Chapter 6

Knowledge is power: the danger of knowledge in the search for sanitation solutions with African communities

Attie van Niekerk
Nova Institute NPC, Pretoria, South Africa
University of Pretoria, Pretoria, South Africa
attievanniekerk@nova.org.za

Betsie le Roux
Nova Institute NPC, Pretoria, South Africa
betsieleroux@nova.org.za

Antoinette van der Merwe
University of Pretoria, Pretoria, South Africa
6510478@myuwc.ac.za

Abstract

People in low-income communities in South Africa generally suffer from inadequate sanitation. This causes numerous health and safety risks, especially to women and children who are most vulnerable. In this chapter, the authors reflect on the way that we are preparing ourselves for a process to develop decentralised, non-sewered sanitation practices together with residents in rural and peri-urban communities, who often have different cultural and religious thought patterns than the experts who present technical solutions to them. In our experience, when people from a modern Western context implement solutions in the African context, the solutions are often incompatible with the new context. We used the concepts of *lifeworld*, *sense of place* and *consciousness* to better understand the relationship

between people, their environment, and the technologies that they use. We present two case studies to illustrate how such philosophical theories can be applied. We keep in mind that knowledge is power. A better understanding of knowledge transfer and how it can undermine the co-creation process is considered an important step in preparing for co-designing solutions with end users.

Keywords: co-design, consciousness, lifeworld, sanitation, sense of place, transdisciplinary research

1. Introduction

Life in the Anthropocene is characterised by globalisation, fragmentation, and dysfunctional relationships. An important problem arising from globalisation is the disconnect between the solutions that are developed in one context and then transposed to another context where they do not fit, leading to poor adoption of technologies by the end users or the creation of new problems. In this chapter, we reflect on ways in which citizens' daily practices can be brought into the process of improving sanitation systems in some low-income communities in South Africa.

What Enda Hayes (2017) wrote about air pollution applies to many projects that aim to solve some or other problem where people are involved, not least in Africa:

> …around the world… 'people' are absent in the models and scenarios used to estimate and predict air pollution concentrations. The modelling of emissions sources, not the human activities that result in them, leads to a bias in policy that focuses on mitigating emissions through technological change rather than through changing individual and societal behaviour. In turn, this leads to a consequent reliance on technological innovation, not social innovation. We need to bring citizen's daily practices, activities and behaviours into this debate.

This call has also been made strongly by proponents of contextual engineering; for example, Witmer (2022) provides a clear argument why "technical design must be interwoven with sociocultural identity if it is to achieve the objective of addressing a user population's physical needs effectively and sustainably".

A common practice is that information is obtained about the target group's "user requirements" and this is then considered when the solution is designed by the experts. We argue that such information is insufficient for the goal of designing a solution.

The crucial question is which debate Hayes refers to when he talks of "this debate". Is it a debate where technical experts call in the help of social scientists, who bring their knowledge of the people into the debate so that it becomes an inter-disciplinary or multi-disciplinary debate, or are the "people" and practitioners also included in the debate, making it a trans-disciplinary debate?

The authors of this chapter believe that it must be the latter and describe in this chapter the way in which they are preparing for a process to co-design, with two groups of smallholder farmers, non-sewered sanitation systems that are integrated with their farming practices.

A thorough knowledge of the particular context is required for a solution to become sustainably embedded within the complex system in which it is applied. The question is, what does this knowledge look like, and how can one obtain it? And can developers from outside a community solve a problem, such as poor sanitation, for a target community by gathering all the relevant contextual information?

The aim of this chapter is not to reach general, empirically supported or certain knowledge. It is rather to explain how we have tried to open our minds to be able to enter into an inter-subjective relationship and exchange with the smallholder farmers during the co-designing process.

One of the threats to such a process is the unconscious assumption in the minds of the experts that they have more knowledge than the people whom they work with. It is not an unfounded assumption; they are, after all, experts in their field. The people for whom these technical solutions are meant, often share this assumption. The problem with such an assumption is that these technical solutions may cause more harm than good within the particular context where it is implemented, as Witmer (2022) clearly shows with various case studies. This happens when the knowledge of the experts influences the eventual result to such an extent that the residents' knowledge of their context does not play a sufficiently strong role in the design process.

The warning of the Swiss Alliance for Global Research Partnerships (GRP-Alliance) - previously the Swiss Commission for Research Partnerships with Developing Countries [June 2025] - (SCNAT, 2012, p. 7) is therefore very relevant: "Transparency and unrestricted flow of information are the bread and butter of research in partnership aiming at outcomes relevant to society. This is true for interactions at the personal as well as institutional levels. But information is power, and sharing information or opening information channels might very well lead to tangible losses."

Rather than looking for certain knowledge, our aim at this stage is to have a sufficient understanding of the complexity of the context in which we plan to work, to open our eyes to the different factors that may interact and combine in that context, the tensions and synergies, the flowing nature of an unfinished process. An informed and considered uncertainty, combined with a rational and intuitive understanding of what is happening, is necessary to not be too certain on the one hand, and not be ignorant on the other.

The eventual aim is one or more technical solutions that have become part of the daily practices of life and that work well in the daily patterns of low-income communities, in (this case) the South African Lowveld, which can mostly be described as rural and peri-urban. We want to achieve this by building

relationships with a small but representative group of residents, by constructing solutions together with them, testing the solutions in practice, redesigning them, and testing them again until all agree that the solution complies with their criteria. Both parties are present as people, with our thoughts, feelings, values, prejudices, etc. There is never "certain knowledge", and the design can always be improved upon.

2. Theoretical framework

As part of our preparation, we look at three theories that may help to guide us: the concepts *lifeworld* in the work of Hannah Arendt (Vanneste, 2023) and Jurgen Habermas (Cherem, n.d.), *sense of place*, and *consciousness* as used by Peter L Berger (Berger et al., 1974). The concepts are further used to discuss case studies of the development of non-sewered sanitation in low-income communities in South Africa.

Low-income communities in South Africa, mostly with an African background (81,4% of South Africans are black African, (RSA, 2025), struggle with problems of hunger, malnutrition, poor sanitation, water scarcity, etc. Their current practices have ecological impacts, which become a problem for them. Assistance from outside is needed, but the problem is, how can this assistance be given by a person from outside the community?

3. The philosophical debate

3.1 Lifeworld

The concept *lifeworld* originated in the late 19th century, with the German-Austrian philosopher Edmund Husserl (1859-1938) as the leading figure. It was a central concept in the philosophical school of phenomenology that he founded. Phenomenology has become a strong movement, with philosophers and other scholars mostly from Europe.

