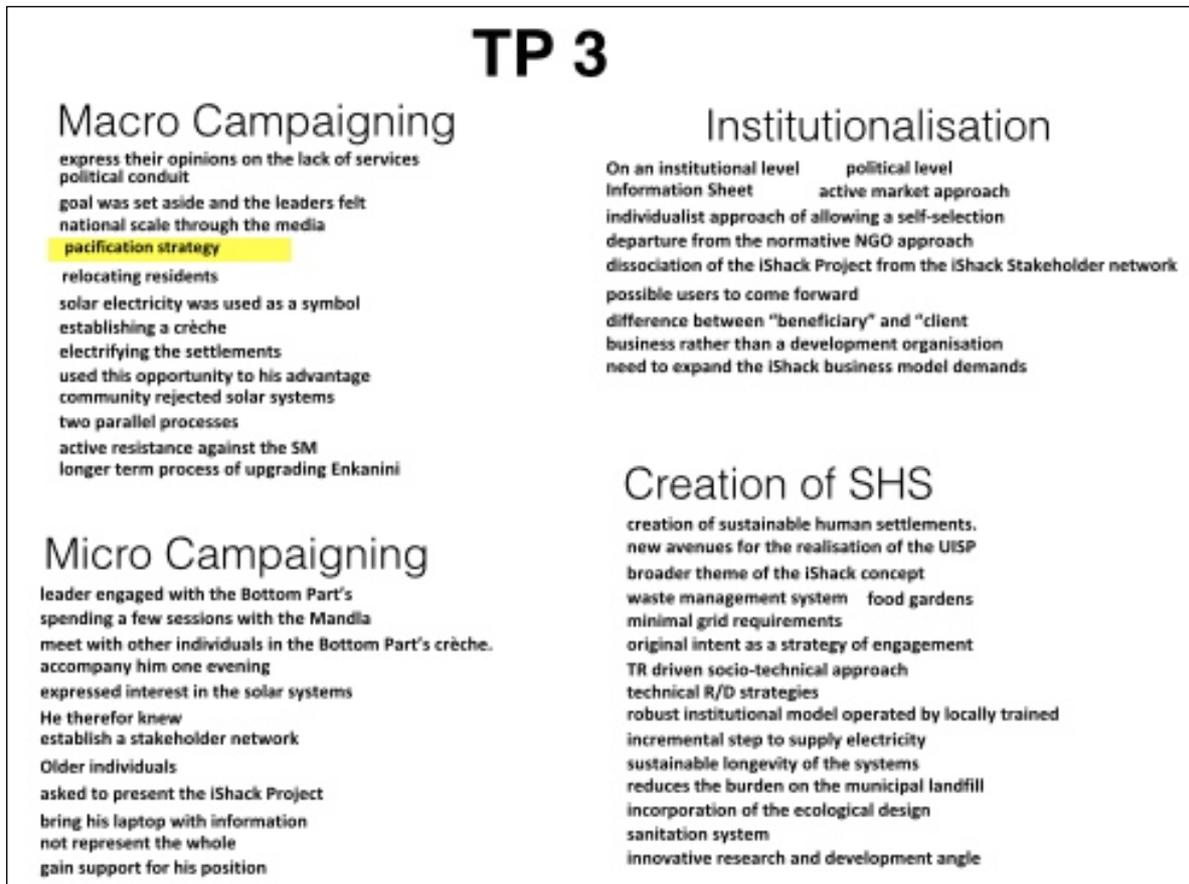
Step 6: MAXQDA screenshot (an explanation of this process is given under the figure).

