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RECLAIMING AGENCY IN THE INFORMAL ECONOMY: NAVIGATING THE PARADOX OF ECONOMIC EMPOWERMENT AND ENVIRONMENTAL DEGRADATION IN ARTISANAL BRICKMAKING IN RURAL KWAZULU-NATAL

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ABSTRACT

The intersection of climate change and local economies, particularly those heavily reliant on natural resources, presents a complex and pressing challenge. Artisanal brickmaking has emerged as a vital economic activity. However, its impact on local ecosystems and environmental health is a subject of intense debate. This study examines the interconnected nature of artisanal brickmaking and its socio-economic and environmental implications in a rural community in Blaauwbosch, KwaZulu-Natal. Employing a qualitative case study design, the study drew on in-depth interviews with 30 brickmakers who also engage in artisanal mining, complemented by ethnographic site observations.

The findings illustrate that informal brickmaking has had a positive impact on the local economy, fostering income generation, livelihood diversification, and employment opportunities. Moreover, the availability of locally produced bricks has facilitated an improvement in housing conditions, enabling community members to transition from precarious, makeshift dwellings to more durable brick houses fabricated from locally produced bricks. However, these socio-economic benefits are juxtaposed by acute environmental and public health risks, including air pollution, water contamination and soil erosion, as articulated by some participants. Given the community's dependence on natural resources for survival, this study recommends that informal brick producers be provided with support to facilitate a transition to more sustainable and environmentally friendly practices. These measures should be integrated into broader initiatives that support local economies, such as training programs for brickmakers, entrepreneurship development and access to markets for locally produced bricks.

KEY WORDS Climate change, Environmental sustainability, Informal economy, Rural Communities

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1. INTRODUCTION

The informal economy, particularly in regions where land and natural resources drive economic activity, presents both a challenge and an opportunity for developing countries. Often criticized as an obstacle to development, it also holds potential as a catalyst for economic growth (Magwedere & Marozva, 2025). In its destructive capacity, the informal sector is characterised by insecurity, unreliability, and heightened vulnerability to shocks and stresses, including both climate- and non-climate-related disruptions (Brown, McGranahan & Dodman, 2014). Despite these vulnerabilities, the informal sector is an important safety net for many and is a means of survival and livelihood for those who lack access to formal employment opportunities (Magwedere & Marozva, 2025).

This paper explores this paradox by examining the interplay between climate change and informal economies, using artisanal brickmaking as a case study to understand its socio-economic and environmental implications. This inquiry responds to the call by several scholars who observe that the informal economy remains largely invisible within dominant climate resilience discourses, even though the majority of poor households in developing countries rely on informal income-generating activities that are inherently insecure, unreliable, and vulnerable to climate-related shocks and stresses (Brown, McGranahan & Dodman, 2014). Despite its economic importance, the informal sector's exclusion from mainstream adaptation planning limits efforts to address workers' vulnerabilities to escalating climate risks (Brown, McGranahan, & Dodman, 2014).

Climate-related challenges disproportionately affect informal workers because they rely heavily on natural resources and often lack the tools, infrastructure or institutional support needed to adapt. This is further affirmed by the International Labour Organisation (ILO, 2022), which

observes that many informal economic activities are resource-dependent, making them particularly vulnerable to environmental disruption. Informal workers often operate without adequate occupational safety, social protection, or access to vital information and financial resources, which are factors that undermine their capacity to adopt resilient and sustainable practices. notes that informal workers are often excluded from policy dialogues, resulting in their environmental risks, adaptation needs, and lived experiences being ignored in climate resilience strategies. This study bridges this gap by analysing the impact of climate change on rural informal economies and proposing inclusive resilience pathways.

2. INFORMALITY AND CLIMATE CHANGE

The concept of the "informal economy" (also referred to as the "informal sector") is used to describe a wide range of work and economic activities that occur outside official institutional regulation and fall beyond the scope of formal labour and social protection frameworks (ILO in Liimatainen, 2002). According to the dualist school of thought, the informal economy comprises activities that are distinct from, and unrelated to, the formal economy (Hart, 1973; La Porta & Shleifer, 2008). The legalist perspective, by contrast, views the informal sector as a residual domain consisting of activities that operate outside the formal regulatory system, often due to weak enforcement or inadequate regulations (de Soto, 1989; de Soto, 2000). The modernist school purports that the informal sector represents a transitional and inferior stage of economic development, necessitating formalisation and modernisation to enable its integration into the formal economy (Rostow, 1960). However, in developing countries such as South Africa, the informal sector has proven to be an essential part of the economy, supporting over 7.8 million people (Statistics South Africa, 2023).

The proliferation of informality in developing countries unfolds against

the backdrop of escalating global demands for sustainable development. Sustainable Development Goal 11 (SDG 11) of the 2030 Agenda is particularly relevant, as it emphasises the need for sustainable cities and communities, seeking to "make cities and human settlements inclusive, safe, resilient, and sustainable" (United Nations, 2015b; Magidi, 2022). In parallel, the Paris Agreement of 2015 sets out to mitigate climate change by reducing greenhouse gas emissions and promoting sustainable development (Magidi, 2022). While substantial scholarship has explored climate change resilience in urban informal settlements and among agricultural livelihoods, limited attention has been paid to the broader spectrum of rural informal economies that fall outside of agriculture. This gap is especially significant given the growing dependence on informal income-generating activities in rural areas, such as artisanal brickmaking and mining, which are both climate-vulnerable and environmentally consequential.