3.1.1 Hannah Arendt

According to Vanneste (2023), the Jewish philosopher Hannah Arendt struggled with the two types of knowledge: scientific knowledge and the experience of everyday life. Classical philosophical tradition keeps truth, *aletheia*, and the lifeworld apart. In this tradition, truth has its own terrain: you have to make an effort to gain it, and above all you have to make an abstraction of it – you deal with ideas rather than with events. You can capture facts once and for all in logical or mathematical reasoning. This approach has its roots in ancient Greek philosophy, especially the philosophy of Plato (Vanneste, 2023). Arendt, on the other hand, considered life experience as a different kind of knowledge in which truth relates to meaning, a result of talking, listening, and discussing (Vanneste, 2023, p. 39). She thus ties in with the Jewish *emeth*, which associates truth with faithfulness and reliability. It has to do with relationships, of working together in trust. It is something on which you can trust in your daily life. The classical truth, *aletheia*, can be grasped by an individual; for *emeth,* you need a relationship with others. The power of a reliable promise is a means to accommodate the unpredictability of action (Vanneste, 2023). This approach does not deny the facts of scientific knowledge but situates these facts in the context of life.

3.1.2 Jürgen Habermas

The German philosopher and social theorist Jürgen Habermas argues in a similar fashion to Arendt in several ways. Cherem (n.d.) grounded his social theory in spontaneous communication:

> For Habermas the lifeworld is a reservoir of taken-for-granted practices, roles, social meanings, and norms that constitutes a shared horizon of understanding and possible interactions. The lifeworld is a largely implicit "know-how" that is holistically structured and unavailable (in its entirety) to conscious reflective control. We pick it up by being socialized into the shared meaning patterns and personality structures made

> available by the social institutions of our culture: kinship, education, religion, civil society, and so on. The lifeworld sets out norms that structure our daily interactions. We don't usually talk about the norms we use to regulate our behavior. We simply assume they stand on good reasons and deploy them intuitively.

Systems that function in a given lifeworld can be revised and changed, but that requires careful communication that roots these changes in mutual understandings of the lifeworld. There is a dialectical relation between knowledge (theory) and world (practice):

> Without being rooted in the mutual understandings of the lifeworld, we would get untrammeled systems… disconnected from the intersubjectively vouchsafed practical reason that Habermas thinks underpins all meaning. The organizing principles of systems themselves would stop being coherent (Cherem, n.d.).

In this view, lifeworld is more than the subjective appropriation of the world based on external conditions, more than a person's subjective construction of reality (Kraus, 2015) – it is intersubjective, based on the interactions between the taken-for-granted practices, roles, social meanings, and norms of the culture in which people grow up, and the external conditions that they experience.

3.1.3 How can a lifeworld be understood?

If (aspects of) the lifeworld are unavailable to conscious, reflective control, if we pick them up and deploy them intuitively, the question arises: how can we understand the lifeworld of a community other than our own? If Arendt, as interpreted by Vanneste, is correct that classical philosophical tradition keeps truth, *aletheia*, and the lifeworld apart, what happens when such an approach is used to study the lifeworld of a specific community? The scientific approach followed by social scientists finds it easier to study some aspects of everyday life than other aspects. It can study the observable "daily

practices, activities and behaviours" of the citizens that Hayes (see above) talks about, and interpret them according to the meaning patterns of the social scientists rather than according to the meaning patterns of that lifeworld. However, social innovation based on this approach would most probably not work in a given context (it will be "untrammelled, disconnected from practice, not coherent"). To be meaningful and effective, social innovation must involve the "implicit 'know-how' that is holistically structured and unavailable (in its entirety) to conscious, reflective control" that Habermas, according to Cherem, talks about. It includes the shared meaning patterns and personality structures of the social institutions of that culture: kinship, education, religion, civil society, and so on.

The methods of the natural sciences are used by social scientists to study social observable phenomena such as the employment situation, availability of material resources, housing conditions, social environment (friends, foes, acquaintances, relatives, etc.), as well as the persons' physical conditions (fat/thin, tall/small, female/male, healthy/sick, etc.), what Björn Kraus (2015) calls "life conditions". *Life conditions* can be measured and quantified to produce data. These things can be directly observed, especially if they are seen separately from the shared meaning patterns and personality structures of their culture. The lifeworld is more evasive; it is intangible, it is often tacit. You cannot simply ask a person what their lifeworld is and expect a simple and direct answer, in the same way that you can ask them about their life conditions. The social sciences do not, however, give much attention to the intangible aspects of lifeworld. This is conducted in the Humanities, which are the *Geisteswissenschaften*, that deal with meaning from the start. If 'people' must be present in the models and scenarios used to estimate and predict things (Hayes, see above), it will be important, but not enough, to have quantitative information from social scientists' part of the discourse. A qualitative understanding is also needed, but that is still not enough if people from the relevant community, who understand the tacit and implicit character of that lifeworld, are not involved in a meaningful way.

The lifeworld(s) of a given community can only be comprehended through personal encounters, through entering into the world of the other, through intuitive awareness of meaning, a result of talking, listening and discussing, in relationships with others, by working together in trust (cf. the type of truth that Arendt spoke about). Also, through observing expressions of feelings, through listening to views that people share, and through attending to what they do. It takes time to develop some understanding of another lifeworld. Experts from outside a community cannot know that lifeworld adequately, but they do need some level of understanding to be able to engage people from that community in a meaningful way. That includes an understanding of the limits to their understanding.

Both ways of knowing, what we can call the more objective and quantitative way of the natural sciences and the more intuitive, relational and inter-subjective or qualitative way of efforts to understand the "experience of everyday life" (Vanneste, 2023), that one may find in the Humanities, the *Geisteswissenschaften*, are relevant and important, but inadequate if the debate is limited to outsiders.

Researchers who want to understand the lifeworld of a group other than their own face certain limitations: they cannot leave those aspects of their own lifeworld that are unavailable to conscious reflective control behind. These things influence what they see and how they understand it. However, an awareness of such limitations increases the chance of a successful orientation towards the lifeworld of addressees. "This can happen when two very important criteria are fulfilled: First of all, when social work professionals critically reflect on their own part in recognition and comprehension processes. And secondly, when the addressee's subjective view of the world becomes the major focus of professional interest" (Kraus, 2015, p. 7).

It is difficult to translate the one type of knowledge, the knowledge of everyday experience and the tacit aspects of a group's lifeworld, into the other type of knowledge, into scientific knowledge that is separated from the lifeworld, which makes an abstraction of the knowledge of everyday

experience. Everyday experience is about events, about relationships, about unconscious thought patterns that cannot be translated sufficiently into objective scientific knowledge. But the opposite must be done. To find a meaningful solution for a given problem, the scientific knowledge must be made functional within the everyday patterns of life in that context. The scientist must make an effort to enter into that world, to understand it. When specific problems of everyday life must be solved, everyday experience is paramount, the relevant scientific knowledge must be translated into the knowledge of everyday experience so that it can function constructively within that specific context. In Arendt's terminology, scientific truth must help to develop something that is reliable in practice, something that fits into the given pattern of relationships, something on which people can trust in their daily lives.