Figure 18: Drawing data sets from text



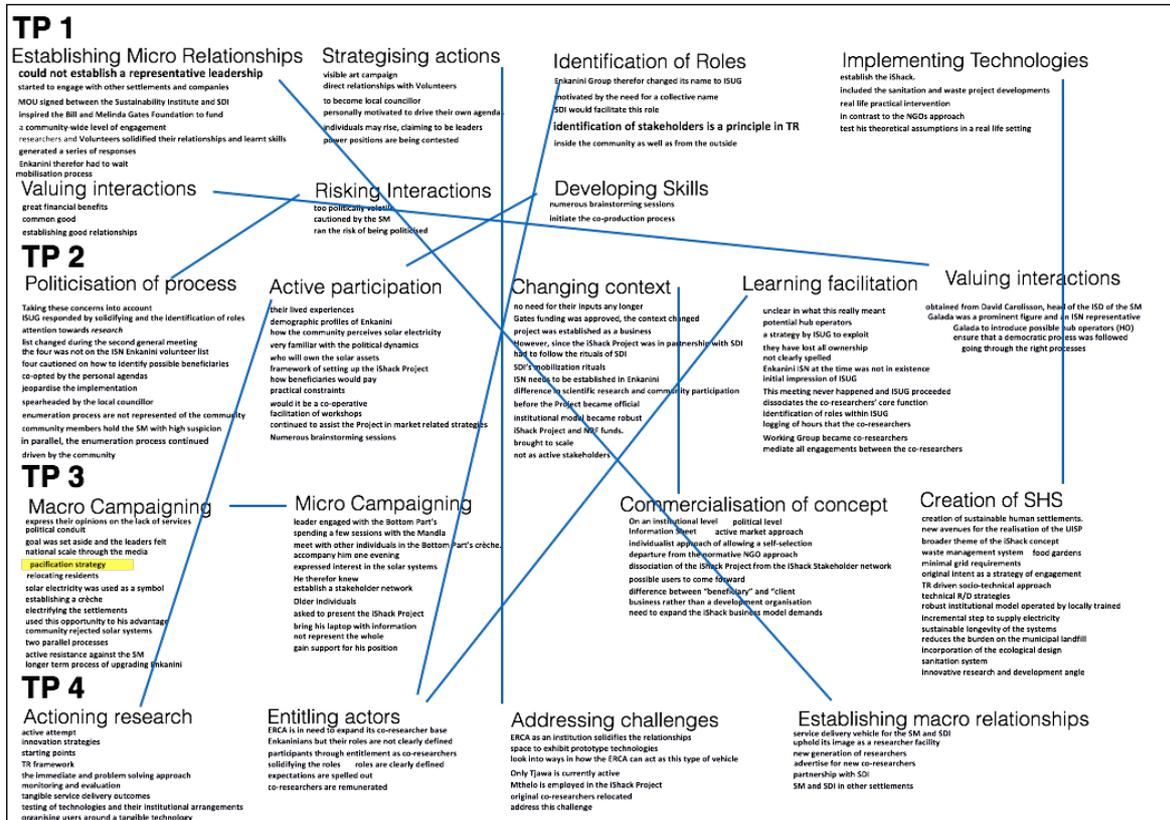
Source: Author

Figure 19: Comparing level 1 codes under each turning point



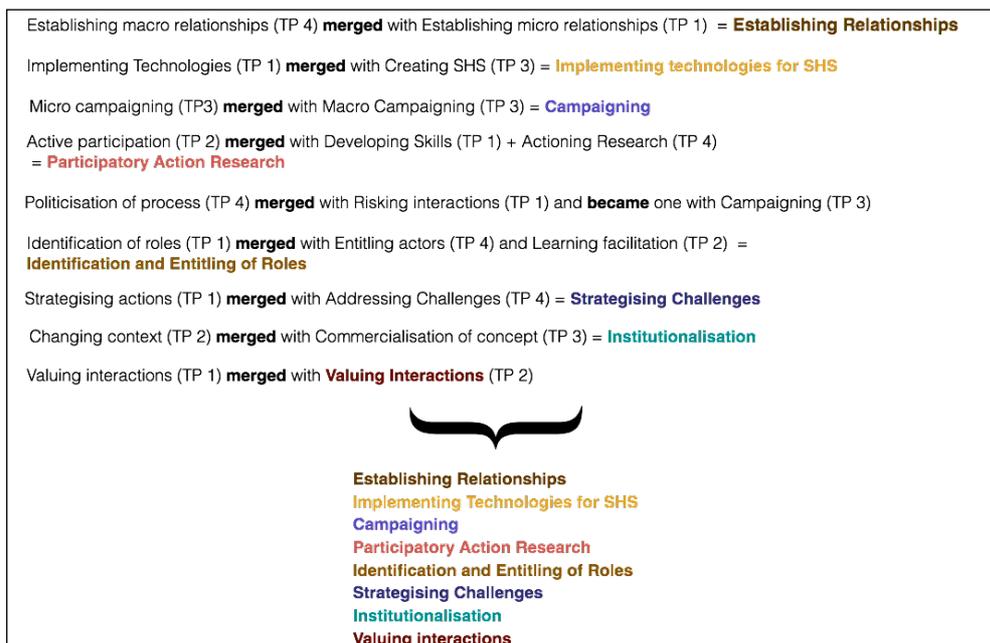
Source: Author

Figure 20: Coding comparisons



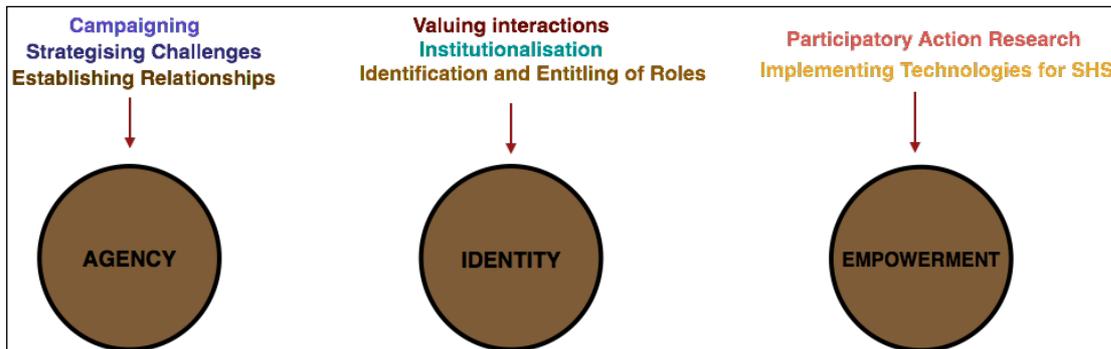
Source: Author

Figure 21: Level 2 coding



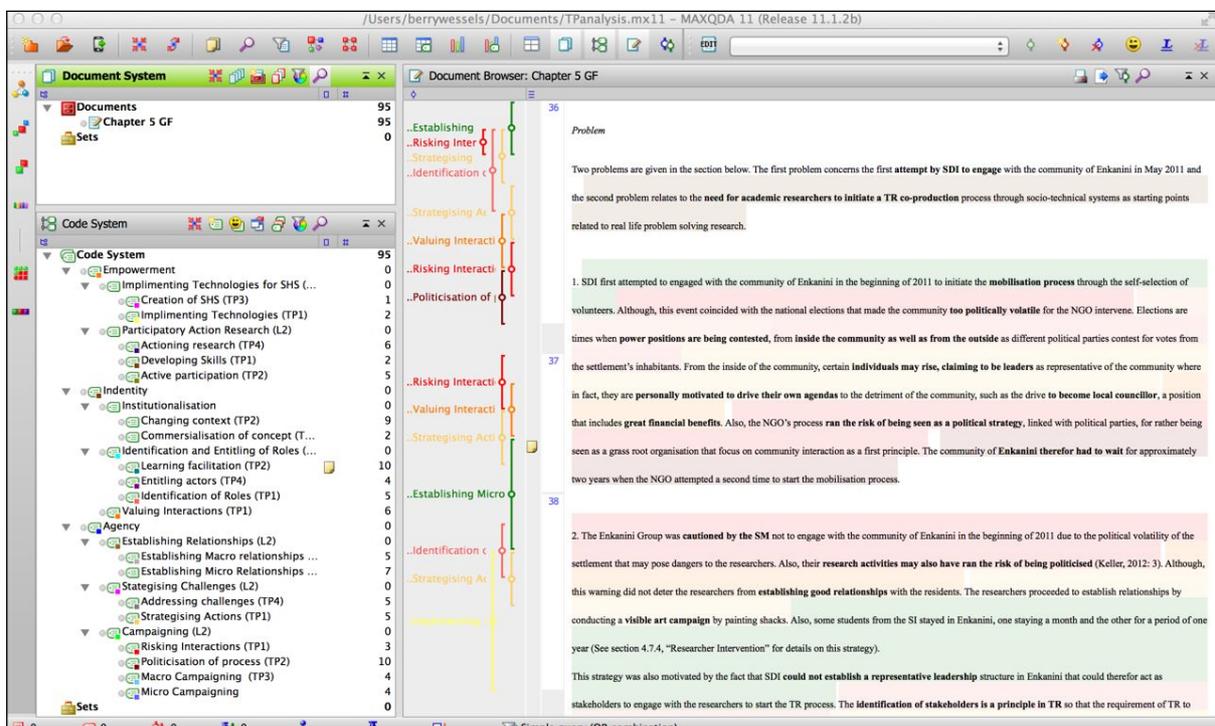
Source: Author

Figure 22: Level 3 coding



Source: Author

Figure 23: MAXQDA screenshot



Source: Author

Figure 23 shows an overview of the coding procedure with the assistance of computer-aided qualitative data analysis software. MAXQDA (Yin, 2011) was used in this study as it allows for the visualisation of data and displays the real-time coding procedure in windows. The bottom left coding hierarchical “tree” shows the categories with their level 1 and 2 codes. The window on the right shows the colour-coded text with their in vivo codes (in bold) constructed by “open” coding.

5.4.2 Interpretation through explanation

The analysis of the turning points as bifurcations through grounded theory allowed for the emergence of three themes as categories. These categories are agency, identity and empowerment. This study indicates that in order to shift power from government to communities in a context of informal settlement upgrading these three emergent categories must be embedded in all engagement strategies and capacity-building initiatives, while recognition of context provides for a broader understanding of the recipient community.

Interpretation is the second last phase in the analysis process before concluding the study. Yin (2011) notes that for interpretation to be consistent it should have a clear beginning, middle and end, it should be fair so that others may come to the same conclusions, it should be empirically accurate, it should add value and it should be credible.

The style of interpretation used in this study explains how and when events came to be and also who and why people acted in a certain way. Interpretation through explanation also serves to describe how events unfolded in the study (Yin, 2011). I have used Yin's (2011) aids for the interpretation process. Firstly, that the title should act as a guide, the patterns derived from the analysis process should act as pillars to the interpretation – these were agency, identity and empowerment, and the research question provides the central point of the analysis. The research question was: If it is accepted that the locus of power needs to shift from government to citizens during the incremental upgrading of informal settlements, then how can the co-production of knowledge contribute to this shift?

The three categories are detailed below, as are the properties of each, followed by an interpretation of the results. The interpretation of the results is drawn from figure 22 where each interpretation is accompanied by its level 2 codes to form a category. The analysis process departs from grounded theory at this stage since explicit reference is made to the use of theory and the methodological triad.

Agency

Agency refers to the capability of an actor to make a difference by exercising her/his power within an existing dynamic considered to both transformative and dominant (Giddens, 1984 in Gaventa, 2003). Cornwall expands further by noting that an actor with agency is situated in a space that s/he can create, open or reshape to influence the dynamic of power (2002).

Property of category

The property of this category is exercising power within a space.

Interpretation

Establishing relationships: Relationships were established within and outside Enkanini. Macro-relationships outside the settlement were forged with Slum/Shack Dwellers International, which resulted in the iShack Project receiving funding from the Gates Foundation. Power was shifted from “power as domination” to “power as transformation” because residents (as co-researchers and operators) started to actively engage with upgrading initiatives through co-production of knowledge. Reflexivity allowed for an awareness of “power as matrix” within a politically volatile setting (high levels of power contestations) that contributed to the constructive manifestation of power as transformation. This shift is exemplar of co-arising as transdisciplinary, indigenous and reflexive research merged to produce agency in residents.

Strategising challenges: Researchers established direct relationships with individuals, rather than with the broader community. It was important for the Transitions Collective to uphold its image as a research entity so as to not be co-opted by personal political agendas. Challenges such as lack of service delivery were addressed by testing and prototyping technologies in the research centre. The centre also institutionalised relationships as an act of creating a space for research and mediating power dynamics.

Power tools were used to map positions of power within the settlement, which allowed for strategising the path of influence.

This was useful when deciding to use the solar systems as a political strategy to secure the project in Enkanini, in the face of possible vandalism. This also speaks to power in an actor-network within which solar as an actor influenced the relationships between residents and the iShack Project.

Campaigning: The Transitions Collective took risks by engaging with Enkaninians during times of political volatility. During this time, the co-researchers gave valuable advice in how to proceed with the iShack Project to select beneficiaries by not following a community-wide approach due to the undemocratic representation within the Enkanini Informal Settlements Network. Solar power was seen as a municipal pacification strategy to inhibit protests. In the same instance, solar power was desired by the leaders who rejected it in the public sphere. This contradictory statement speaks to mode 2 of knowledge co-production in which assumptions, beliefs and contradiction are inherent (Regeer & Bunders, 2009). Through reflexion on this, solar power acquired a new meaning, as a critique on government inaction (dimension 2 of “power as dominance”) and a pragmatic power tool, constructed by the leaders to wield against the municipality. Parallel to this, solar power served as a socio-technical solution in the immediate term while pressure is put on the municipality to upgrade Enkanini. This parallel process captures a “space of appearance” as a fleeting moment where spaces were created to mount a visible campaign through protests and clandestine, inner-settlement campaigning in favour of solar power. Agency, albeit brief, was produced through co-arising that took local, indigenous knowledge, mode 2 knowledge and knowledge derived from reflexion into account.

Identity

Lawhon and Murphy (2011), bringing in the dynamic of power to socio-technical transitions towards sustainability, ask through whose agency does change occur, whose knowledge counts and who is represented and making decisions? Similarly, Cornwall, states that to bring accountability and legitimacy into participatory development, one need to asks “who speaks for whom about whom” (2002: 24).