Magidi (2022) argues that within the discourse on climate change and environmental sustainability, certain perspectives frame the informal sector as an obstacle to sustainable development. This perception is largely rooted in the sector's lack of regulatory oversight, which has led to its association with environmentally harmful practices, including land, air, water, and noise pollution, as well as the unsustainable exploitation and degradation of natural resources (Brown, McGranahan, & Dodman, 2014; Magidi, 2022). Among various international efforts to address the nexus between informality and climate change, the 2015 Recommendation No. 204 represents a notable attempt to promote the formalisation of informal economic activities. It acknowledges the adverse effects of informality on sustainable development, public revenue, and governance, and proposes a framework for transitioning toward formal economies by creating employment opportunities and curbing the spread of informality (International Labour Organisation, 2022). Although

well-intentioned, many of these policy prescriptions converge on a singular response, which is the eradication of informality through formalisation.

This paper contends that efforts to formalise the informal sector are fraught with problems and limitations. This is particularly evident in the South African context, where informality is inextricably linked to the enduring legacy of apartheid-era spatial and economic exclusion, most notably through policies such as the Group Areas Act, that systematically excluded the majority of South Africans from economic, social, and spatial opportunities (Moyo, Zuidgeest, & Van Delden, 2021). These policies did not just segregate people, they entrenched a systemic reliance on informal economies that continues to shape contemporary livelihoods. Formalisation initiatives that fail to engage with this historical and structural context risk deepening existing inequalities rather than enhancing resilience, particularly when formalisation is often framed as a technocratic solution to climate vulnerability.

One major limitation of formalisation lies in its imposition of regulatory frameworks that are often misaligned with the lived realities of informal workers. Many formalisation initiatives prioritise registration, taxation, and compliance with statutory standards, yet these requirements are frequently prohibitively burdensome for individuals operating at the margins of the economy.

Echoing this, Fourie (2018), argued that the formalisation of the informal sector in South Africa is often misunderstood. It is commonly interpreted in one of two ways. First, it is seen as shifting people out of informal self-employment and wage employment into formal wage jobs. However, this approach is unrealistic in the South African context, where not enough jobs are created to absorb the unemployed, let alone those already employed in the informal sector. Second, formalisation is often seen as registering, taxing and regulating informal enterprises. However, this again is often hindered by cumbersome and exclusionary requirements. These barriers disproportionately affect vulnerable and economically marginalised informal operators, who often lack the necessary documentation, bureaucratic literacy and financial resources to comply. As a result, registration becomes a barrier to entry, rather than a pathway to formalisation and economic inclusion (Fourie, 2018).

Formalisation efforts also falter when they fail to address the climate-related vulnerabilities inherent to the informal sector, especially in the context of climate resilience. Informal workers are often scapegoated for environmental degradation such as pollution from unregulated activities, yet they are simultaneously the most exposed to climate impacts (Hosseini, Elsadig, & Climate Refugees, 2019; Dlamini, Nhleko, & Ubisi, 2024). This dual burden underscores a systemic failure to address the underlying drivers of vulnerability within informal economies.

Moreover, scholars argue that the push for formalisation as a means of enhancing climate resilience overlooks the fact that informal economies are already adapting to climate-related shocks, albeit in ways that are often invisible to policymakers (Tucker & Anantharaman, 2020). Rather than supporting these grassroots strategies, formalisation policies may inadvertently undermine the livelihoods and resilience of informal workers, who are already disproportionately exposed to climate change. This

reflects a broader developmental bias that privileges regulatory control over the agency and lived experiences of marginalised communities. In response, Tucker & Anantharaman (2020) propose a reparative approach that centers on decent work, ecological health, and the redistribution of power and resources to workers and their organisations, recognising the essential role of informal work in urban and rural economies and promoting more inclusive and sustainable development pathways that prioritize climate justice.

This framework critiques traditional formalisation efforts, which often exacerbate inequality and undermine the resilience of informal workers by imposing regulatory burdens without addressing systemic barriers or climate vulnerabilities. Instead, it advocates for inclusive, sustainable development pathways that centre climate justice, recognising that informal workers, despite being scapegoated for environmental degradation, are disproportionately exposed to climate impacts. By supporting grassroots adaptation strategies and empowering workers through participatory governance and targeted investments in infrastructure, the reparative approach seeks to ensure that climate mitigation efforts do not deepen marginalisation but instead foster equitable resilience.

3. THEORISING AGENCY IN THE INFORMAL ECONOMY

The preceding sections have framed informality not as a developmental anomaly, but as a dynamic space of adaptation and agency, particularly in climate-vulnerable rural contexts. This paper further draws on the concept of agency as the capacity of individuals and communities to mobilise available resources, both material and social, to sustain their livelihoods in the face of structural constraints and environmental vulnerability (Scoones, 1998; Gibson-Graham and Cameron, 2016). Scoones (1998) advances the Sustainable Livelihoods Approach (SLA) by

conceptualising agency as the strategic mobilisation of diverse assets such as natural, human, social, physical, and financial to cope with shocks, manage risk, and pursue well-being.