If the researcher, designer, development officer or social worker cannot understand all the tacit aspects of a given community and then make a decision for that community, it means that the members of that community must make the decision for themselves, e.g. about the way in which a certain technical solution that is presented for a perceived problem will be used. The reason is simple: a solution that does not fit into the lifeworld of a certain group of people, that does not make sense to them, and that they do not see as a possibility for themselves, will not be used by them. There may be, in the eyes of people who are not part of that specific group, better options available, but in this case, too, beauty or usefulness is in the eye of the beholder.

The ability to find a meaningful solution for a given context requires the combination of the insights of various role players. No single role player has the complete insight to do so on their own. The development agent is needed to introduce new technical possibilities or other potential solutions to communities that may not be aware of them. However, being aware of one's own limitations will help the development agent who presents a potential solution to do it in such a way that the persons in the given context can understand it, compare it to other possibilities, and decide if it is a possibility for themselves

or not, and if so, how it must be adjusted and redesigned to fit into their lifeworld and life conditions. The development officer and researcher can and should take part in this process in a constructive way, knowing when to take part and when to stand back.

The tacit aspects of a community's lifeworld are not expressed adequately in rational language, but it does come into full operation when the community decides to use, or not to use, a solution that is presented to them.

Tony Waters (1992) provides an interesting case study of the reasons why grain mills that were introduced to villages in Tanzania worked well, while water systems, which were technically very comparable to the grain mills, did not work. He explained it with reference to Habermas' model of lifeworld and systems. Habermas' model also helped him to understand why villagers offered 'purposive-rational accounts' of their activities even though they may have been embedded in 'traditional-rational systems of reasoning'. The communication between these two worlds of knowledge is complicated and often skewed and distorted.

3.2 Sense of place

A similar concept to lifeworld, *sense of place,* has developed in the United States, in Geography and other social sciences. Like lifeworld, sense of place refers to how people in a given context experience things, what meaning they give to things, to those characteristics, in particular the less tangible ones, that make a place special or unique, and those that foster a sense of authentic human attachment, identity, and belonging (Pritchard, 2023). The reason why this concept is so similar to the concept *lifeworld* is that human geography, especially Anglo-American geography, has since the 1970s been heavily influenced by phenomenological philosophy and has become interested in studying the meanings that places have for people within it. Sense of place refers to the way that people experience the location in which they are. It is described as follows: "(S)ense of place is the lens through which people experience and

make meaning of their experiences in and with place" (Adams et al., 2016). Sense of place is built upon the direct and full engagement of all senses.

In Geography, ecosystems in general are a central pillar of 'sense of place' (Pritchard, 2023). Sense of place can explore the positive bonds of comfort, safety, and well-being engendered by place, home, and dwelling, but also the negative bonds, e.g., the term 'placelessness' characterises the weakened bonds of attachment to community and home produced by the forces of modernism and postmodernism, while some places and situations induce senses of fear and dysphoria. Attention to sense of place has highlighted the importance of the perceptual and cognitive dimensions of human decision-making - such awareness can lead to action, to placemaking (Foote & Azaryahu, 2009).

3.2.1 The problem of placelessness in the Africa context

The concept of "placelessness" that cropped up in the discussion of the concept *sense of place* is in agreement with the concept *exile and homecoming* that have been central themes in the political struggles against colonialism and apartheid. The longing for home is expressed in many ways. In his book *Homecoming*, Ngũgĩ wa Thiong'o (1981) of Kenya sees building a home for all Africans as the main task of the post-colonial era:

> We need to see Africa's cultural history in three broad phases: Africa before white conquest, Africa under colonial domination, and today's Africa striving to find its true self-image [...] we are all involved in a common problem: how best to build a communal home for all Africans. Then all the black people, all the African masses can truthfully say: we have come home. (xix, 4)

Today, the search for homecoming is still at the heart of prominent streams in the decolonisation movement, even though the concept has become entangled in the conflicting interests of various stakeholders in various contexts: historical,

spiritual, cultural, political, and economic (Schramm, 2010, p. 247; see also Van Niekerk, 2024).

In their book, *The Homeless Mind: Modernization and Consciousness* (1974), Peter L Berger and others describe the particular impact of modernisation (see next section). Foote and Azaryahu (2009, p. 98) add some more features of placelessness:

> … placelessness is the result of the erosion or fracturing of the coherence of place since the mid-nineteenth century as the result of homogenization and standardization, consumption and commodification, and last but not least: the influence of international patterns of planning and architectural styles which gradually effaced regional and local differences in style. Placelessness means the loss of individuality, distinctiveness, and authenticity. Moreover, the erosion of sense of place also entails a decline of a sense of community, since place-based communal attachments become geographically fragmented to the effect that the basic association of place and community is severed. (p. 98)

Placelessness seemed very much tied to the rise of mediated environmental experiences, such as those mediated through literature, film, television, music, photography and, mostly recently, the Internet, and other network technologies.

3.2.2 Consciousness and the formation of packages

In 1974 Berger et al. attributed the experience of homelessness, which is similar to placelessness, to the impact of modernisation. Modernisation leads to a feeling of homelessness all over the world. In order to understand the processes of modernisation, one should recognise the reciprocal relationship and interdependence between institutions that are carriers of modernity (such as technological production and mass education) and the consciousness of the community (Berger et al., 1974).

Consciousness refers to our everyday knowledge, perceptions, attitudes and affects, our thought processes, our

emotions and will, our beliefs, our dreams, our subconscious and memories, our paradigms and our theories. Consciousness is organised in patterns that can be described systematically to some degree, but not always in clear formulas. Art is one way to express consciousness. Consciousness must always be understood in a specific context.

Interaction takes place between the carriers of modernity and the consciousness of the community: there is give and take. Technological production is a primary carrier of modernity (there is also education, bureaucracy, the media, etc.), and consciousness is the determining factor in the process of modernisation. Processes in modernity and processes in consciousness that have an affinity to each other seek each other out and form 'packages' (Berger et al., 1974). A package is a new thing, a new combination of things and thoughts from different sources. It has a new dynamic and meaning. Within this new context, the function of each individual element is different from the function it had in its original context (see also Van Niekerk, 2024).

3.2.3 Practices

Practices are similar to packages. The German philosopher Martin Heidegger argues in *Being and Time* (German: *Sein und Zeit*, published in 1927) (Heidegger, 1967) that a practice is a complex phenomenon that is constituted by the unity of the resources and tools used to perform the practice (e.g. a stove), the labour of performing the practice, the 'product' of the practice (a meal) and the 'for-the-sake-of' of the practice (a family meal, healthy family relationships). The 'for-the-sake-of' determines the meaning of the practice as a whole. In a practice, the aspects of resource, tool, labour, and human being belong together in such a way that none can be without the others (Ingram, 2009).

A domestic practice combines diverse elements in a set but more or less flexible pattern in which different household members play different roles, usually making use of resources and tools, for whatever purpose that they have, such as to satisfy a fundamental need or needs. (see also Van Niekerk, 2024).