Property of category:

The property of the category is “who” constitutes the co-production of knowledge process?

Interpretation

Valuing interactions: The ideal scenario for the identification of stakeholders would entail a NGO-facilitated beneficiary and participant selection process to ensure democratic representation. As this did not exist in Enkanini, the Transitions Collective had to go through their own channels to select participants. Galada initiated these procedures and the co-researcher group continues in action-research activities.

Identity was established through the Doing Policy Work tool that outlined the characters that had influence on political interaction (International Institute for Environment and Development, 2004 in Gaventa, 2003). Dawie Carrollisson, deputy director of Informal Settlements was considered the “maverick” since he, as an African National Congress member, stood out within the predominately Democratic Alliance-driven municipality with “individual ideological predispositions” (International Institute for Environment and Development, 2004 in Gaventa, 2003). On the community level, Galada was considered the “village sage” (Chilisa, 2012:41) with indigenous knowledge expressed through the notion of “quiet development” (Keller, 2012). Carrollisson drove the enumeration process that derailed and at the same time provided the idea of co-researchers to the Transitions Collective. Galada identified the first four volunteers who eventually became co-researchers and thus shifted the locus of power from the municipality and Slum/Shack Dwellers International in choosing the hub operators by himself, as a resident of the settlement. This was set in motion through the co-production of knowledge process initiated by Keller with the establishment of the iShack.

Institutionalisation: The context of the research space underwent changes when the iShack Project shifted from a research undertaking towards an institutionalised project.

This entailed the commercialisation of the concept by following a market approach to identify clients, as opposed to choosing beneficiaries as users of the solar systems. Also, the selection of hub operators had to be drawn from the community as a whole and not only from the group of co-researchers.

The institutionalised project entered the socio-technical regime level (Geels, 2004) to embed electricity through solar power within the informal urban space that could open new subsidy flows to indigent households. This speaks to the World Watch Institute's proposition about initiating shifts in funding resource mechanisms to the urban poor (2007). The project can act as this mechanism.

It also forms identity for the informal settlement dweller, as both end-user and operator, as part of the urban fabric. The release of the free-basic electricity subsidy for these solar systems would be the penultimate moment of co-arising within the community engagement project as identity is formed through a new understanding of capacity building and engagement strategy that shifted the locus of power from government to citizens.

Identification and entitling of roles: The uncertainty in direction of the research process placed the researchers in a position of accountability since they were responsible for the interactions with the co-researchers and the ownership created by the co-researchers in the research process. In response, the co-researchers became entitled within the research centre as active researchers that differentiated them from the iShack Project. Also, the identification of research participants as co-researchers clarified their positions in Enkanini as research participants, rather than political leaders.

A better understanding of the indigenous researcher's call for a relational axiology could have facilitated the initial engagements. This value system that places the responsibility more firmly on the researcher to be aware of relational representation and relational accountability (Chilisa, 2012) could have brought the co-researchers more firmly into the scientific knowledge space.

This space represents a relational epistemology of the co-researcher as the decision-maker on how co-produced knowledge should be managed and presented. Authorship is a method to embed the identity of the co-researcher into the scientific knowledge world.

Empowerment

Sadan states that a definition of empowerment cannot be attained without looking at the underlying currents of power that produce empowerment and disempowerment (1997). VeneKlasen and Miller build on this ambiguous nature by adding that the process of empowerment is not a linear process since it spirals between contradictions, discoveries and changes (2002). To allow for the process of empowerment, it is suggested that spaces can be constructed where confidence in knowledge and capabilities can grow and recognition of agency can shape one's sense entitlement (Cornwall, 2002).

Property of category

The property of this category is holding the process of empowerment through constructed spaces.

Interpretation

Implementing technologies for sustainable human settlements: Socio-technical systems such as solar systems, off-grid sanitation, organic waste management and ecological design created spaces of action in the transdisciplinary research process.

Power of transformation is manifested through socio-technical strategies by creating spaces of participation and empowerment. Incrementalism realised through co-produced strategies alleviates constraints in the immediate term while a parallel political process unfolds. The incremental shifting of power from government is exemplified by local co-produced innovations that can synchronise with government processes in the future once a new level of rationality is achieved on both sides. Institutions, locally designed and managed, form this bridge balancing out power relationships.

Participatory action research: The actioning of research by implementing tangible technologies related to real-world problems has developed skills and confidence in the co-researchers enabling them to contribute experiential and local knowledge to the research space. Their technical project design knowledge as well as knowledge about local power dynamics was expressed through workshops, brainstorming sessions and their active participation in the Enkanini Research Centre space. The centre effectively embodies a literal and figurative space of empowerment that can encourage knowledge and capability growth.

5.5 Conclusion

Chapter 5 outlines the contribution made by each of the chosen methodologies: transdisciplinary research to enable understanding of the complexities of the research space, indigenous research to locate researchers in a power matrix to build capacity and reflexive research to take into account the influence of power on research processes and outcomes. Grounded theory is introduced as a way of assembling and disassembling the data to allow the theory to emerge from the data, as opposed to preconceptions shaping the data to fit the theory.

Themes were highlighted through an “open” coding practice following Yin’s (2011) five-phase analysis approach. The identified turning points identified through the case study process are interpreted as bifurcations – the start of a new translation that changes the meaning and outcome of a narrative (Latour, 2005). The turning points were identified as the establishment of the iShack, the start of the iShack Project, the iShack stakeholder meeting and the establishment of the Enkanini Research Centre.

These bifurcations are explored as dialectics with descriptions provided of the initial problem, the response and the resultant emergent problem. Coding was used to analyse these turning point and three dominant categories emerged: agency, identity and empowerment. These are interpreted in the Enkanini context and provide the research outcome of this project.

Chapter 6: Results and insights

6.1 Introduction

This chapter concludes the research study by addressing the research question that emerged during the research process. The research question was: If it is accepted that the locus of power needs to shift from government to citizens during the incremental upgrading of informal settlements, then how can the co-production of knowledge contribute to this shift?

The title of this thesis: *Turning points: Exploring power transitions in an incremental upgrading process in Enkanini, Stellenbosch* provides a clue as to the spaces that were identified and explored to attempt to answer the research question. These spaces, termed turning points, are viewed as bifurcations opening up potentially new ways of engaging with the present to determine an alternative future. These turning points are dialectic in nature – each starting with a problem, which generates a response that, in turn, presents a new challenge. These four turning points were:

- Establishing the iShack
- Commencing the iShack Project
- The iShack Project stakeholder meeting
- Establishing the Enkanini Research Centre Association.

Just as with incremental upgrading, incremental capacity building has taken place resulting in a sense of identity, agency and empowerment in both researchers and the research participants (who evolved into co-researchers over the three-year study time-frame).

6.2 Study outcomes

The study outcomes, generated through an “open” coding process based in grounded theory, indicated that in order to shift power from government to community in the context of informal settlement upgrade processes, identity, agency and empowerment need to be embedded in all engagement strategies and capacity-building strategies, whether they are led by government or NGOs.

In addition, acknowledging context (political, economic and social) is vital for deepened understanding of the settlement that initiatives are embedded in.

Power is a central aspect to all three of these notions and was therefore explored through a literature review and formed the rationale for the methodological triad.

6.2.1 Agency, linked to capacity building

Agency, referring to the capability of an actor to make a difference by exercising her/his power with an existing dynamic (Giddens, 1984 in Gaventa, 2003), is pivotal if citizens are to drive incremental upgrading processes that are suitable to their own context and needs and to open up space to engage with and shape policy relevant to them. Agency refers to the ability of an actor to create, open or reshape spaces to influence power dynamics (Cornwall, 2002). These spaces can be political, social, institutional, geographic or even “inner” space, brought into the qualitative study through reflexivity. Agency can be enhanced through capacity building. It became apparent during this study, that the research process itself provides a platform for building capacity, and thus agency, in researchers, co-researchers and participants.

Indigenous research was incorporated into the methodological framework to emphasise the importance of capacity building. This methodology creates an awareness of power from both a critical and transformational perspective. It is particularly apt for this study as it is used in research spaces where groups are marginalised and have no “voice in the research space (Chilisa, 2012). There is a focus on building capacity to ensure that research participants can actively participate in the entire research process (Chilisa, 2012) and, in this case, the co-production of knowledge process. The first of The World Watch Institute’s (2007) three shifts needed to accommodate the growing population of urban poor while designing resilient and adaptive cities speaks to the need to revise the systems that regulate resource flows through funding to the urban poor. This is linked to capacity building – creating projects and institutions that manage resources in participation with the urban poor. The Transitions Collective, by situating innovation through socio-technical systems within a transdisciplinary framework, provides a possible way to organise people around these systems and build capacity in the process.

