Int. j. adv. multidisc. res. stud. 2026; 6(4):803-813

Received: 01-06-2026
Accepted: 11-07-2026

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

Institutional Abandonment and Livelihood Disruption in Mining-Dependent Communities: Evidence from Chibuluma Mine Closure, Zambian Copperbelt

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Abstract
Mine closure precipitates severe and frequently irreversible socio-economic disruption in communities whose livelihoods have been organized around extractive industries for generations. Despite growing international literature on post-mining transition, primary empirical evidence from sub-Saharan Africa remains limited. The specific dynamics of institutional abandonment, characterized by minimal governmental and corporate support following closure, remain poorly understood.

This study examines the socio-economic consequences of the closure of Chibuluma Mine in Kalulushi District, Zambia, using a concurrent triangulation mixed-methods case study design. Quantitative and qualitative data were collected simultaneously through structured questionnaires (n = 63, response rate 52.5%), semi-structured interviews with municipal, environmental, and corporate officials, and systematic secondary data analysis. Data were analyzed using descriptive statistics and thematic analysis and integrated at the interpretation stage.

Findings reveal severe institutional disengagement. Among respondents who reported on assistance, 84.6 percent received no government support following mine closure. Only 3.8 per cent accessed job training programs, 3.8 per cent received direct financial aid, and 15.4 per cent received social welfare transfers. Civil society/NGO support reached 3.3 per cent of respondents. Corporate closure obligations were minimal and reactive, with the only documented intervention being a K8 million remediation payment to 42 households affected by tailings dam displacement.

Post-closure employment outcomes were adverse: 30.6 per cent reported formal employment, 8.1 per cent informal activity, 3.2 per cent self-employment, and 3.2 per cent unemployment. Three principal barriers to livelihood recovery were identified with near-equal frequency: lack of capital (30.2%), absence of transferable skills training (27.0%), and limited availability of formal employment outside mining (27.0%). Despite these constraints, adaptive intent was high: 96 per cent expressed willingness to undergo vocational retraining, with agriculture (68%) and SME development (54%) as preferred alternatives.

On environmental matters, 57.7 per cent of respondents were unable to assess changes in soil quality, reflecting the absence of systematic monitoring, baseline surveys, or community environmental communication rather than the absence of risk. Approximately 30.4 per cent believed mining had caused adverse environmental changes.

The study concludes that Chibuluma Mine closure reflects a pattern of institutional abandonment inconsistent with domestic legislation and international best practice. It contributes primary community-level evidence to the mine closure and just transition literature and advances a multi-stakeholder policy framework centred on capital provision, skills training, agricultural extension, and environmental monitoring for post-mining resilience in mining-dependent economies.

Keywords: Mine Closure, Just Transition, Sustainable Livelihoods, Post-Mining Communities, Zambian Copperbelt, Institutional Failure, Economic Diversification, Chibuluma Mine, Concurrent Mixed Methods

1. Introduction

Mine closure ranks among the most consequential and least adequately managed events in the lifecycle of extractive industries. When a mine ceases operations, whether through ore body depletion, commodity price collapse, or regulatory pressure, the socio-economic consequences for dependent communities can be catastrophic and long-lasting (Haslam McKenzie *et al*., 2023;

Measham *et al*., 2024) [24, 40]. Unlike the closure of a single firm in a diversified economy, mine closure frequently dismantles an entire community's economic infrastructure in one movement: formal employment, informal service economies, municipal revenue, social facilities, and housing markets may collapse together (Marais *et al*., 2018; Franks, 2010) [38, 19]. This compounding character of closure has led researchers to describe resource-dependent communities as exhibiting a structural vulnerability that leaves them poorly equipped for post-closure transition (Marais, 2013; Shandro *et al*., 2011) [36, 47].

The global scale of this challenge is substantial and growing. More than 10,000 mines are estimated to require closure over the next two decades (World Bank, 2002) [51], and the geographical concentration of extractive industry in low- and middle-income countries means that the heaviest adjustment burdens will fall on communities with the least institutional capacity to carry them. Sub-Saharan Africa, where mineral extraction has historically been structured to serve export markets rather than to build endogenous development capacity, is especially exposed. The region hosts major copper, cobalt, platinum, and gold deposits, yet the record of responsible mine closure remains poor and communities have repeatedly been left to manage the social consequences of closure with negligible external support (Fraser and Lungu, 2007; Mbilima, 2019) [20, 39].