4. The lifeworld of township residents, as observed in some of Nova's surveys

Over the last twelve years, Nova has done extensive surveys of townships in the Mpumalanga, Free State, North West and Limpopo provinces. This included questionnaires and focus group sessions, as well as the co-creation of solutions and the successful implementation of some of the results. In most cases, the residents report that their general satisfaction with life is much higher than one would expect, given the high levels of poverty and the strong negative opinions on living conditions: poor service delivery, deteriorating infrastructure, high levels of joblessness and growing populations. In discussions and focus group sessions, the picture is not always that positive. We provide a general overview of what was found regarding sanitation, which is still in a preparatory phase.

Problems with sanitation must be seen against the general feeling that the place is dirty: the air is polluted by industries or mines, by traffic, by dust from the roads, by waste that is burned because it is not removed, and by the use of dirty fuels such as coal and wood. Waste, including diapers, is scattered everywhere. In some places, it seems that diapers are the most prominently dumped waste type. Pigs and dogs eat from the diapers and bring the wasted diapers into the yard or even into the house. When it rains, the diapers mix with water on the road, or the pit latrines fill up, and the content is washed into the neighbour's yard or into the street. Focus group members complain about residents' lack of respect for each other as a major cause of waste being dumped everywhere.

Sanitation is a problem on its own. Some places are not connected to a sewerage system, and people resort to non-sewered sanitation such as pit latrines. Full pit latrines are often not emptied by municipalities, and are too expensive for many residents to empty. Some residents, who do not have sanitation, use buckets to relieve themselves and then throw the waste in the veld or in informal dumping areas, which creates problems for waste pickers. Flush toilets do not necessarily solve the problems. Sewerage systems become overloaded or deteriorate

as they age. One resident from the town of Northam in the North West province summarised it as follows:

> So, what is happening is that there are T-shirts and clothes and children's disposable diapers that are thrown into the drain. Whenever the municipal workers come, they come to unblock the sewer every two days. This happens in my full view. In that way they work, I don't want to lie. They always find these diapers and clothes inside. After they have unblocked the drain, people throw stuff in, and it blocks again in about two days. The pipes are too small. When the water comes again, it gushes out of the mainlines through the pipes and then up. It was difficult for me to even go around the back of my house. Municipal workers come to check it, but they say there is nothing they can do. The problem is underneath my neighbour's house foundation. They said they can only from time to time drain the sewer. When they unblock today, tomorrow the drain leaks again. When my neighbours flush their toilets, the whole dirt comes to my drain. I ended up buying a new pipe to close the leakage. Since then, it has been better but I am not sure if it will leak again. When the dirty water flows into the street, the kids go and play there. The kids like to play with water and they contract different ailments which make them sick. Children play there and come home wet and full of mud, as they enjoy playing with wet and dirty things.

4.1 Reflection

These communities are in the process of transition from an old traditional social order that was able to construct an integrated world of life on a small scale, to a large-scale order formed by large, and seemingly irreconcilable powers.

The general impression is that waste is a function of, or at least part of, the general dysfunctional condition of these communities. Some residents call it chaos. The dysfunctionality can exist on different levels and is described in different ways:

- Tensions between residents and corrupt or absent local leaders, leading to group-forming and tension between residents. Sometimes ethnic groups form, but it can also be other formations.
- Poor service delivery by local government.
- High levels of unemployment cause poverty and idle youth, which manifest in drunkenness and refusal to listen to parents.
- Social cohesion is not strong; the feeling is that people do what they want and claim that they have human rights.
- Two opposing themes are common in these surveys: a feeling of powerlessness ("There is nothing we can do" is a general comment) as well as a general willingness or even eagerness to think about solutions and actively participate in their implementation (for example, recycling). With this willingness to do something, residents request help: they want to do so in cooperation with entities from outside their own community, such as an industry or even Nova itself. One group emphasised that residents need to be educated, while others thought of projects that could make jobs available.

5. Two case studies

In this section, we report on the results of a scoping study that Nova conducted for the Water Research Commission in two communities in the Mopani District of the Limpopo province in the Lowveld of South Africa in 2022 to 2023.

5.1 Ga-Sekororo, Limpopo

The first study was in Ga-Sekororo (Van Niekerk et al., 2023). The project aimed to determine the potential of integrating non-sewered sanitation with agriculture. The study demonstrated the difference in perspectives between project team members living outside the context of the target community (who are also the authors of this chapter) compared to the perspective of the farmers living within the context. Focus group meetings with smallholder farmers in the Ga-Sekororo village were undertaken

in September 2022 and March 2023. The main aim of the discussions was to prepare for a project about how to integrate sanitation into agriculture in a way that could work.

Based on this conversation with the farmers, a "deep systems analysis" (Van Rooyen et al., 2017) was developed on how their problems are interlinked. This systems analysis was mostly conducted by the team members living outside the context of the village, using the information that was shared with them by the farmers.

The second focus group meeting followed a different approach, aiming to develop the deep systems analysis from the smallholder farmers' perspectives. The Nova researchers visited several farmers, explained the aim of the study, asked about their living conditions and invited them to attend the exploratory meeting, where it was agreed to work together in pursuit of improved sanitation. In a follow-up meeting, the researchers said that they wanted to better understand the sanitation and agriculture problems in the villages. The farmers were then given approximately two hours to talk about these problems. The researchers asked questions, and the farmers responded, but also volunteered opinions.

Figure 17 shows the systems analysis that was conducted according to the understanding of the team members living outside the context of the Ga-Sekororo village, using the information that the farmers presented to them. A lack of water and services, poverty and the meeting of different cultures were identified as primary drivers. Poor sanitation, crop failures and the striving for progress were identified as secondary drivers. Problematic outcomes included groundwater pollution, hunger, the safety of children and females, poor health, crime, etc. This framework is not wrong in the sense that these are not fundamental problems that people deal with. It was after all the issues that the farmers communicated during the first focus group meeting.

This was followed some months later by a second systems analysis. In this meeting, apart from making notes (in the form of flow diagrams) on a flip chart that was displayed and visible

to all who attended the meeting, the team members who lived outside the village did not participate in the conversation; for example, by asking questions or by making suggestions.

The two analyses that were developed during the two focus group meetings differed in many fundamental ways. As shown in Figure 18, a very different picture emerged from the second meeting. The first important difference was that the farmers spent more than two-and-a-half hours discussing the problems related to agriculture and water pollution. Only in the last few minutes were some comments made about sanitation, and then they continued their discussion on agriculture. Their livelihood is a much greater concern compared to sanitation.

During the second focus group meeting, the farmers also showed concern for environmental impacts through their complaints about other people dumping waste in the river. They initially mentioned that a dam would solve their irrigation problems, but this idea was rejected when they started thinking about the impact of such a dam on the environment and the environmental authorisation that they would need.

A fundamental difference between the first and the second systems analyses was that the first provided a very neat and somewhat abstracted view of the community. The second analysis shows the details of the messy reality in which the farmers live.