It must be noted that whole organised communities (those with representative leadership and organisational structures) are considered a *de facto* condition for capacity-building initiatives (Huchzermeyer, 2008; Mitlin, 2008; Satterthwaite, 2008; Bolnick et al., 2011). The iShack Project has bypassed this normative approach by adopting an active, market-orientated approach that allows self-selection of end-users to take place. This is described in turning point 3. Co-produced knowledge is vital to allow innovation to overcome local technical restraints and social barriers and reach acceptance (Regeer & Bunders, 2009), as it includes demand-side innovation, which when combined with supply-side innovation forms a socio-technical system (Geels, 2004). Turning point 4 – establishing the Enkanini Research Centre – provides both a geographical and research space through which to continue building capacity (and thus agency), in research participants, co-researchers and residents of the settlement.

Lawhon and Murphy (2011) and Cornwall (2002) question through whose agency does change occur, whose knowledge counts, who is represented and who is making decisions. The research outcome of the importance of identity relates directly to this.

6.2.2 Identity, linked to place and space

Cornwall (2002:24) notes that one needs to ask “who speaks for whom about whom” in participatory development. Several instances of shifts in or emergence of identity occurred during the research process. The “adoption” of Enkanini as “our” local settlement for the Sustainability Institute conferred a sense of identity on Enkaninians on a spatial level. The Enkanini Research Centre is another such space, aimed to facilitate capacity building and act as a resource and mobilisation centre in terms of interaction between settlement residents and government structures and NGOs. The centre, referred to as the “church” has formed an identity of its own falling within Cornwall’s (2002) third cluster as residents can choose to use the space or not and participation in the space can be perceived as an act of identification. In addition, protests by residents, occurring as they do in brief moments of time, relate to Cornwall’s (2002) fourth cluster as “spaces of appearance” which also bestow a temporary collective identity on participants. The illegal status of Enkanini also affects the identity of residents.

A shift in focus to upgrading these settlements to sustainable settlements that are recognised formally as neighbourhoods enables a more positive identity for residents.

The research participants became co-researchers and were entitled, with clearly defined roles and remunerated for their efforts. This shifted their sense of identity within the project framework and it also shifted their identity in the wider settlement, as they were confirmed as research participants, as opposed to political leaders who might be steering the upgrade process to benefit themselves.

Reflexive research that situates the researcher as an actor with insight in the social space allowed for this identity of the co-researchers to form through entitlement. Including co-researchers as authors in publishing research findings would acknowledge their identity and ownership in the research process. It would also bring the focus of co-production of knowledge to capacity building and empowerment through exposing them to scientific techniques, including observation, validation and replicability of results. The transdisciplinary research call to bring society into science is perhaps better recast as a call to bring science into society, thus shifting the base of power to people, not scientific institutions.

6.2.3 Empowerment and exposing power

There can be no empowerment without exposure of the underlying currents of power that either empower or disempower (Sadan, 1997). Cornwall (2002) recommends constructing spaces that build confidence in knowledge and capacity to allow for empowerment, which is not a linear process spiralling as it does between discoveries, contradictions and change (VeneKlasen & Miller, 2002). The constructed spaces outlined in this study include spaces of action generated through the transdisciplinary research process, these include solar systems, off-grid sanitation, organic waste management and ecological design. The co-production of knowledge process can institutionalise the operations and management of these systems to realise the upgrading of informal settlements. The Enkanini Research Centre is another such space.

6.3 The research process, methodology and “open” coding

The process followed in attempting to address the research question followed a series of steps:

- Build a theory of power relationships to understand how power influences the co-production of knowledge process during the incremental upgrading of informal settlements.

This has been built through a comprehensive literature review and the methodological framework.

- Construct a methodological framework that contributes an understanding of the influence of power on the transdisciplinary research process of knowledge co-production.

The study has done this by creating the methodological triad that takes the inherent, transient and shifting power dynamics of Enkanini into account and its affect on the process of knowledge co-production.

- Identify turning points where power dynamics influenced the outcome of the co-production of the knowledge process.

Four turning points were identified as bifurcation points opening up space to empower and build capacity and identity among researchers, co-researchers and residents.

- Analyse the turning points to see how the co-production of knowledge contributed to a shift of the locus of power from government to citizens.

Analysis of the data allowed three categories to emerge: identity, agency and empowerment. All three are key to co-production of knowledge processes and to shifting power from government to citizens in incremental informal settlement upgrading processes.

6.3.1 Building a theory of power relationships for settlement upgrading

The literature review of chapter 2 was outlined according to a transdisciplinary research framework that tasks the researcher to ask questions related to complex problems, such as the upgrading of informal settlements. Transdisciplinary research incorporated the challenge of urbanisation, an acknowledgement of policy responses, incrementalism and co-production of public services and knowledge in its framework. A theory of power relationships had to be constructed to support this framework since the framework cannot be applied to solve problems without taking power dynamics into account during the upgrading of informal settlements. This power dynamic influences participation and stakeholder identification to initiate the upgrading process and the way knowledge is produced.

The theory of power relationships was built from three modes of power as domination, transformation, and power as a matrix. Dominating power is expressed through decision-making of the powerful, non-decision-making through coercion and manipulation and finally, through shaping people's perceptions to be unaware of domination. Transformative power empowers people through action and certain power tools can be used to map and strategise actions for development. Power as matrix describes the pervasiveness of power that can take on the different modes through its expression in concrete spaces, the actual sites of power contestations and metaphorical spaces of deliberation, opinions and discourse. These spaces are created, opened and reshaped by actors to form their identities, agency and power to participate and influence the co-production process.

6.3.2 Constructing the methodological triad

Chapter 3 outlined the construction of three methodologies that was pertinent throughout the study. Transdisciplinary research, indigenous research and reflexive research were combined into an interdependent triad to best describe the complex nature of the data, experiences, theories and practices of this study. The methodological triad was distilled into a conceptual mechanism constructed as the notion of co-arising. Co-arising encapsulates the symbiotic relationship of the methodologies by relating their convergences through their limits and contributions to the study.

Transdisciplinary research contributes a method of understanding the research space through the notion of co-production of knowledge. This methodology is limited in its capacity to take the pervasive dynamic of power relationships into account. Indigenous research addresses this limitation by situating indigenous knowledge within a postcolonial indigenous research paradigm to highlight power imbalances. This methodology is limited in its method to engage with the research space from the perspective of a researcher without the background of the colonised other. Reflexive research situates the researcher in a social space that acknowledges the interpretive, political and rhetorical nature of empirical research thereby providing an avenue to engage with the research space.

Co-arising brings the interdependency of the methodological triad together in a theoretical framework through their corresponding themes of understanding, capacity and engagement. This theoretical framework served as the guiding principle of observation, practice, theory and experiences during fieldwork and analysis of findings.

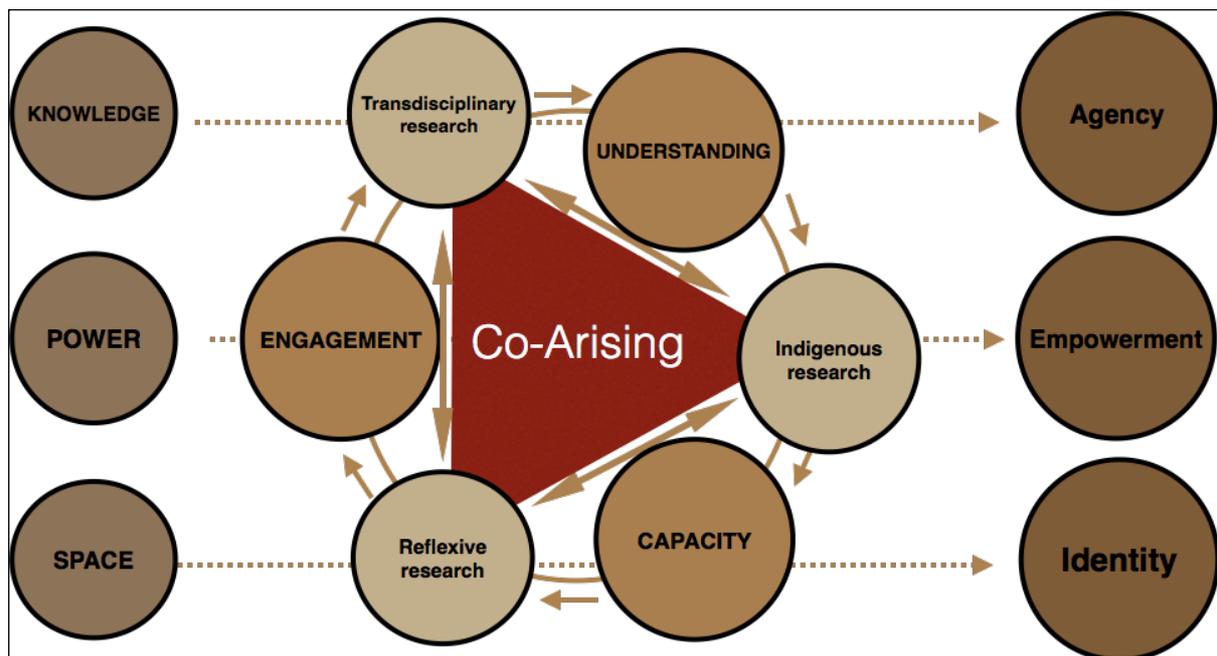
6.3.3 Grounded theory and “open” coding

To assemble and reassemble the data, “open coding” was used to allow the categories to emerge, which could then be used as a theoretical base (Charmaz, 2008). This tool is affiliated with grounded theory, which aims to minimise the interference of pre-conditions that shape the research process and outcome (Bryant & Charmaz, 2007 in Charmaz, 2008). Coding can be used throughout the study or used for particular purposes, as it was for this study (Yin, 2011) to develop conceptual data sets derived from the turning points identified in chapter 2 and then into manageable codes representative of a series or categories of data. It is useful – given the complexity of the research space and the varying roles played by the researcher in this study – as it forces the researcher to ground her/his ideas on empirical data (Charmaz, 2008). The study used Yin’s five phases of analysis to compile the data, disassemble it, reassemble it, interpret it and conclude (Yin, 2011).