Gibson-Graham and Cameron (2016) conceptualise community enterprises as generative economic spaces in which marginalised actors actively reconfigure economic relations beyond the dominant capitalist paradigm. Rather than viewing informality as a deficit, they position it as a site of local resilience, where collective action and shared resources enable communities to forge alternative livelihoods. These scholars focus on initiatives such as local cooperatives and mutual aid networks as concrete examples of how economic agency can be enacted in spaces where formal systems have failed to provide security or opportunity. This article presents a paradoxical case, in which such economic activities emerge as adaptive responses to persistent precarity, while simultaneously deepening environmental degradation and increasing exposure to climate risks. Artisanal brick production, for example, relies on local resources such as land, coal, and clay, which demonstrates the agency of communities to adapt to economic hardship. However, these practices can inadvertently intensify environmental vulnerabilities, particularly in already fragile ecological contexts. The following section contextualises this tension through the case of artisanal brick production in Blaauwbosch, where acts of economic survival intersect with environmental degradation in complex and uneven ways.

4. SITUATING INFORMAL BRICK PRODUCTION IN THE CLIMATE CRISIS

The South African brick production economy encompasses both formal and informal activities (Algoa Brick, 2019). Across the globe, the bulk of brick production is attributed to the unorganised small-scale industry that employs the use of energy-inefficient traditional techniques. South Africa is

known to be the largest producer of clay brick, contributing over 70% of the total production volume for the Southern African Development Community (SADC). Informal or Artisanal brick production involves manually moulding and firing clay bricks using locally sourced materials like clay, water, and biomass for fuel. In rural South Africa, particularly in areas such as the Vhembe District of Limpopo Province, this practice is a key economic activity (Musyoki et al., 2016). Similar to the informal sector as a whole, informal brick production operates largely outside the formal regulatory framework, without official licensure or oversight yet remains a vital source of livelihood for many. As a result, there is limited information on the size of the industry and its environmental and socio-economic impacts on host communities (Aniyikaiye et al., 2021).

Artisanal brickmaking, typically done in small-scale, traditional setups, is a significant livelihood for many in South Africa, especially in rural and peri-urban areas. It's labour-intensive, relies on local clay, and uses basic kilns often fueled by coal, wood, or waste materials (Aniyikaiye et al., 2021). This makes it accessible to low-income communities but also ties it directly to environmental and economic challenges. The process emits greenhouse gases and particulate matter, contributing to local air pollution and, to a lesser extent, climate change. The reliance on finite resources like clay and fuelwood can also degrade local ecosystems, which are already stressed by rising temperatures and erratic rainfall. These shocks hit hard because most artisanal workers operate on marginal, climate-exposed land (Dodman, et al., 2023).

Rural communities engaged in artisanal brick production are disproportionately vulnerable to climate change due to their dependence on natural resources. Erratic rainfall, extreme weather, and resource depletion directly affect both brick-making and complementary activities such as agriculture, thereby amplifying economic instability (Ziervogel et al., 2014). Limited access

to adaptive technologies, such as efficient kilns or alternative fuels, and financial resources further heighten this vulnerability. Historical socio-economic disparities, including unequal access to infrastructure and education further compound these challenges, leaving these communities less equipped to cope with climate shocks (Seekings and Natrass, 2005).

5. RESEARCH METHODS

5.1. Research Design

This research adopts a qualitative methodology to thoroughly investigate the complex and multifaceted relationship between climate change and informal economies, using artisanal brickmaking as a specific and illustrative case study. The decision to employ a qualitative approach is intentional and well-suited to this study, as it facilitates a deep and nuanced exploration of the socio-economic and environmental dynamics that characterise informal economic activities in the context of a changing climate. Unlike quantitative methods that focus on numerical data and statistical trends, qualitative research excels at uncovering the intricate details of human behaviour, lived experiences, and social interactions, all of which are essential for the topic under study (Eyisi, 2016). The research utilised a single case study approach because it offers an in-depth and detailed exploration of both the topic and the participants involved. This method supports the use of a variety of fieldwork techniques, such as informal discussions, one-on-one interviews, and direct participation and observation, thereby enhancing the depth of the investigation (Gobo, 2008; Sclafani, 2017).

5.2. Research Site

This study focuses on a mining community in the Blaauwbosch area, situated in one of the primary coal mining towns within the Coal-Rim Cluster of northern KwaZulu-Natal (Nel et al., 2003). The community utilises an old, decommissioned mine to extract sand

and coal and also uses the site for brick production. The extracted coal and sand, along with the produced bricks, are sold locally and used for domestic purposes. According to the Institute of Natural Resources (2018), land use in this region consists of an assortment of agriculture (commercial and subsistence), afforestation, industrial uses, mining and high-density urban settlements and sparse rural settlements. The vast majority (74%) of the District's land cover consists of natural, untransformed vegetation. In almost all areas, this is grassland which is utilised as grazing land for livestock. The district's history of coal and metal ore mining in areas like Newcastle, Durnacol, Dundee, and Glencoe has contributed to the local economy but also created conflicts between biodiversity conservation and mining interests (Institute of Natural Resources, 2018). The Blaauwbosch area is amongst those heavily impacted by the historical legacy of coal mining, evidenced by the prevalence of artisanal or "illegal" mining and artisanal brick construction.