To conclude, the following five key sanitation issues were identified in Ga-Sekororo:

- **A lack of options to manage waste when the pits are full**: farmers are, in general, much more concerned about managing the waste in the pit and relatively less concerned about the front end of the toilet (user interface). Most farmers who attended the focus group meetings aspire to have good service delivery in the form of cartage to empty their pit latrines; they do not aspire to have on-site flush toilets because of the reality that there is not enough water for that.

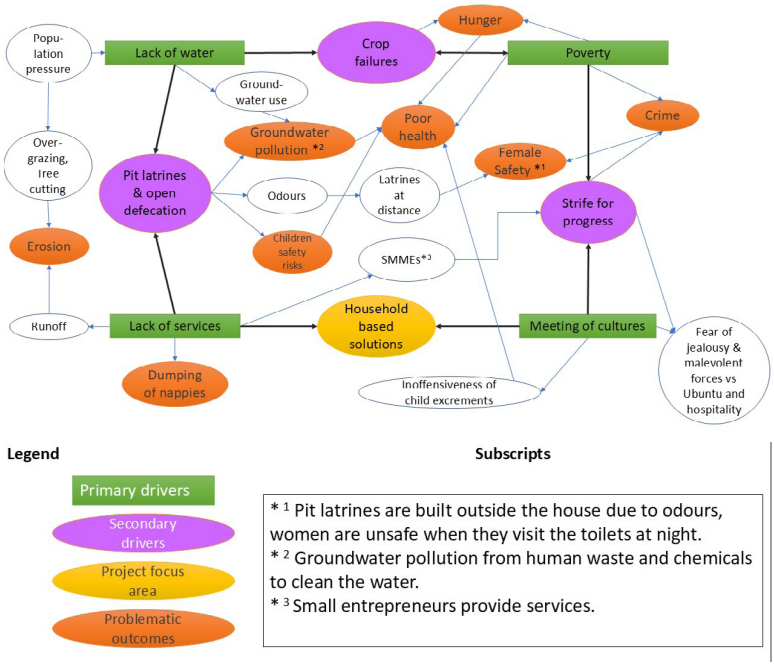

Figure 17: A systems analysis of the smallholder farmers in Ga-Sekororo (Compiled by the researchers after consultation with the smallholder farmers).

- **Safety risks**: Toddlers are not allowed to use pit latrines because of the risk of falling into the pit. They are taught to practice open defecation. Crime in some areas is a risk for women when they have to use a pit latrine at night.
- **Difficulty in cleaning:** Most people do not have a problem with cleaning the toilets, but it is not easy to clean out or empty the pit itself. All participating farmers use cleaning materials such as *Domestos*, *Jeyes Fluid* and *Jik* to clean their pit latrines regularly (one to three times per week). A few farmers mentioned using decomposing granules in their pit latrines to increase the processing of the waste and to reduce odours. They mentioned that these chemicals require a lot of water, and one is not allowed to use the toilet when the chemical is poured inside the toilet. They normally use the chemicals at night. They do not discard foreign objects

into the toilets that are still in use; old and unused pits are used for general waste disposal.

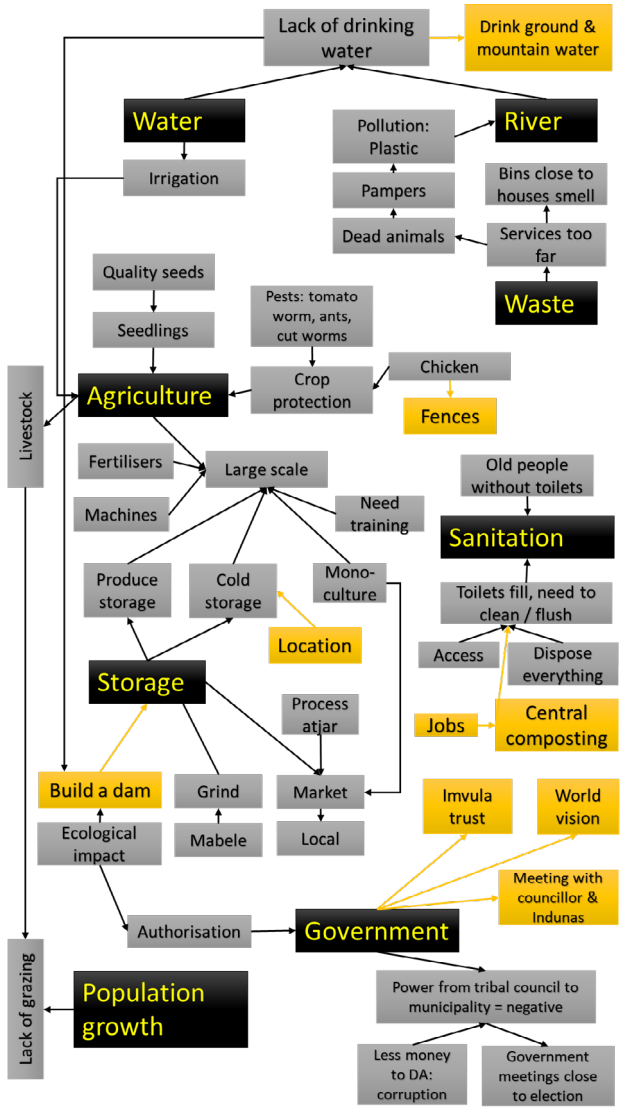

Figure 18: A systems analysis of smallholder farmers' perspectives at Ga-Sekororo

- **Insects:** People mentioned insect pests that are a problem in the pit latrines. The toilets can become very hot, and there are many flies inside. When you enter the toilet, the flies sit all over you, and the people fear that this could cause diseases. A farmer said that insects bite her legs when she cleans the toilet. Sometimes, there are so many ants in the toilets that people are unable to sit on the toilets, and there are also huge cockroaches.
- **Odours:** Some of the farmers said that the ventilation-improved pit latrine has an unpleasant odour that sticks to one's skin and clothes after using the toilet, and they have to change their clothes after visiting the pit latrine.
- **Lack of privacy**: A sixth aspect, the importance of privacy, was not apparent in Ga-Sekororo. However, Nova found it to be the case in other projects. The phenomenon was illustrated by a Central Ablution Block (CAB) facility in KwaZulu-Natal. This facility included wash basins and showers, and not just the toilets. The doors of the toilets are not visible from the outside. That is in contrast with a public toilet, where everyone can see you entering and leaving. According to an official from the eThekwini Municipality, the CAB brings the small community together: it is something that belongs to all of them, children play there, and people put up shops around it, like a town square.

These aspects were taken up in the questionnaire that was used in Ikemeleng.

5.2 Ikemeleng, North West

Another case study aimed to learn some lessons about the reasons why some people are not using the toilets that were provided for them, while others do. This was performed by exploring the emotional bonds and attachments that people develop towards certain spaces and places using *sense of place* as a framework, and to determine how those attachments influence the sanitation practices that develop and how sanitation shapes the sense of place of rural or peri-urban communities.