6.4 Towards an Enkanini research paradigm for new research

This study formulated an Enkanini research paradigm that provides for a time slice into the research space of Enkanini. The time period started in 2011 and ended in 2014. This paradigm contains certain paradigmatic criteria that encapsulate the constructed knowledges from experiences and analysis. The paradigm may then serve as a window into possible future research. The following figure illustrates this paradigm.

Figure 24: The Enkanini research paradigm



Source: Author

6.4.1 Summary of the study

The notions of knowledge, power and space are derived from theory and literature to focus on the challenge of working within communities where the dynamic of power relationships influences the production of knowledge, the potential for capacity building and the method of engagement from the researcher's perspective.

The interdependent methodological triad constructs a foundation built on understanding, capacity and engagement. This foundation is solidified by the three respective methodologies of transdisciplinary research, indigenous research and reflexive research.

Their interdependency is distilled into the conceptual mechanism of co-arising that serves as the all-encompassing term that influences method and analysis to produce results. This conceptual mechanism, through a coding process, generated three dominant categories – agency, identity and empowerment – as determinants for shifting power from government to citizens in a co-production of knowledge process.

6.4.2 Recommendations for future research

The following recommended research areas can be mediated by the Transitions Collective through the Enkanini Research Centre.

- Exploring the options for settlement-wide technical upgrade interventions, such as infrastructural improvements related to roads, drainage and street lighting.
- Exploring, developing and enhancing community cohesion through spaces: public spaces for recreation, creative expression, child care, medical needs, food and emergency facilities.
- Exploring institutional design for delivery of infrastructure and services, such as waste management and sanitation solutions for deliberation with the municipality.
- Exploring the structures capable of managing these potential projects.

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Appendix A1–6: Enkanini Research Centre construction process

A1: Space characteristics

The church was one of the original structures in Enkanini, built around 2007 (Galada, personal communication) and located in Section H on Snake Valley Road, one of two main roads that make Enkanini accessible to motor traffic.

The structure was 9 metres long and 5 metres wide with a roof height of approximately 2.5 metres. It had one door on the east side, two windows on the north and one window on the south side. It was a post and beam structure⁵ and wrapped in corrugated iron sheets (zinc) for the walls and roof.

The floor had a carpet that lay on top of advertisement canvas material that separated the interior from its base: the original clay soil of the settlement. The south side overlooked the road running 2 metres below it and into the valley of Stellenbosch with the backdrop of the Hottentots Holland mountains indented by the horse-shoe shaped Jonkershoek valley with Botmanskopp on the right and Stellenbosch Mountain on the left. The church had the classic layout of most churches in Enkanini of different Pentecostal denominations and was constructed by materials dominated by the local vernacular of zinc, hardboard, advertising boards, canvas, asbestos and any other piece of water-proof and light material that can be found on the dumpsite (or any other site) that can withstand, albeit for a short while, the weather conditions of the Western Cape.

The weather of this region of South Africa is characterised as a dry subtropical Mediterranean climate with an average high temperature of 20°C and an average low temperature of 10.6°C. The average amount of precipitation in the year is 929.6 millimetres with most falling in June (167.6 millimetres) and the least in January (22 millimetres).

⁵ A post and beam structure is a timber frame constructed by corner posts with beams supporting the roof.

A2: Team selection

The team was selected based on the skills aligned with the unconventional design criteria specific to the site characteristics and the social milieu of the settlement.

(Appendix B gives an outline of project participants and their respective roles and responsibilities)

Architectural plans

Malcolm Worby from Malcolm Worby Designs was contracted to draw up the architectural plans for the Enkanini Research Centre. Mr. Worby had designed a number of the houses in the Lynedoch Eco Village, home of the Sustainability Institute. He was also seminal in the design of the iShack, together with Andreas Keller who formulated the iShack concept in his masters thesis (Keller, 2012). Malcolm's approach to this project was influenced by the imperative that the design and construction process should be able to take hold in Enkanini, i.e. that the residents should be able to apply the same building methods and materials to build their own dwellings. This approach aligned with mine and laid the foundations for a good working relationship based on the desire to enable Enkaninians to upgrade Enkanini by themselves.

Malcolm was aware of the challenges of designing structures for informal settlements that are transient, and in this case, illegal, meaning that residents could be evicted at any point. In addition, the materials had to be affordable and available to Enkaninians. He had extensive experience in natural building design from his architectural firm in California. As an aside, he has designed mansions for celebrities, including for the lead singer of the popular rock band ZZ Top.

Building contractor

Elijah Skosana of Siqalo Eco Builders was contracted to oversee the construction process. Mr Skosana had extensive experience in ecological-design building methods from working with Malcolm on projects at Lynedoch at elsewhere. It was the first time that Elijah would take on a project of this kind. It became apparent that Elijah was not finding the construction process itself challenging, but was battling with the notion being an outsider and struggling to assume his normal managerial role.

He made it clear that he could not engage strictly with local residents participating in the project, as it was their “territory”. He appointed a site foreman, Simon, to oversee the day-to-day activities. Simon, a master artisan in terms of carpentry, plastering and bricklaying, was pivotal in directing the construction process in such a way that it would adhere to the strict building guidelines laid out in the plan. It must be noted that Simon, also an outsider, had difficulties in fulfilling his role due to underlying power dynamics and the researcher had to facilitate this dynamic when needed.

Builders

Co-researchers, Yondela and Zame, introduced a range of builders from which a choice was made (see Appendix B). The construction of the centre was an opportunity to train residents in new building methods; this was a requirement for the project. Wages were negotiated on the first day and leveraged against training and community service. They initially asked for R170 a day, but after it was explained that this would be a community centre that would benefit Enkanini in the long-term, settled for R110 a day.

A3: Design criteria

Ecological features – affordability, potential for replication and simplicity – influenced the design criteria. The materials needed to conform to the local vernacular and were influenced by its transient nature. In addition, the structure could not draw too much attention to itself, as this would have created an impression of permanence and might have drawn unwanted attention. As one resident said when helping a lost academic find his way to the centre, “*Look its over there, you see, you cannot see it. That is the idea*” (Wessels, Field notes).

Enkaninians earn on average R1 000 a month and building materials needed to accommodate this reality. Recycled tyres for the foundations, recycled brick and zinc and using cargo pallets, mud and straw for insulation would align with this budget.

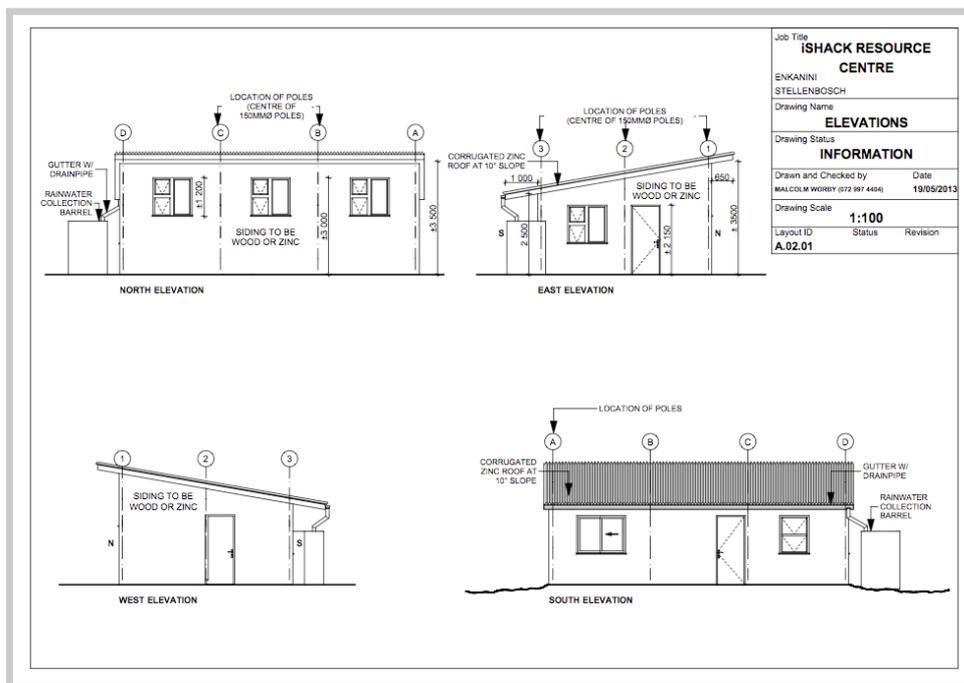
The loamy soil made for the perfect building material as it contained the correct ratio of organic and inorganic material. If it had had a higher clay content, then lime, cement and sand or straw would need to be added to create the right mix for plastering.