Zambia offers a defining example of this wider pattern. The copper mining sector contributes 17.5 per cent of gross domestic product, 72 per cent of export earnings, and approximately 44 per cent of government revenues (IMF, 2023; EITI, 2023) [27, 18]. Some 73,203 people are directly employed in mining, equivalent to 2.4 per cent of the total employed population (ZEITI, 2023) [54], but indirect and induced employment effects multiply far beyond that figure the number of livelihoods connected to the sector. Structural dependence of this depth means that individual mine closures reverberate well beyond the immediate workforce. The privatisation of the Zambia Consolidated Copper Mines (ZCCM) from the mid-1990s dismantled the vertically integrated social infrastructure that had historically provided housing, healthcare, and education to mining communities, without establishing adequate alternative institutional arrangements (Fraser and Lungu, 2007; Whitworth, 2014) [20, 50].

Kalulushi District, on the Zambian Copperbelt, experienced this dynamic through the progressive contraction and effective closure of Chibuluma Mine. Majority-owned by Metorex Limited (South Africa), with a 15 per cent government stake retained, Chibuluma Mine was among the older operations on the Copperbelt, with geological exploration beginning in 1928. Successive shaft closures in 2005 and significant workforce restructuring in 2016 progressively reduced employment, leaving behind elevated unemployment, weakened household income, and unresolved environmental contamination in the surrounding community.

Despite a substantial body of scholarship on mine closure in South Africa (Marais, 2013; Marais *et al*., 2018) [36, 38], Australia (Haslam McKenzie *et al*., 2023) [24], Canada (Pembina Institute, 2008) [44], and Latin America (Castro *et al*., 2011) [7], primary empirical research from Zambia remains sparse, particularly at the community level. This study addresses that gap through original mixed-methods research examining four dimensions of post-closure experience in Kalulushi District: employment and livelihood impacts; the adequacy of institutional responses from government, corporate, and civil society actors; community perceptions of environmental contamination; and preferences for economic diversification. In so doing, it offers an empirical contribution to the international post-mining transitions literature and advances a policy framework grounded in the specific institutional realities of Zambia and comparable sub-Saharan African mining economies.

2. Literature Review

2.1 Global trajectories of mine closure research

Academic and policy attention to mine closure has grown substantially since the 1990s, when declining commodity prices and the exhaustion of historically productive ore bodies forced post-mining transitions onto institutional agendas in mining jurisdictions worldwide (Limpitlaw, 2004; Laurence, 2011) [33, 32]. Early scholarship treated closure primarily as a technical undertaking, encompassing geotechnical rehabilitation, tailings management, and land-use transition, with community well-being addressed as a secondary consideration (Swart, 2003; Cooke, 1999) [48, 11]. From the early 2000s onwards, however, a more complex picture emerged in which the social costs of closure, among them unemployment, income loss, mental health deterioration, and demographic outmigration, were increasingly recognized as ethically significant and economically substantial (Franks, 2010; Nixon *et al*., 2016; Measham *et al*., 2024) [19, 42, 40].

Several consistent pathways through which mine closure disrupts community well-being are now well established in the literature. Employment loss is the most immediate mechanism: termination of mining operations eliminates formal employment not only within the mine itself but across supply chains, service economies, and contract labour markets that mining sustains (Shandro *et al*., 2011; Haslam McKenzie *et al*., 2009) [47, 25]. Research in South Africa's Free State Goldfields by Marais and colleagues (2018) [38] demonstrated that cascading unemployment across domestic service, retail, and hospitality sectors produced community distress persisting for more than a decade following initial closures. Similar dynamics have been documented in Queensland, Australia, where coal mine closure triggered population decline, infrastructure deterioration, and municipal fiscal stress (Haslam McKenzie *et al*., 2023) [24].

The adequacy of institutional responses to mine closure has attracted growing critical attention. Laurence (2011) [32] argues that many corporate closure plans constitute regulatory theatre, that is, documents satisfying formal compliance requirements whilst delivering negligible material benefit to affected communities. Owen and Kemp (2016) [43] document persistent gaps between social licence commitments made during operational phases and post-closure support actually delivered. A comparative analysis by Marais and Atkinson (2006) [37] found that legislative frameworks for mine closure, whilst formally comprehensive in South Africa, were consistently under-resourced and inadequately enforced. A recent systematic literature review by Measham and colleagues (2024) [40], spanning 90 peer-reviewed publications, concluded that genuine 'beyond closure' frameworks integrating environmental, social, and economic dimensions into sustained post-mining governance remain the exception

rather than the rule globally.

2.2 African mine closure: Structural disadvantage and institutional gaps

The mine closure literature from Africa reveals dynamics inadequately captured by experience in high-income mining jurisdictions. Post-colonial mining structures in much of sub-Saharan Africa were designed to export mineral wealth whilst minimising local economic linkages: smelting was typically conducted offshore, skilled labour was often imported, and extraction benefits concentrated in an enclave rather than distributing through local economies (Fraser and Lungu, 2007; Akabzaa and Darimani, 2001) [20, 1]. Where this enclave structure prevails, mine closure can extinguish the entire economic rationale of a community rather than merely diminish it.