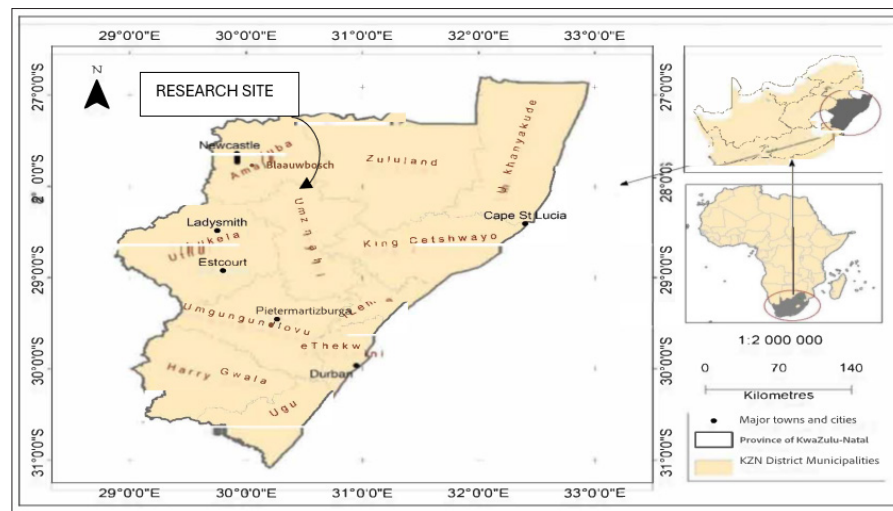


Figure 1: Study area

5.3. Sampling Methods

This study used non-probability sampling through a purposive sampling technique to select the participants. Participants were selected based on three parameters: first, their experience as brickmakers; second, their historical knowledge of the mining operations and their vicinity to the mine operations. This group included older people who had previously worked or are still working in the mine. Thirdly, participants were recruited based on their willingness to participate. The study comprised 30 male and female artisanal miners who are simultaneously engaged in brick making. These brickmakers operate from an abandoned mine site, where they extract coal and sand used in the brickmaking process. As such, the study uses the terms "artisanal miners" and "brickmakers" interchangeably. Since this is a qualitative study, a smaller sample was chosen to enable an in-depth and nuanced examination of the topic. As noted by Trotter (2012), qualitative research often focuses on describing the typical behaviours and views within clearly defined groups. Because of this, qualitative samples are usually smaller and aim for shared understanding, unlike large-scale surveys that rely on statistical power or random sampling.

5.4. Data Collection Methods

A combination of primary and secondary data was used to conduct this study. Primary data was collected using a combination of in-depth interviews, site observations, and oral histories. When undertaking this method of data collection, critical information was sought from the participants to address the objective of the study, including basic biographical information, artisanal miners history and experiences as miners, the nature of their work, the obstacles and opportunities, their personal views on

mining operations, and the role and impact of these operations on them and communities at large. Their experiences with mining regulations, criminalisation, and legislation were also discussed. Secondary data involved an extensive review of literature (e.g., documents, histories, newspapers, diaries, memos, stories) and visual materials (e.g., video recordings and television programmes). Thematic analysis was used to analyse the data that was collected. Thematic analysis entails looking through and analysing textual evidence, such as transcripts of interviews (Mehrad & Zangeneh, 2019). To analyse the data, all interviews with the participants were transcribed and thoroughly engaged with to gain an understanding of the content. Following this, important points and recurring ideas were identified and grouped as codes to form broader themes that address the study's objectives. The themes were reviewed to make sure they accurately reflected the data and did not overlap. Thereafter, each theme was clearly defined and given headings that captured its main message. Finally, the themes were used to write the findings and were supported with quotes from participants and relevant literature.

5.5. Ethical Considerations

Ethical clearance to conduct this study was sought from the University of KwaZulu-Natal Research Ethics Committee on September 16, 2020, with the reference: HSSREC/00001796/2020. As per the requirements of the ethics committee, these ethical principles were to be covered in the gatekeeper letter, information sheet, and consent form addressed to the research participants.

6. RESULTS AND DISCUSSION

6.1. Socio-Demographic Characteristics of the Brick Producers

The brick producers interviewed in the study consisted of 60% male and 40% female participants. While men made up the majority, the number of females

is notable given the traditionally male-dominated nature of the operations. The inclusion of women likely reflects economic desperation, changing gender norms, or the accessibility of informal economic activities for marginalised groups. Female headship, family responsibility, and unemployment were frequently cited as reasons for women’s participation in artisanal mining in this study. This is corroborated by the statistics that reveal that the highest concentration of the unemployed in Newcastle is amongst the female population (20,129) as compared to the male population (17,557) (Newcastle Municipality, 2024). The age distribution of the 30 artisanal brick producers who participated in the study reveals a broad generational spread, ranging from 21 to 80 years. The distribution shows that artisanal mining is not limited to a specific age group, it engages both younger entrants (21–30) and older, possibly lifelong miners (71–80). This suggests that the production of bricks is a multi-generational livelihood, possibly passed down through families or adopted as a long-term means of survival. In terms of household dependency, a significant portion of the participants (46.7%) support more than 5 dependents. This underscores the heavy economic burden placed on the participants, reinforcing their continued dependence on these operations.