A4: Architectural design

The architect and project manager visited the space on the winter solstice, the perfect time to witness the sun's effect on the site, observe minimum sunlight penetration and calculate the location of thermal mass potentials to absorb sunlight. The sun's energy would be stored and subsequently released during the night. During this visit, there was a focus on the social space, as well as the geo-physical location. The design specifications are below.

The height of the neighbouring shacks was measured because this influences the window positioning to maximise the sunlight penetration. The northern window was lifted as a result of this process as was the northern wall.

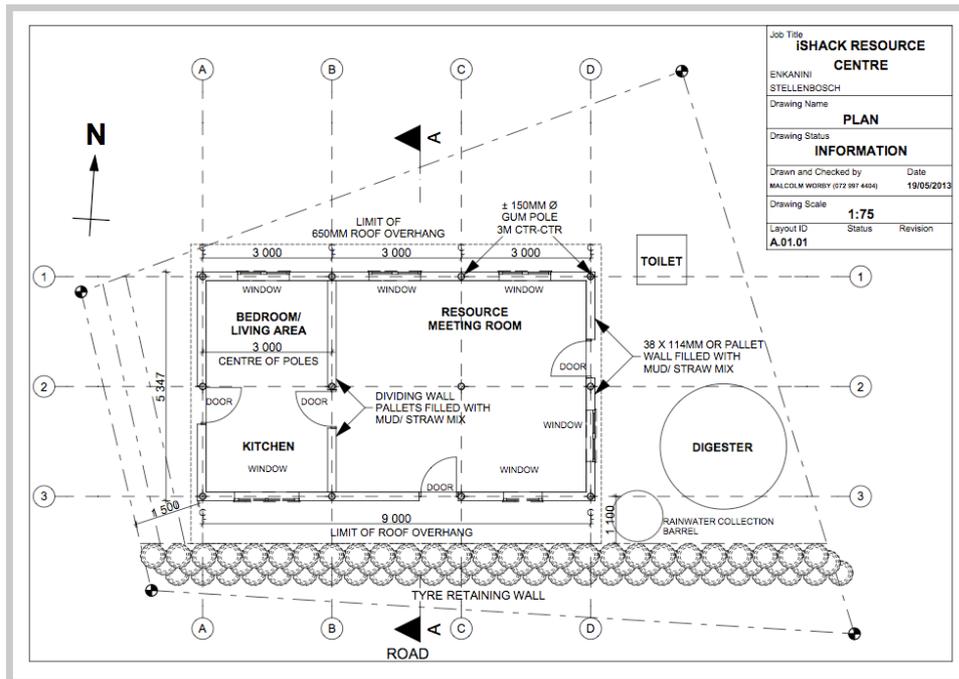
Figure A 1. Elevations



Source: Malcolm Worby & Ayesha Adams 2013

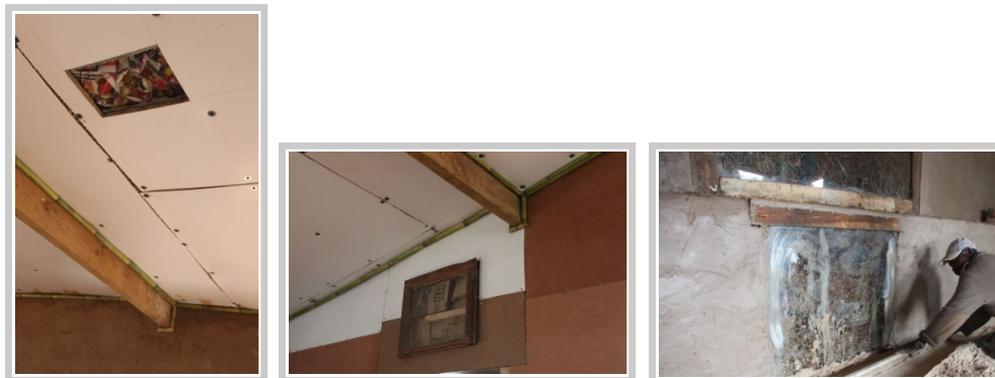
The floor plan was based on three functions. It would be the core of the centre where meetings were held between researchers and co-researchers. The building also serves as the administrative headquarters of the Transitions Collective. There is a space to sleep over for visitors and the meeting room doubles up as a restaurant. In addition, the space serves as a walk-in information centre for the Transitions Collective's projects. There is also a bedroom/living area for the custodian.

Figure A 2. Floor plan



Source: Malcolm Worby & Ayesha Adams 2013

Figure A 3. Truth windows for ceiling (newspaper), dividing wall (cardboard) and north wall (pallets filled with straw and clay)

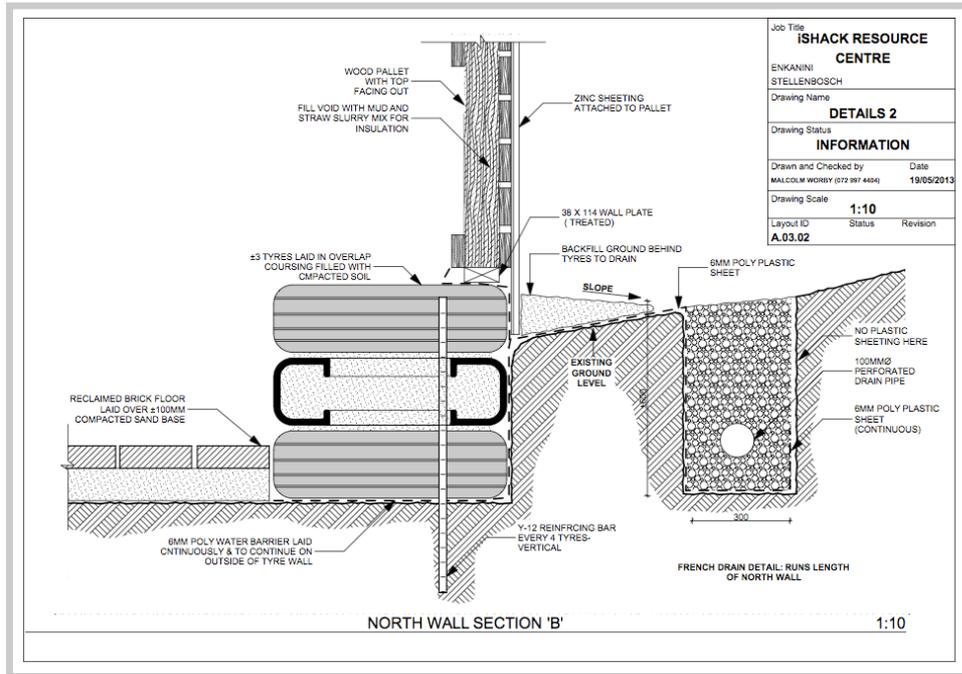


Source: Author

The distance to the neighbouring shacks was measured since a French drain had to be put in on the northern side to accommodate water run-off. A clearance of 600 millimetres, from the northern wall, was necessary to construct the drain, which was a semi-submerged 150 millimetre perforated PVC pipe laid in a ditch about 600 millimetres deep that is lined with damp-proof coating. In this case, thick black plastic.

This was covered with a layer of bidim (a geotextile to protect it from being punctured by the gravel), followed by a thin layer of gravel upon which the pipe lies. A final layer of gravel is added to fill the ditch.