The study area is a peri-urban area in Ikemeleng, Rustenburg, where mines have given people prefabricated pit latrines in one area after displacing the people about five years previously. During a scoping of the area, it appeared that these toilets were used with varying degrees of success. Ikemeleng provides a good study area for determining the influence of sense of place on sanitation practices.

Other problems at Ikemeleng included poor waste management services (a problem with which the Nova Institute, with funding from Anglo American, has made much progress), air pollution, no streetlights, no secondary school, drugs, and high crime rates. The community has only one primary school, which does not have enough capacity for all the children in the community. Children must travel far for schooling, and they have to leave their houses before sunrise, walk in the dark on streets covered with sewage and with a high risk of crime.

5.2.1 Methodology at Ikemeleng

Qualitative research, such as individual interviews and focus groups, is useful for exploring the emotional bonds and attachments that people develop towards certain spaces and places. The planning of this project at Ikemeleng included a scoping of the study area. The authors of this chapter visited a few households that had received the said state-of-the-art ventilated improved pit latrines. We had in-person discussions with a few households about the new ventilated, improved pit latrines and what the people liked and disliked. Some households used the ventilated improved pit latrines for toilets, and others did not. Also, in preparation of the survey, a focus group meeting and training of the fieldworkers were conducted. The survey was adapted after the focus group meeting, based on inputs from the fieldworkers, all of whom reside in Ikemeleng. This was followed by the survey, which was conducted in April 2024 by six fieldworkers who interviewed 175 households in total. The participants were selected by sampling every third house with an improvised toilet and every second house without. If someone was not home, the neighbour on the left was approached and then the neighbour on the right was

approached. This process was followed to ensure a random selection of households. We followed up the survey with two focus group meetings, one with the fieldworkers and the other with selected residents, in May 2024.

The six key sanitation issues, namely (1) the lack of waste management options, (2) safety, (3) cleaning, (4) insects, (5) odours, and (6) privacy, as discussed in Section 4.1, were used to set up a quantitative survey that we filled in with households in Ikemeleng that received the ventilated improved pit latrines and other non-recipient households. Based on the site visit and focus groups, the survey also included questions about all used and dysfunctional toilets on their property, the details about the toilets, what the people like and dislike about the toilets, and why they do not use the dysfunctional toilets anymore.

The survey also included questions to households about other factors related to well-being, namely education, income, and wealth. Participants were asked about their subjective levels of general life satisfaction and satisfaction with their access to sanitation. We compare the improvement in access to sanitation, in terms of privacy, security and health risks, between recipients of the improved pit latrine and non-recipients five years after receiving the ventilated improved pit latrines. Lastly, we also consider participants' level of satisfaction regarding sanitation and sanitation characteristics, such as the number of people using the toilet, cleanliness, safety, and others.

5.2.2 Comparing results from the quantitative versus qualitative research

There were differences between results from the quantitative versus qualitative research, as well as between results within the questionnaires. The survey results were unexpectedly positive; 56% of interviewees reported their life satisfaction as seven or more out of ten. On average, people had a life satisfaction of 6.7 out of 10. People were also positive about their communities, with 54.6% saying that they liked their community or neighbourhood somewhat or a lot and 59.2% saying that they liked their houses somewhat or a lot. However, during focus group meetings that followed the survey, many people seemed

less satisfied and called Ikemeleng a community with many problems.

5.3 Feedback on current sanitation

Of all survey participants, 44% had an improved pit latrine that was originally installed by the mine. About 13% of households with improved pit latrines actually disassembled the structure to use the toilet on a new pit which they dug themselves. Approximately 50% of the households that have received the lined pit latrines were still using them. The others said that it is not functional any more.

Satisfaction with their toilet scored lower than general life satisfaction, with an average of 4.1 out of 10, with no significant difference between those who have an improved toilet and those who do not. However, when asked how well their toilets work, 84.7% said that they worked well or very well. When we asked fieldworkers and residents in focus groups about the contradictions, in reportedly low satisfaction with toilets and high reported functionality, focus group members said that residents do not have any other reference point. Even with dysfunctionalities, they report high satisfaction because it is their own toilet, and it is all that they know or are familiar with.

House visits that were performed in preparation for the survey have revealed that some people were not using the pit latrine that was given to them by the mines. The reason was mostly that the pits filled up too quickly, and it was too expensive for the people to empty the pits regularly. The reason for this is that the pits are too shallow and do not drain because they are lined with panels to prevent groundwater pollution. Some of the toilets had cracks where rainwater could enter and fill up the pits, but because of the lining below, the water did not drain out of the pits again. Full toilets can overflow when it rains, and the waste can then flow towards the street or to a neighbour's yard. It costs between R800 and R1,200 to empty a pit, which is up to twice as much as the mean income per capita per month of households in the poorest decile, according to data from the Luxembourg Income Study 2024 (Our World in Data,

2024). The cost of emptying the pit latrines could, therefore, be more than a third of the monthly income of poor households in South Africa, making it unaffordable for most low-income households.

However, in the survey, the households that received an improved pit latrine said what they liked most about these pit latrines was various aspects of the structure, such as the toilet, the door, or the cubicle structure. What participants liked the least was the shallow pit. This was also confirmed with follow-up focus groups and emphasises our observation during visits to other similar projects that researchers often focus more on the actual toilet structure (front end) than on the management of the waste (Van Niekerk et al., 2023). If a few end users who have the everyday knowledge of the context in which they live were included in the design of the toilet, it would have been clear that better management of the human waste, especially given the shallow and lined pit, would have improved usage. This could have allowed the intervention to be changed to resolve that problem.

The safety of the toilet was another concern. Children are often not allowed to use a pit latrine. For the unimproved pit latrine, there is a high risk of children falling into the pit and drowning. However, during the follow-up focus groups, participants said that children are also not allowed to use the improved pit latrine, with a seat that is similar to a flush toilet, since the pit latrine is still dirty and small children are always at risk where there is a hazard such as deep pits, even if the hole in the seat is small. Other household members said that they do not use the pit latrine at night because it is not safe to use it in the dark or to walk outside at night. Another concern was that traditional healers could access their excreta and use it for casting spells on them; almost 30% of interviewees indicated that they believe that, and are very concerned about it. This was confirmed during the focus group meeting. We first encountered this aspect in the literature about water, sanitation and hygiene in sub-Saharan Africa, (see Akpabio & Takara, 2014). During the focus group meeting, it was said that emptying the pits is more difficult because of people disposing undergarments into

the pits, which blocks the "honeysuckers" (a honeysucker is a term used in South Africa for a cesspool emptier that is used to empty cesspits, septic tanks and latrines) during emptying. This is a general practice because people also believe that people who mean you harm can burn your undergarments and so put spells on you.