Table 1: Demographic and Socio-Economic Characteristics of brick producers (n = 30)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	18	60.0%
	Female	12	40.0%
Age	21–30	6	20.0%
	31–40	4	13.3%
	41–50	3	10.0%
	51–60	7	23.3%
	61–70	6	20.0%
	71 and above	4	13.3%
Household Dependants	No Dependants	2	6.7%
	1-3	5	16.7%
	4-5	9	30.0%
	More than 5	14	46.7%

6.2. An Overview of the Brick Production Activities in Blaauwbosch

Brick production in Blaauwbosch takes place within an artisanal mining site, where both activities, brickmaking and mineral extraction are conducted. The Blaauwbosch mine, which is believed to be over 50 years old, has consistently been occupied by Blaauwbosch residents and surrounding communities. As previously noted, the site is actively utilised by both men and women across various age groups, all engaged in the pursuit of income generation. The Blaauwbosch area, particularly the mine site, is rich in clay and coal, often used interchangeably. Both resources are mainly used for brick production and occasionally sold for local use, such as heating and cooking. The discovery of the mine and brick production have played a significant role in shaping the community. According to a participant, prior to the discovery of the mine site, housing conditions in this community were appalling, with most homes made from clay and mud, later replaced by corrugated iron. The community’s shift to producing their own bricks marked a dramatic change in housing, with many homes near the mine built using bricks from the site.

This dramatic change in their housing conditions also reflects the participant’s agency. Despite the lack of formal support or resources, they were able to find a way to improve their living conditions using what was available to them. As discussed earlier, agency in this study refers to how individuals and communities take action, use the resources at their disposal to meet their needs when faced with challenges.



Figure 2: Blaauwbosch houses built using the bricks produced from the mine. Photograph by Nonkululeko Zondo

6.3. Traditional Brick Making Process

As the researchers were approaching the site, much smoke was observed coming from the mining site, with small building-like structures filled with smoke, known as kilns, used for firing bricks. Mineworkers claim that the municipality and the Department of Mineral Affairs committed to rehabilitating the mine by developing a block-making facility and brick-making yard several years ago, but the project has not materialised. One of the miners walked us through the brick production process, which included the following steps: raw material preparation, which includes preparing the soil using a homemade soil sieve. Once the soil has been sieved, water is added and mixed to make mud until the mixture is ready to be moulded into bricks. The prepared mixture is then placed and pressed into the brick moulds, as shown in (Figure 3). This is followed by removing the excess material from the mould and smoothing the bricks using trimming tools that are also homemade. Finally, the bricks are left to dry in the sun for another 5-10 days or longer, depending on the weather, or until ready to be fired in the kilns, see (Figure 4)



Figure 3: Miners constructing bricks. Photograph by Nonkululeko Zondo



Figure 4: Brick manufacturing in the Blaauwbosch mine. Photograph by Nonkululeko Zondo

6.4. Socio-Economic Drivers of Brick Production in Blaauwbosch

The findings from this study reveal the complex socio-economic drivers that sustain brick production in Blaauwbosch, a community marked by economic hardship and environmental challenges. Brick production emerges as a pivotal informal economic activity, shaped by income generation, employment opportunities, social cohesion and environmental influences.

6.4.1. INCOME GENERATION AND EMPLOYMENT

Like many other townships and rural areas, the informal economy is a significant source of income generation and a survival mechanism amid high poverty and unemployment rates in Blaauwbosch. The majority of the participants expressed that brick production has immensely benefited the local economy in terms of income generation, livelihood diversification, and employment opportunities. According to statistics, the Newcastle Municipality has a predominantly low-income population, with many living in abject poverty due to a lack of a reliable source of income. Blaauwbosch is amongst the wards with the highest concentration of the unemployed. (Newcastle Municipality, 2022). One participant indicated that:

If you look there (pointing at the other end of the mine), you will see that it is just young people. Some do have matric certificates, and some have grade 11; they would tell us that they have tried looking for employment opportunities with no luck; some come from child-headed households and are sole providers at home; as a result, they are forced to make ends meet to support their families (Participant TTT, interview, 02 June 2021)

This participant argues that the struggle to find work has forced the youth to turn to this precarious industry. Newcastle Municipality (2022) reports a high number of child-headed households. According to the report, 1.3% of the total number of households in Newcastle is headed by a child who is either 18 years old or younger. Furthermore, most of these child-headed households live below the Lower Bound Poverty Line (LBPL) of R1,109 a month.

Several participants indicated that the ability to earn cash on a daily basis makes this form of work more viable than waiting for uncertain formal employment opportunities. One respondent explained:

My sister, I am just here to get at least R210 for the day. If I want more, I will return in the afternoon; I can easily make R500 daily. It is good that with this job, you get what you put in, and money is guaranteed on the spot (Participant SSS, interview, 01 June 2021).

Based on such accounts, earnings range between R200 and R500 per day, which translates to R4,000 to R12,500 per month, depending on the number of days worked and market demand. When compared to the Lower Bound Poverty Line (LBPL) of R1,109 per person per month (Statistics South Africa, 2024), while these figures are slightly higher, however, the highly uncertain and precarious nature of these operations undermines any sense of financial stability or long-term security for those involved.

6.4.2. SOCIAL COHESION AND COMMUNITY TIES

The collective nature of brick production in Blaauwbosch fosters social cohesion and strengthens community bonds. Brickmaking is often undertaken collaboratively, with groups of friends, family members, and neighbours working together to produce and market their goods. This cooperative approach enhances productivity while creating a support network for individuals who might otherwise experience isolation

or marginalisation. Findings from the study highlight how participation in brick production instils a sense of purpose and belonging. One participant stated:

I came to Newcastle in 1992 from Paulpietersburg (eDumbe). I started working at the mine because I needed bricks to build a house, but when I realised that I could make an income from working here, I decided to work here permanently. Not even once did I ever feel discriminated against because I was not from here; I have friends and family now (Participant MMM, interview, 01 June 2021)

6.4.3. ENVIRONMENTAL DRIVERS

Environmental conditions in Blaauwbosch, including land degradation and water scarcity, have elevated both mining and brick production as a practical alternative to traditional farming. Study participants noted the poor soil quality, unsuitable for agriculture, and frequent water shortages that hinder irrigation, compounded by competition from nearby markets. These ecological barriers limit the feasibility of farming as a reliable income source. By contrast, brick production demands fewer resources and can be adapted to local conditions, utilising readily available materials like clay or sand. This adaptability makes it an attractive option for residents seeking sustainable livelihoods. However, the activity's reliance on natural resources raises concerns about its environmental impact, as participants acknowledged that their operations may exacerbate land degradation, highlighting a tension between immediate economic needs and long-term ecological sustainability.