Figure A 4. Northern elevation with French drain



Source: Malcolm Worby & Ayesha Adams 2013

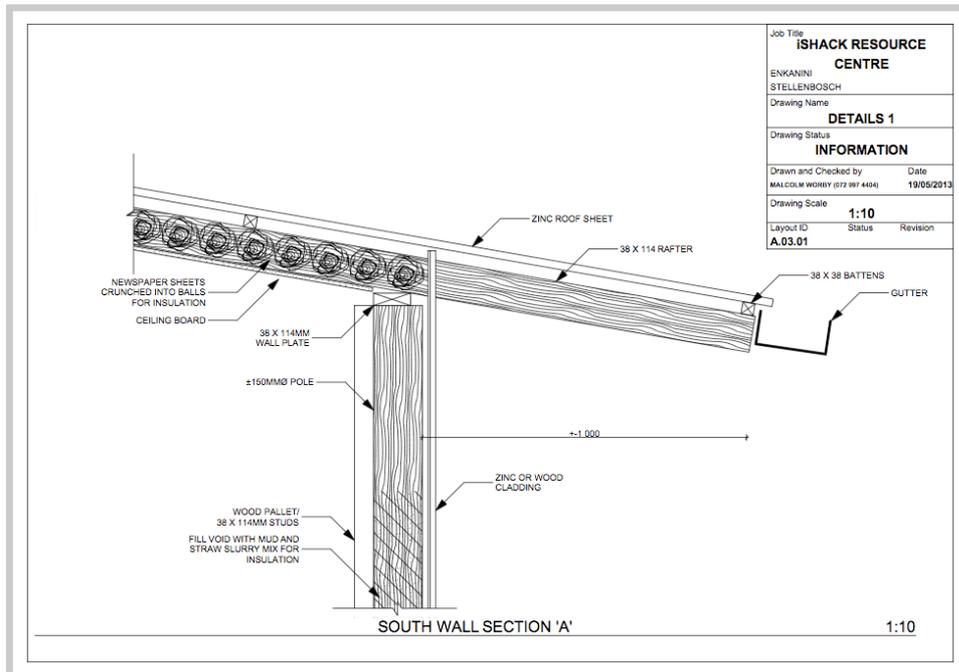
The walls are a combination of recycled pallets and filled with a slurry mix of clay and straw. A wall plate separates the roof and the pallets. The outer shell of the shack is constructed from corrugated iron zinc sheets, also recycled.

The north elevation is 3.5 meters from the floor up to the roof. The windows are placed at a height to capitalise on the winter sun. The sun therefore shines through the windows and heat up the thermal mass floor. At night, the absorbed energy stored in the thermal mass floor, made out of recycled brick, radiates and heats the interior of the shack. The roof overhang also prevents the midday summer sun from entering the building thereby shading the northern facade. The topography of the site was taken into account and it was deduced that approximately 15 square meters of soil had to be removed to level the northern side in line with the southern side. This was due to the fact that the site had an inclination of about 30 degrees sloping towards the southern side.

This inclination is extended over the whole of Enkanini and increase in some areas, especially around the rivulets to almost 80 degrees. Consequently, water run-off is a big issue in Enkanini with huge implications for water drainage. Also, Malcolm took note of the topography and how it would affect roof's inclination to catch the most water possible.

Due north was calculated in order to orientate the building in a northerly direction to harness maximum sunlight penetration. The length of the roof overhang was calculated to ensure that summer temperatures would be minimised as much as possible. In turn, winter sun penetration would be maximised. The southern side were therefore the coldest part of the shack and fewer windows would be fitted to minimise heat loss in winter. The roof is slanted to capture rainwater for collection through the gutter into a holding cistern. The ceiling of the roof is fitted with honeycomb cardboard as ceiling board and rolled-up newspaper is used for insulation material.

Figure A 5. Roof

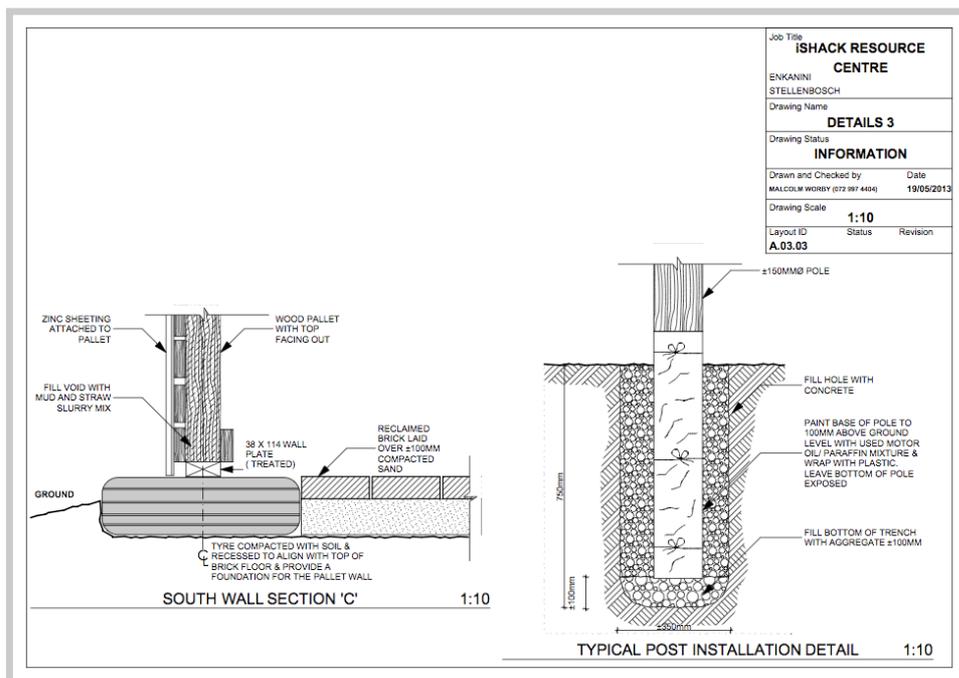


Source: Malcolm Worby & Ayesha Adams 2013

The surroundings offered examples of what material people were already using to construct shacks as well as favourite colour schemes. This was important to observe to ensure that the centre blended in with the surrounds. The juxtaposition of garbage lying around, overflowing sewerage drains, donga formations in the slopes and the spirit of camaraderie in the settlement is startling.

The southern elevation is constructed from rammed tyres, similar to the retaining wall. A wall plate divides the rammed tyres from the pallets that rest on top of the tyres. The floor is layered with damp-proof coating, then sand and then recycled brick. A mortar mix of sand, cement, lime and clay was used to fill the gaps between the bricks.

Figure A 6. Southern elevation



Source: Malcolm Worby & Ayesha Adams 2013

A5: Fittings

Solar systems

The centre is fitted with solar PV DC Microgrids, designed and manufactured by Specialized Solar Systems, based in George. The 1 kilowatt per hour (kwh) systems generated electricity from 4 X 75Wh photovoltaic panels fitted in a northerly direction of the roof with an inclination of 23 degrees. The system powers a 235Ah battery that is encased in a stainless steel box.

The distribution box is the “brain” of the systems that regulates the electrical current from the PV panels to the battery and distributes the power to the different appliances. The appliances includes two 5 Watt outside motion-sensor spotlights, three indoor 3 Watt LED light bulbs, a radio and a 54-centimetre flatscreen television. The system also supports a 225-litre fridge/freezer. All the appliances are in DC format. This negates the need for an inverter.

Anaerobic biogas digester

The biogas digester converts organic matter, such as human waste, animal dung and food waste into methane and carbon dioxide. The biogas can then be used as fuel for cooking, lighting and electricity generation. The biogas chamber was sunk into the ground on the south eastern side of the site

Figure A 7. Biogas digester



Source: Author

A6: Construction process

An approach of “Learning by Doing” was adopted and it was a condition of Malcolm Worby’s. Various reasons support this approach, these are explained briefly below.

The construction process becomes a workshop whereby builders become participants to learn new innovative ecological building methods in order for the application of learnt skill to be applied in their own dwellings and also filter through the rest of the social network of Enkanini. By using the same material that residents already use in the construction of their shacks, coupled with easy-to-learn ecological-design features, homes can be radically transformed to improve living standards. Waterproofing, comfortable indoor-living conditions and better fire retardation can all be achieved with no or little monetary expense.

Passive energy flow, an ecological design theory that describes how thermodynamics are passively controlled by using material with embedded energy potential to create a comfortable indoor living environment, is, for example, achieved by using straw and clay to fill pallet cavities. The builder had to constantly adapt measurements or adapt the design to fit in with the use of recycled material that did not necessarily conform to the design. A great deal of creativity was required in this process over a short space of time.

Appendix B: Enkanini Research Centre construction team

A Project core team			
Name	Profession	Project role	Responsibilities
Mark Swilling	Academic director: Sustainability Institute	Project Director	Supervising all project activities. Budget management. Liaising with group members. Advising on project activities. Reporting to Stellenbosch University and municipality.
Malcolm Worby	Sustainable, natural building and energy design consultant Company: Malcolm Worby Designs	Project Architect	Architectural design of building and landscape. Advising on ecological design principles. Advising on material use. Liaising with site manager, coordinator and director. Reporting to project director.
Elijah Skosana	Ecological building contractor. Company: Siqalo Eco Builders	Project Manager	Oversees all construction. Manages and pay builders. Liaising with architect on building plans. Organise logistics and materials. Training of builders and other community members. Reporting to architect and coordinator.
Yondela Tjawa	Co-researcher	Community Liaison Officer	Liaises with community members. Contributing to the design process. Construction. Providing general information. Liaising with street committees. Assisting researchers. Reporting to coordinator.