In terms of the cleanliness of the toilets, 68.0% indicated that their toilets were somewhat or very clean. However, during the follow-up focus group with fieldworkers, they said that the toilets were not as clean as residents had said, which could show their sense of ownership of their own toilet. That means that participants would probably rate a public toilet or a neighbour's toilet with the same level of cleanliness as much dirtier. There was no significant difference between the reported cleanliness of improved toilets and others.

In the survey, 65.0% of participants said that bugs never or only occasionally bothered them in the toilets, but during the focus group discussions, people said that flies in the toilets were a particular concern. Similarly, most people (50.9%) said that they are never or very rarely bothered by the odour in their toilets. This was not significantly different between households that received an improved toilet and others. However, in the follow-up focus group, when asked about the biggest problems regarding sanitation and the community in general, bad odours was one of the prominent complaints, and that odours from the toilets are in the streets and in the houses, especially on really hot days.

In the survey, a large majority of participants (86.1%) said that they were satisfied with the level of privacy that their toilet gives them. During the focus groups, it was mentioned that there are various cultures within the community; some households do not have a problem with privacy and even just have a small curtain in front of their toilet. Other households prefer a solid structure with a lock. Households living in more public walkways or areas, especially those around shebeens (informal bars), complained that people enter their property without consent to use their toilets.

5.4 Disposal of greywater

During the focus group meetings, another significant problem was mentioned: the disposal of grey water, which is often discarded in the street or in your own yard and it then flows to a neighbour's yard. This is the cause of much frustration and conflict between neighbours. The municipality even went so far as to cut off the water supply during the day so that people could not throw dirty water onto the roads. However, residents complained that they did not have any other choice and that cutting the water supply did not solve the problem.

5.5 Ikemeleng's lifeworld and sense of place

The impact of sanitation on the sense of place of the community in Ikemeleng is negative. Most of their biggest problems are connected to or exacerbated by poor sanitation. While a foul-smelling environment, insects in your toilet and the lack of safe sanitation for children will have a direct impact on the sense of place in the community, issues such as outside toilets exposing people to crime, overflowing toilets causing conflict with the neighbours, and school children walking over human waste in the dark on their way to school are ways in which poor sanitation combines with other issues to increase their feeling of placelessness. Our focus group meeting with the residents was unpleasant. People felt hopeless and powerless against the problems that they faced and showed very little agency or intention to work their way out of these problems.

6. Discussion

The philosophies and case studies discussed highlight how tough it is to develop solutions in rural and peri-urban communities, where the development agent comes from outside the community.

A common practice is that solutions are given to such communities without sufficiently engaging with the dynamics and living patterns of such communities, and the result is poor adoption of the solution by the recipients. For example, many non-sewered sanitation development projects in South Africa

focus on developing toilet seats and pedestals (front-end) while the problem of managing waste (back-end) has received far less attention (Van Niekerk et al., 2023) - but the residents in our focus group emphasised the management of the waste as being far more important.

If research is undertaken to gather information to make better-informed decisions, it is often not sufficient. The difference between the system analysis prepared by the researchers based on information obtained by farmers in Ga-Sekororo, compared to the analysis that the farmers themselves have conducted in a focus group afterwards, clearly illustrates the differences in how people from inside a certain context (with living experience) and outside the context (with information only) perceive the system. Both may provide a certain insight into the situation (the view from the outside and the view from the inside may both have value).

Some of the results of the focus groups and the survey are consistent with each other, while others show discrepancies. We asked the fieldworkers why there was such a discrepancy between the survey results and what was said in the focus groups. They gave the following possible explanations:

- The current conditions are what people are familiar with. They do not feel unhappy with something if they have no other frame of reference.
- People are shy to discuss sanitation, and when they are asked direct questions in a survey, they hold back more uncomfortable information.
- During the interview, in some houses, residents said that their toilets were clean, but when the fieldworkers saw the toilets, they did not think that they were clean. This may be because the residents clean the toilets themselves, and they believe them to be as clean as they could get them. The fieldworkers also mentioned that residents do not think of their own waste as dirty.

At this stage, we can merely highlight the complexity of the system and how insufficient any one research instrument is on its own. Even more, the picture that emerges, with the

discrepancies and yet obscured aspects of the lifeworld, does not provide us with certain knowledge of the situation.

The discrepancies between the results from the various projects confirm, to some extent, the concept of lifeworld as described by Hannah Arendt and Jürgen Habermas. Lifeworld is not grasped through scientific understanding or analysis but through relationships and trust. Lifeworld is not available to conscious, reflective control, and one can only gain access to the lifeworld through personal interactions. It is not possible to analyse another person's lifeworld by directly asking them about it or through a survey. Open-ended conversations are more effective in understanding a person's lifeworld than direct questions, but the open discussions during the focus groups do not give full insight into the lifeworld of the residents.

We hope that the inconclusive results of the research so far, the various loose pieces of information and insight, will help us to achieve the transparency and unrestricted flow of information that the Swiss Alliance for Global Research Partnerships (GRP-Alliance) (SCNAT, 2012) regards as the bread and butter of research in partnerships aiming for outcomes relevant to society. It can help us in two ways: it has opened our eyes to the wide variety of factors that interact and combine to produce the patterns of sanitation use that we have observed and which form the context in which the eventual solution must work; and it undermines any tendency that we may have to think that we know better than the residents themselves. If knowledge is power, and if there is a risk that experts from outside the community may be regarded as more knowledgeable than the residents of the community, this lack of certainty helps to even the playing field.

The most reliable information regarding the use of an intervention in a community is how they receive and use it, and the impact it has on them.

Another debate than "this debate", which Enda Hayes seems to refer to (the technical debate, even if it includes social scientists), is necessary. A debate where the citizens of the given context can explain the dynamics of their situation

is needed. Or, actually, it is not a *debate* that is needed. The citizens in the given context cannot explain their lifeworld adequately because "much of it is largely implicit 'know-how' that is holistically structured and unavailable (in its entirety) to conscious reflective control" (Habermas, see Section 2.1.2). But it does play a huge role in the choices that they make, in their decisions and actions. A *co-design process* is needed, where they can make decisions about the solutions that will, or will not work for them.

A second way in which the residents are empowered to give their opinions is to provide them with several available potential technical solutions that they can use and evaluate. This prevents the possible assumption that the experts from outside want to promote a certain option. They can compare the different options, discuss the merits and demerits of each, and decide what would work best in their situation and how they can be adjusted and approved. The experts from outside provide information and opinions as needed.

7. Conclusion

From various focus group meetings and conversations with residents in different communities in South Africa, we have obtained surprising information about the way in which people use their toilets. Solving the problem of sanitation in low-income communities is indeed a tough task. The problem cannot be considered without some understanding of the full context of the community.