One of the interviewees stated:

It is not like we have the luxury to engage in other income-generating activities. There are limited opportunities here; we are neglected. Yes, the operations have damaged the environment, but at the end of the day, we need to eat; if this is the only way, then so be it. Furthermore, it is not like these people are farming here if you look around; it is dry in most places; at the end of the day, we are all trying with the little resources at our disposal (Participant ZZZ, 01 July 2021).

6.4.4. AWARENESS OF ENVIRONMENTAL PROBLEMS AND CLIMATE CHANGE

When asked about their awareness of the environmental problems emanating from their operations, the majority of brickmakers demonstrated a practical awareness of the environmental problems associated with their work, particularly the visible degradation of land, air pollution from brick kilns, and contamination of water sources. Several participants expressed concern about the smoke emitted during the firing process, noting its effects on their health and nearby vegetation as illustrated in the quote above, participant ZZZ acknowledged the environmental damage caused by artisanal brickmaking however, they are compelled to continue out of economic necessity, making do with the few resources available to them.

The study went on to explore participants' awareness of formal regulations and permit requirements governing their brickmaking activities. When asked whether they were aware of any permits, laws, or policies that applied to their use of the site, the majority of participants expressed uncertainty or a complete lack of knowledge. As illustrated in Figure 5, 89% (26 out of 30) indicated that they had no awareness of any formal permits or regulatory processes related to their operations. Although some acknowledged that the site was "not legal" or that their activities might fall outside official approval, only one participant (3%) demonstrated any familiarity with relevant permit conditions or compliance obligations.

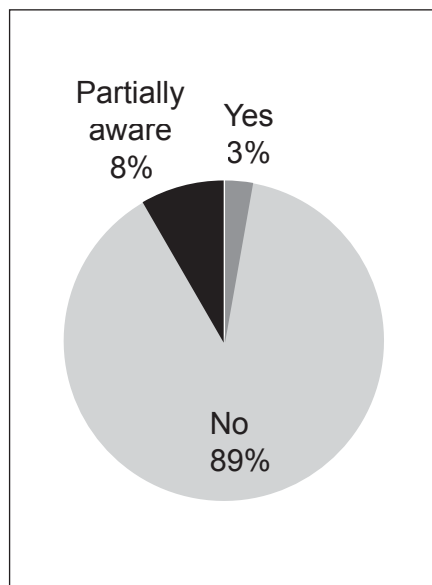


Figure 5: Participant's awareness of formal regulations and permit requirements

This lack of awareness regarding regulatory permits has broader implications for how environmental responsibility and climate vulnerability are understood within informal economies. Additionally, the findings reveal that for some of the participants, economic necessity far outweighs environmental or legal concerns, especially in cases where there are limited alternative economic opportunities.

6.5. Environmental Implications of the Brick Production Process

The interviews showed that the mine had caused the community several environmental and health-related challenges. For example, as shown in (Figure 5) below, inside the mine, there are pools of contaminated water that pose a threat to humans and animals. One participant was captured saying:

6.5.1. WATER CONTAMINATION

Brick production operations, as observed in Blaauwbosch, significantly contribute to water contamination, particularly when occurring alongside artisanal mining. The process requires water to mix clay or other raw materials, and inadequate wastewater management can lead to environmental degradation. The presence of pools of contaminated water on the site highlights

the potential risks. The combined extraction and processing of mined materials like clay for bricks can increase the leaching of harmful substances into the water table, posing severe risks to community health and ecosystems. The dual impact of mining and brick production thus amplifies the threat to both human and environmental well-being. Notably, livestock such as sheep and goats were seen grazing near these contaminated water sources, potentially exposing them to harmful substances (figure 5). Nearby residential areas were also observed, raising concerns about the impact on local communities.



Figure 6: Contaminated water on the mine site. Photograph by Nonkululeko Zondo

The brickmakers themselves are also exposed to these contaminated conditions daily. Many operate with minimal or no protective gear, increasing their risk of direct contact with polluted water and are exposed to environmental health risks. In addition to working under these conditions, several brickmakers reside near the production sites, further intensifying their exposure to environmental health risks. A study by Aniyikaiye et al. (2021) similarly observed that host communities, especially local workers and their children are more vulnerable to adverse health impacts due to their extended exposure to elevated levels of airborne and waterborne pollutants.

6.5.2. AIR POLLUTION

The air quality around the site deteriorates markedly due to brick production, as evidenced by community reports of smoke causing headaches and other respiratory complications. One participant stated:

We thank God every day that we are still alive. This is not work; it feels like we are digging our graves daily. I am on chronic medication, and I know that working here makes me vulnerable. I have constant back problems and always struggle with flu and headaches. When I went to the clinic, they told me that the constant smoke inhalation was the cause of this, so I had to slow down with brick firing. Luckily, my colleagues do assist me with it. However, it is difficult because it means less money coming in (Participant xxx, interview, 01 June 2021).