Sylvia Silegi	Co-researcher	Community Liaison Officer	<p>Liases with community members.</p> <p>Contributing to design process.</p> <p>Providing general information.</p> <p>Liaising with street committees.</p> <p>Assisting researchers.</p> <p>Reporting to coordinators.</p>
Berry Wessels	Masters candidate in Sustainable Development	Project Coordinator	<p>Coordinating project activities.</p> <p>Liaising with team members, community members, municipality and companies.</p> <p>Data capture and research.</p> <p>Construction.</p> <p>Reporting to project director.</p>
B Builders			
Oscar	Community member	Builder	<p>Construction.</p> <p>Reporting to site manager.</p>
Phakamisa	Community member	Builder	<p>Construction.</p> <p>Reporting to site manager.</p>
Siviwe	Community member	Builder	<p>Construction.</p> <p>Reporting to site manager.</p>
Zama	Community Member	Builder	<p>Construction.</p> <p>Reporting to site manager.</p>
Mzozuko	Community member	Builder	<p>Construction.</p> <p>Reporting to site manager.</p>
C Research group			
Lauren Tavener-Smith	PhD candidate in Sustainable Development	Researcher	<p>Represents sanitation component of the station.</p> <p>Liases with offsite sanitation households.</p> <p>Contributing to design process.</p> <p>Reporting to coordinator.</p>
Lorraine Armallo	PhD candidate in Sustainable Development	Researcher	<p>Represents sanitation component of the station.</p> <p>Liases with off-site sanitation households.</p>

Lorraine Armallo			Contributing to design process. Reporting to coordinator.
Vanessa von der Heyde	Masters candidate in Sustainable Development	Researcher	Represents compost and food garden component of the station. Bokashi project coordinator. Contributing to design process. Reporting to coordinator.
Claire Mollat	Masters candidate in Sustainable Development	Researcher	Represents compost and food garden component of the station. Bokashi researcher. Contributing to design process. Assistance in construction and sourcing materials. Reporting to coordinator.
Susan Immelman	Masters candidate in Fine Arts	Researcher	Contributes to the art component. Reporting to coordinator.
Anni Beukes	Masters candidate in Anthropology	Researcher	Critical anthropologist.
Post-graduate Diploma students	PDG	Researcher	Painting.

Appendix C: Enkanini Research Centre construction budget

BUILDING: Enkanini Research Centre

Date: 30 May 2013

Scope Of Work	Quantity	Original Tender Cost (off the shelf)
MATERIALS		
Foundations & Foundation Walls		
Tyres	94	1000
Reinforce Steel V 12	3	390
Damp Proofing		
Plastic Sheeting Black 250Mic 4M Wide	3	1592.16
Posts and installation		
Pine Poles Cylindrical 4.8m - 150 U/T	12	5915.79
Walls		
Corrugated Roofing X 4.2m X 0.5m	24	5971.39
Corrugated Roofing X 3m 0.27m	24	1473.6
Floor Finish		
Sand	5m ³	1100
Reclaimed Bricks		3960
Cement	18	1530
Roof Framing		
Rafter Pine Rough U/T 38 X 152 X 3.6m	14	2456.14
Purlin Pine Rough U/T 50 X 75 X 6m	16	3340
Ceiling Pine Rough U/T 38 X 38 X 3m	20	789
3000mm X 70		
Roofing		

Roofsheets 5m X 0.3m	15	2809.8
Sisalation Grade 405 RESI 1.25n X 40m	40	666.56
P House Gutter	4m	95.09
Gutter Brackets		82.9
Gutter Stop EHSS		17.46
Gutter Connector		24.48
Down Pipe		56.07
Insulation		
Silicone		46.05
C Nozzle		24.39
Doors, Handles & Locks		
Doors	4	1250
Unionlever Lockset	4	1000.65
Hinges Butt Brass		762.7
Windows & Glass		
Window North	3	900
Window East	1	300
Window South	2	500
Interior Finish		
Hardboard 3mm X 1220mm X 2400mm		947.4
French Drain		
Perforated Pipes	4	792.84
Bidim	30m	285.9
Stones	4m ³	1600
Nails/Screws/Safetops		263.14
Threaded rod/Nuts/Washers		76.63
	Total Excl VAT	42020.14
	VAT 14%	5882.82
TOTAL MATERIALS		47902.95
LABOUR		
	Time	Cost

Levelling the Ground	1 Day	1000
Digging Holes for Poles/Treating	1 Day	1000
Digging out French Drain	2 Days	2000
Building up Shack	3 Days	3000
Roof Ceiling	2 Days	2000
Dividing Walls/Pallets	1 Day	1000
Flooring/Paving	2 Days	1500
Filling and Compaction Tyres	2 Days	2000
TOTAL LABOUR		13500
PROJECT MANAGEMENT		
Site Manager		7875
TOTAL PROJECT MANAGEMENT		7875
STORAGE		
Storage for May and June	2 months	5000
TOTAL STORAGE		5000

TOTAL: MATERIALS + LABOUR + STORAGE	74277.95
LESS MATERIALS IN STORE ROOM	-12167.74
GRAND TOTAL	62110.21

Appendix D: Enkanini Research Centre construction inventory

Item	Dimensions	Quantity	Condition/Description
Sandbag	40 kg	20	Good
Big Cooking Pot	50l	1	Good
Hardboard	1800mm X 1070mm X 20mm	2	Good 20cm cut hole in middle
Pole	2060mm X 110mm	3	Average Contains nails
Pole	2350mm X 120mm	2	Average Contains nails
Pole	2350mm X 70mm	1	Average Contains nails
Pole	3000mm X 100mm	10	Average Contains nails
Beam	3000mm X 70mm X 70mm	1	Average Contains nails
Beam	2200mm X 800mm X 400mm	40	Average Contains nails
Batten	380mm X 380mm	4	Average/Bad Contains nails
Tyre	Various	10	Good Used car tyres
Crate	800mm X 600mm X 1500mm	2	Good
Carpet Base Liner	10m X 7.5000m X 10mm	2	Good
Door	2000mm X 800mm	1	Good 4 Glass windows
Door	2000mm X 800mm	2	Good
Door	2000mm X 800mm	1	Bad Repairable
Pallet		3	Broken

Window	520mm X 880mm	1	Bad Rusted 2 Windows, 1 glass broken
Window	825mm X 890mm	2	New Top window can open
Bench	2790mm X 230mm	1	Bad Three of the four legs broken (repairable)
Bench	2790mm X 230mm	1	Good
Bench	1340mm X 230mm	3	Good
Gutter	5.9m	1	Good Need some fittings
Braai grid	1230mm X 920mm	1	Good
Zink sheets (Wall)	2.2m X 0.77m	14	Average/Bad Contain holes 9 Rusted
Zink sheets (Roof)	2.7m X 0.7m	27	Good/Average Contain some holes
Zink sheets (Pieces)	1.73m X 0.7m	3	Average Contain holes
Zink sheets (Pieces)	0.87m X 0.7m	10	Average/Bad Contain holes Rusted
Window	660mm X 120mm	1	Bad Glass broken Rusted 1 Opening door
Window	1200mm X 1000mm	1	Bad Many glass windows Rusted
Window	170mm X 1000mm	1	Bad Only a frame
Plastic	3.2m X 3m	3	Good

			Can act as DPC
Fence	5m	1	Bad Rusted
Cardboard boxes		10	Good Flattened
Carpet	Floor surface area	1	Bad
Hardboard	1200mm X 800mm X 10mm	1	Good

Appendix E: Enkanini spaces and places: In images

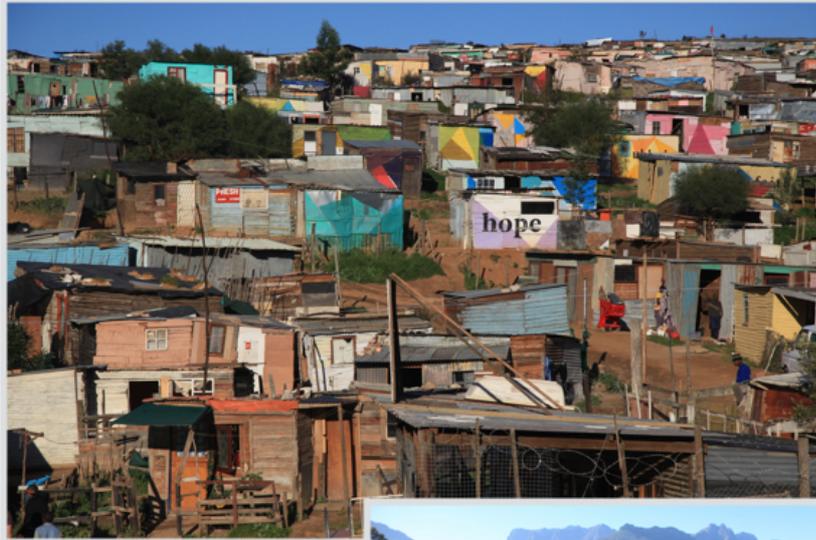


Enkanini Research Centre



iShack Project





Enkanini



Nyamankulu
Eastern Cape