Privatisation of state-owned mining enterprises across sub-Saharan Africa in the 1990s further weakened the social safety nets available to mining communities. Zambia's ZCCM disaggregation transferred assets to private investors without adequate provision for the social obligations the state company had historically discharged (Fraser and Lungu, 2007) [20]. Communities that had relied on mine-provided housing, healthcare, and education found themselves simultaneously facing unemployment and service withdrawal. Data from the immediate post-privatisation period show unemployment rising from approximately 15 per cent in the late 1980s to over 40 per cent by 1995 in Copperbelt communities, with more than 4,000 jobs lost and poverty rates exceeding 65 per cent by 2005 (Fraser and Lungu, 2007; IMF, 2023) [27, 20].

More recent scholarship has examined specific dynamics of institutional absence in African mine closure contexts. Kalul Ndaguba *et al*. (2023) [29] document patterns of disengagement across multiple Zambian Copperbelt closure sites, finding governmental responses characterised by reactive rather than anticipatory interventions. Mbilima (2019) [39] identifies legislative inadequacy as a structural constraint: while Zambia's Mines and Minerals Development Act No. 11 of 2015 creates formal requirements for mine closure planning, enforcement mechanisms are weak and compliance monitoring is minimal. Besa and colleagues (2019) [4] found, in a parallel study of Kalumbila District, identical patterns of abandoned closure obligations and community-led coping without institutional support.

2.3 Environmental dimensions of mine closure

The environmental legacy of mining operations intersects with post-closure socio-economic distress in ways increasingly recognised as a distinct research domain. Heavy metal contamination of soils, groundwater, and surface water bodies is extensively documented across the Zambian Copperbelt (Kribek *et al*., 2023; Lupanga, 2020; Dusengemungu *et al*., 2022) [31, 34, 17]. Contamination of food crops, particularly leafy vegetables and root crops cultivated in mine-proximate areas, creates a direct pathway from environmental exposure to human health outcomes, disproportionately affecting households whose post-closure food security depends on subsistence agriculture (Mweemba *et al*., 2018; Kachenko and Singh, 2006) [41, 28]. Tchounwou and colleagues (2015) [49] document the mechanisms of heavy metal toxicity at concentrations typical of mine-proximate soils, establishing the scientific basis for treating soil contamination as a public health concern rather than a purely aesthetic one.

The absence of systematic environmental monitoring following mine closure is a documented governance failure across multiple jurisdictions. Chomba and Mwila (2021) [10] found that fewer than 30 per cent of former mine sites in Zambia's Copperbelt had undergone standardised post-closure environmental assessment within five years of cessation of operations. In March 2025, an acid mine drainage event at the Sino Metals facility released acidic effluent into the Kafue River, disrupting potable water supply to the cities of Kitwe, Kalulushi, and Chambishi (Kille and Zimba, 2025) [30]. That incident demonstrated that environmental risk from mining in the region is active and ongoing rather than historical, and it underscores the inadequacy of a regulatory framework that permits mine sites to close without binding environmental monitoring obligations.

2.4 Economic diversification in post-mining communities

Research on economic diversification as a post-mining transition strategy consistently reveals a tension between community willingness and institutional capacity. Populations affected by mine closure typically express strong desire for retraining, business development, and economic adaptation, but the capital, skills, market access, and institutional support necessary to realise these aspirations are systematically absent (Andrews *et al*., 2005; Haslam McKenzie *et al*., 2023; Measham *et al*., 2024) [3, 24, 40]. This gap between adaptive intent and adaptive capacity recurs across jurisdictions and deposit types, from Australian coal communities (Haslam McKenzie *et al*., 2023) [24] to Appalachian coalfields (Dubinsky, 2013) [16] to Zambian copper communities (Besa *et al*., 2019) [4].

Agriculture is frequently identified as the most viable transition pathway in sub-Saharan African mining communities, given land availability and cultural familiarity. In practice, however, its productivity is constrained by soil contamination, limited access to agricultural extension services, and weak integration into functioning commercial markets (Besa *et al*., 2019; Chikozho, 2016) [4, 9]. Small and medium enterprise development faces analogous barriers, including capital inaccessibility and the absence of business development support systems (Mbilima, 2019) [39]. What the literature consistently shows is that post-closure diversification requires coordinated institutional intervention, not merely the release of community entrepreneurial energy.