Artisanal brick-making typically involves firing kilns with fuels like wood or coal, releasing significant amounts of smoke, particulate matter, and potentially toxic emissions (Mamun-Or-Rashid & Bari, 2023). This pollution has immediate health consequences, headaches and respiratory irritation which affects both the brick producers and the community. Beyond health, airborne pollutants settle on soil and water, further degrading the environment and disrupting daily life.

6.5.3. LAND DEGRADATION

Brick production significantly contributes to land degradation, primarily through the extraction of clay and other raw materials. The process involves stripping topsoil and digging deep pits, which disrupts the land's natural structure and fertility (Aniyikaiye et al., 2021). These activities often leave behind barren, eroded landscapes that are unsuitable for agriculture or other productive uses. As noted in the previous discussion, this has restricted the community from exploring other land-based livelihood activities, which could provide more sustainable income sources.

6.5.4. INFRASTRUCTURE DAMAGE

The physical strain of brick production and mining on local infrastructure, particularly the public facilities and households near the mine. (Figure 6) is what used to be a school, which was forced to be relocated because of the damage caused by the operations. Moreover, numerous households situated near the mine site were also compelled to relocate due to increasing levels of environmental risk and physical damage. Cracks in walls, sinking foundations, and the encroachment of extraction pits into residential spaces created hazardous living conditions. In some cases, relocation was not facilitated through formal resettlement plans, leaving residents to bear the burden of displacement independently. This situation not only highlights the infrastructural vulnerabilities caused by artisanal operations but also reflects the broader socio-political marginalisation of communities engaged in informal livelihoods.³



Figure 7: The dilapidated building of a local school. Photograph by Nonkululeko Zondo

6.6. Environmental Impact and Climate Vulnerability of Brick Production

As a coal mining region, Newcastle's economic dependence on the extraction of the natural environment makes it vulnerable to climate change. In Blaauwbosch, the brick production process, which relies heavily on coal, likely exacerbates this vulnerability. Studies conducted in other informal mining and industrial zones, such as those in Zimbabwe (Maponga & Ngorima, 2003) and India (Nanjunda & Venugopal, 2022), have similarly highlighted the paradox of economic survival and environmental degradation. In these contexts, communities dependent on extractive or energy-intensive informal activities often lack access to cleaner technologies, regulatory oversight, or sustainable alternatives, making their livelihoods both environmentally harmful and ecologically precarious. Similar dynamics have been documented in countries such as Bangladesh and Nepal, where informal brick kilns contribute to severe air quality issues and health problems while also undermining climate adaptation efforts (Khaliquzzaman et al., 2020).

For rural communities reliant on this form of production, the risks extend beyond environmental damage. Artisanal brickmaking also entrenches communities in a livelihood model that is both unsustainable and climate-vulnerable. As environmental conditions worsen through rising temperatures, unpredictable rainfall, and land degradation, brick production itself becomes more precarious (Aniyikaiye et al., 2021). For example, changes in weather patterns may affect the drying process of bricks, while stricter environmental regulations or access restrictions to fuel sources (e.g., coal) could limit production capacity.

This situation creates a double exposure for rural informal producers: on the one hand, they contribute to the degradation of their own environmental base; on the other, they suffer disproportionately from the impacts of that degradation (Leichenko & O'Brien, 2008). Without access to climate-resilient infrastructure, alternative income opportunities, or technical innovation, communities like those in Blaauwbosch are effectively trapped in a cycle of ecological harm and economic dependence. Furthermore, the rural informal economy is marked by institutional neglect, where

limited government support, lack of access to credit, and minimal inclusion in climate policy frameworks leave artisanal workers with little room for adaptation (Durokifa, 2024). Informal workers are not only excluded from formal economic protections but are also left out of just transition and green economy dialogues, despite being some of the most affected by environmental and economic shifts (Satterthwaite, et al., 2020).

7. CONCLUSION AND RECOMMENDATIONS

7.1. Conclusion

This research, specifically the research site, has illustrated how artisanal brickmaking embodies the delicate balance between fostering economic opportunity and contributing to environmental decline within the informal sector. This study reveals that brick production serves as a critical lifeline for a community grappling with high unemployment, poverty, and historical marginalisation. By leveraging locally available resources, such as clay and coal from an abandoned mine, residents have transformed precarious living conditions, replacing mud and corrugated iron dwellings with durable brick homes. The industry fosters income generation, employment, and social cohesion, while its accessibility enables participation across genders and generations, underscoring its role as a multi-faceted economic and cultural practice.

However, these benefits are overshadowed by significant environmental and health challenges. The reliance on traditional, energy-intensive techniques contributes to air pollution, water contamination, and land degradation, exacerbating the community's vulnerability to climate change. The use of coal-fueled kilns and the absence of wastewater management amplify ecological harm, while the physical toll on infrastructure, evidenced by damaged public facilities, infrastructure and homes, further disrupts community stability. This

creates a paradox whereby artisanal brickmaking empowers residents economically but entrenches them in a cycle of environmental harm and climate vulnerability. The lack of institutional support, including unfulfilled promises of mine rehabilitation, compounds these challenges, leaving informal workers excluded from broader climate resilience and economic transition frameworks.