A complex situation requires an approach that can engage with complexity. Development agents from outside typically have flush toilets at their homes; therefore, the front end of a toilet is the only part of sanitation that they routinely encounter. It means that these people do not have personal and practical experience of the problems of dealing with the waste in the toilets, and they tend to focus on the front end rather than on the problems regarding the way in which the waste is disposed of or reused, because it is not within their frame of reference. Another example: development agents would not

have knowledge of situations where people from the street can use your outdoor toilet, e.g. if the owner lives close to a shebeen or where your toilet overflows when it rains and the contents are washed into your neighbour's property.

People who throw all kinds of garments into pit latrines out of fear of curses complicate the process of emptying the pits. Fieldworkers at Ikemeleng encountered a situation where a pit could not be emptied because, for some unknown reason, the people had thrown a pillow into the pit.

These are a few of many important insights that may impact the success of a sanitation solution. Therefore, although development agents from outside are needed, they lack the knowledge of the context to develop a suitable solution on their own.

One of the ways in which efforts are made to bring scientific knowledge and sense of place / lifeworld together is in the search for practical solutions through transdisciplinary research, which includes the end users as active members of the development team.

A process is needed to integrate multiple perspectives and different types of knowledge. The scientific and technological experts have valuable inputs to make, and so do social scientists and the humanities, *as well as* the people who live within the relevant context, because they know what the experts do not know: the dynamics of events within that context in everyday life. To be able to do that, we need to understand the nature of the everyday type of knowledge better. We have looked at three ways in which it has been described, namely according to concepts of the lifeworld, sense of place and consciousness.

All these philosophies highlight the importance of relationships between development agents, end users, and the lifeworld in which the development occurs. In a modern world where social media has reduced the concept of 'relationships' to the sharing of information without a physical presence or knowledge of each other, the challenge is to encourage development agents to understand the importance of building relationships with end users when solutions are developed.

The residents must decide whether the solution will fit into their lifeworld. The researchers from outside that context must determine whether that solution fits into the wider context (ecological, social, economic, political, etc).

List of sources

Ackoff, R.L. 1989. From data to wisdom. *Journal of Applied Systems Analysis,* 16(1), 3-9.

Akpabio, E.M. & Takara, K. 2014. Understanding and confronting cultural complexities characterizing water, sanitation and hygiene in sub-Saharan Africa. *Water International,* 39(7), 921-932. https://doi.org/10.1080/02508060.2015.981782

Adams, J., Greenwood, D., Thomashow, M. & Russ, A. 2016. *Sense of Place*. The Nature of Cities Festival 26 May 2016 [Online] Available at: https://www.thenatureofcities.com/2016/05/26/sense-of-place/

Awad, E.M. & Ghaziri, H.M. 2004. *Knowledge management*. Upper Saddle River, NJ: Pearson Education International.

Berger, P., Berger, B. & Kellner, H. 1974. *The homeless mind: modernization and consciousness*. New York: Vintage Books.

Bryson, S.A. 2019. Can the lifeworld save us from neoliberal governmentality? Social work, critical theory, and Habermas. *The Journal of Sociology and Social Welfare,* 46(3), 63-90. https://doi.org/10.15453/0191-5096.4227

Cherem, M. n.d. *Jürgen Habermas (1929 -)*. The Internet Encyclopedia of Philosophy (IEP). [Online]. Available at: https://iep.utm.edu/habermas/ [Accessed: 22/8/2025].

Foote, K.E. & Azaryahu, M. 2009 Sense of Place. *International Encyclopedia of Human Geography*, 96-100. https://doi.org/10.1016/B978-008044910-4.00998-6

Hayes, E. 2017. Commentary: Challenging the air quality discourse - people create pollution not technology. *Clean Air Journal,* 16(27), 16-17. http://dx.doi.org/10.17159/2410-972X/2017/v27n1a6

Heidegger, M. 1967 [1927]. *Sein und zeit*. Tübingen: Max Niemeyer Verlag.

Ingram, R. 2009. *Development of domestic biogas practices for Southern Africa*. Nova report, unpublished.

Kraus, B. 2015. The life we live and the life we experience: Introducing the epistemological difference between "lifeworld" (lebenswelt) and "life conditions" (lebenslage). *Social Work and Society: International Online Journal,* 13(2), 1–9. Available at: http://nbn-resolving.de/urn:nbn:de:hbz:464-sws-874 [Accessed: 14/09/2025].

Ngũgĩ Wa Thiongo. 1981. *Homecoming.* London: Heinemann.

Our World in Data. 2024. *Threshold income per year marking the richest decile (after tax), 2023.* Dataset. Luxembourg Income Study (original data). Our World in Data, 2024. [Online]. Available at: https://ourworldindata.org/explorers/incomes-across-distribution-lis

Pritchard, D. 2023. Human culture and its evolving place in the Ramsar Convention. *Ramsar Wetlands: Values, Assessment, Management* 2023, 417–446. https://doi.org/10.1016/B978-0-12-817803-4.00005-X

RSA (Republic of South Africa). 2025. *People of South Africa*. [Online]. Available at: https://www.gov.za/about-sa/south-africas-people

Schramm, K., 2010. *African homecoming: Pan-African ideology and contested heritage*. Walnut Creek, CA: Left Coast Press Inc.

SCNAT (Swiss Academy of Sciences - Swiss Alliance for Global Research Partnerships (GRP-Alliance). 2012. *Guide for Global Research Partnerships*. SCNAT. [Online]. Available at: https://globalresearch.scnat.ch/en/guide [Accessed: 14/09/2025].

StatsSA (Statistics South Africa). 2014. *Households Spend a Third of Their Income on Food*. [Online]. Available at: https://www.statssa.gov.za/?p=2564 [Accessed: 20/05/2024].

Vanneste, L. 2023 Leefwereld versus ideële wereld. Achterhuis en Desmet over Arendt. *De Uil van Minerva,* 36(1), 35–44. https://doi.org/10.21825/deuilvanminerva.89875

Van Niekerk, A. S., Le Roux, B., Kruger, E., Maimela, B. & Howard, M. 2023. *Scoping Study Towards Developing a WEF Framework for Decentralised Sanitation in Rural and Peri-Urban Communities in Limpopo*. Water Research Commission, WRC Report No. 3112/1/23. ISBN 978-0-6392-0575-5, Pretoria.

Van Niekerk, A.S. 2024. *Towards the sustainable well-being of communities: Africa, the modern empire and Christianity.* Cape Town: Aosis Books. https://doi.org/10.4102/aosis.2024.BK284

Van Rooyen, A.F., Ramshaw, P., Moyo, M., Stirzaker, R. & Bjornlund, H. 2017. Theory and application of agricultural innovation platforms for improved irrigation scheme management in Southern Africa. *International Journal of Water Resources Development,* 33(5), 804–823. https://doi.org/10.1080/07900627.2017.1321530

Waters, T. 1992. Lifeworld and system: Of water systems and grain mill development in rural Tanzania. *African Studies Review,* 35(2), 35–54. https://doi.org/10.2307/524869

Witmer, A.P. 2022. *Contextual engineering*. Cham: Springer.