The findings reinforce previous arguments that conventional approaches to formalisation have limitations when addressing the vulnerabilities of the informal sector. Formalisation efforts often overlook the lived realities of communities like Blaauwbosch, imposing regulations that can undermine livelihoods without addressing underlying structural inequalities. In contrast, this study highlights the resilience and agency of informal economies, where communities have developed resourceful strategies to overcome constraints such as poverty, unemployment, and exclusion. On the agency of the participants, this study highlights how brickmakers in Blaauwbosch demonstrate agency through their informal practices and everyday decision-making. Despite working in a resource-constrained and structurally neglected environment, they find ways to improve their living conditions and assert control over their livelihoods. A clear example is the use of materials extracted from the abandoned mine to produce bricks, which some residents have used to build more stable homes. The Blaauwbosch case illustrates that informal economies are vital components of rural livelihoods, requiring context-sensitive interventions that balance economic empowerment with ecological sustainability.

7.2. Recommendations

7.2.1. REHABILITATION OF THE MINE SITE

As observed from the study, artisanal brickmaking in the region relies on non-renewable resources like clay and coal for firing kilns, raising concerns about

resource depletion and sustainability for communities dependent on these industries. In Blaauwbosch, diminishing coal reserves have rendered the mine hazardous to miners and residents, exacerbated by climate change impacts such as erratic weather patterns that further degrade mined lands. The absence of proper mine closure and restoration has led the community to continue unsafe coal extraction. This highlights the urgent need for rehabilitating mined-out sites to mitigate environmental damage and address climate change challenges, such as soil erosion and carbon emissions from traditional brickmaking. According to Butler (2014), successful, self-sustaining restoration in artisanal mining is rare due to limited environmental rehabilitation efforts. For Blaauwbosch, restoring the mine could reduce environmental and social harm while enabling alternative economic activities like sustainable artisanal brickmaking and using eco-friendly techniques to lower carbon footprints. This shift could provide ongoing livelihoods, particularly for youth, by fostering climate-resilient economic opportunities on rehabilitated land.

7.2.2. SUPPORT FOR SUSTAINABLE BRICKMAKING

Artisanal brickmaking constitutes a vital economic activity in the Amajuba District Municipality, particularly in communities like Blaauwbosch, where rapid population growth and persistent delays in service delivery underscore the demand for affordable construction materials (Ngobese, 2015). Rather than stifling the demonstrated resilience and agency of local brickmakers, who have adapted to resource constraints and historical marginalisation, interventions should harness these strengths to foster sustainable practices. This approach aligns with the need to address both socio-economic imperatives and environmental challenges, including climate change and land degradation, which threaten the long-term viability of the sector.

To promote sustainability, support mechanisms should prioritise the adoption of eco-friendly technologies, such as energy-efficient kilns and alternative fuels, to reduce carbon emissions and mitigate deforestation associated with traditional brickmaking (Aniyikaiye et al., 2021). Concurrently, restoring degraded mine sites, as previously discussed, could provide raw materials like clay while facilitating land rehabilitation, thereby enabling dual economic and ecological benefits. Furthermore, integrating artisanal brickmaking into broader climate resilience frameworks is critical. Policymakers should recognise the sector's role within the informal economy and incorporate it into climate adaptation strategies, such as those promoting reforestation or soil conservation, to safeguard livelihoods against climate-induced vulnerabilities (e.g., erratic rainfall impacting clay extraction).

7.2.3. CAPACITY BUILDING AND ENTREPRENEURSHIP DEVELOPMENT

To support the informal brickmaking sector in Blaauwbosch, targeted capacity-building and entrepreneurship development initiatives are essential. Such programs should prioritise enhancing local knowledge systems and productive capabilities through accessible training in technical skills, business management, cooperative development, and market access. Recognising the ingenuity and resourcefulness already embedded within the community, interventions must be participatory in nature and co-designed with local stakeholders to ensure contextual relevance and sustainability.

This approach moves beyond deficit-based models of development, instead fostering endogenous growth through the amplification of existing social capital. Tailored entrepreneurship support can assist brickmakers in formalising operations without displacing informal practices that provide critical livelihoods. Moreover, support for micro-enterprise

development, including access to credit, financial literacy, and organisational capacity, can help community members navigate structural economic exclusion. Ultimately, such strategies would enable the transition from survivalist entrepreneurship to more resilient and sustainable forms of local enterprise.

7.2.4. CLIMATE RESILIENCE EDUCATION

Given the environmentally intensive nature of artisanal brick production, climate resilience education must form a core component of any long-term developmental intervention. Climate education initiatives should be aimed at increasing awareness of environmental degradation, resource depletion, and climate vulnerability, while also offering practical knowledge and tools for sustainable adaptation. For the brickmaking community in Blaauwbosch, this could involve training on alternative, low-emission production technologies, sustainable clay harvesting methods, and reforestation or land rehabilitation practices. In addition, integrating climate adaptation strategies such as water conservation techniques or localised risk assessments can help mitigate the vulnerability of livelihoods to climate-induced disruptions.

Importantly, climate resilience education should be embedded within broader development strategies and delivered in culturally appropriate and locally grounded formats. Community-led workshops and partnerships with local NGOs and civil society organisations can serve as effective vehicles for building environmental literacy and fostering collective resilience. By aligning ecological sustainability with socio-economic empowerment, climate resilience education contributes to a just transition that does not undermine the livelihoods of those most reliant on informal economies.

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Notes