3. Conceptual Framework

This study is grounded in the Sustainable Livelihoods Framework (SLF), developed by the Department for International Development (DFID, 1999) [15] and elaborated by Scoones (2009) [46] and Chambers and Conway (1992) [8]. The SLF conceptualises livelihoods as constituted by five interacting capital assets: human capital (skills, knowledge, health); social capital (networks, trust, collective action capacity); natural capital (land, water, ecological services); physical capital (infrastructure, tools, productive technology); and financial capital (savings, credit flows, income). Each asset is shaped by the vulnerability context of the household or community, and mediated by the policies, institutions, and processes that govern access to resources and services.

Mine closure is uniquely destructive of the SLF capital portfolio. It erodes human capital as mine-specific skills become obsolete outside the sector. Physical capital is lost as mine-provided infrastructure is decommissioned and community use conversion is rarely planned. Financial capital drains away with employment termination, while natural capital degrades through ongoing environmental contamination of soils and water. Social capital, sustained through workplace networks and collective bargaining institutions, dissolves with the mine workforce. Where institutional responses are absent, as the Kalulushi evidence indicates, all five of these capital depletions occur simultaneously and without compensating capital formation.

The SLF is complemented by Just Transition theory, which provides a normative framework for evaluating the adequacy of institutional responses to economic transformation. Emerging initially from labour movement contexts and since integrated into climate, energy, and extractives policy discourse, Just Transition holds that the costs of economic change should not be borne disproportionately by workers and communities, and that governmental and corporate actors carry enforceable obligations to provide meaningful transition support (ICMM, 2019) [26]. Applied to mine closure, these principles require that closure plans be developed with genuine community participation, that post-closure support be adequate in scale and duration, and that environmental rehabilitation obligations be fulfilled transparently (Owen and Kemp, 2016; Measham *et al*., 2024) [43, 40].

Together, the SLF and Just Transition framework serve two functions in this analysis. As a diagnostic lens, they identify which capital assets have been lost and at what rate. As a normative yardstick, they clarify what institutional response is commensurate with the scale and character of community disruption. This dual function allows the study to move beyond a description of post-closure conditions and towards an analytical account of why those conditions are inadequate and what alternative governance arrangements might address them.

4. Materials and Methods

4.1 Research Design

A concurrent triangulation mixed-methods design was employed, in which quantitative and qualitative data were collected simultaneously, analyzed independently using procedures appropriate to each strand, and subsequently integrated at the interpretation stage (Creswell and Plano Clark, 2018; Bryman, 2016) [13, 6]. This approach was selected because the research objectives encompass both the measurement of socio-economic change, which demands quantitative data amenable to descriptive generalization, and the interpretation of lived experience, institutional response, and community meaning, which are more effectively accessed through qualitative inquiry (Sale *et al*., 2002; Greene *et al*., 1989) [45, 21]. Points of convergence between the two strands were treated as corroborating evidence; divergences were examined analytically to explain observed variation (Creswell *et al*., 2003) [14].

Within this design, a case study approach was adopted, focusing on Kalulushi District and the Chibuluma Mine closure specifically. Case study methodology is appropriate where the aim is to generate contextually grounded, in-depth understanding of a complex contemporary phenomenon within its real-world setting (Creswell, 2013) [12]. Chibuluma Mine was selected as the focal case because its historical economic dominance makes Kalulushi District an exemplary instance of mining dependency and, by extension, of the socio-economic consequences of mine closure.

4.2 Study Area

Kalulushi District is located in the Copperbelt Province of Zambia, approximately 14 kilometers southwest of Kitwe, at coordinates 12 degrees 50 minutes 29 seconds S, 28 degrees 5 minutes 41 seconds E. The district recorded a population of 170,701 at the 2022 Census of Population and Housing (Zambia Statistics Agency, 2022) [53]. Chibuluma Mine, one of the longest operating on the Copperbelt with geological exploration commencing in 1928 and production extending across multiple shaft configurations until 2016, was the primary employer and economic anchor for the district for most of the twentieth century. Its progressive contraction, including the permanent closure of the 2nd and 7th Shafts in 2005 and substantive workforce reduction in 2016, constitutes the primary closure event examined in this study.

4.3 Population, sampling, and data collection

The study population comprised four groups: 1) former Chibuluma Mine employees, 2) current Kalulushi District residents, 3) local government and environmental regulatory officials, and 4) civil society representatives.

The initial target sample size for the survey component was 399. This was calculated using the Yamane (1967) [52] formula with a 5% margin of error and 95% confidence interval, based on the Kalulushi District population of 170,701 (Zambia Statistics Agency, 2022) [53].

Due to access constraints in post-mining communities, 120 structured questionnaires were distributed. A total of 63 questionnaires were completed and returned, yielding a response rate of 52.5%. For the realized sample of n=63, the margin of error at 95% confidence is ±12.3%, calculated conservatively using $e=1.96\times \sqrt{05 \times 0.5/63)}$. Despite the reduced sample, thematic saturation for qualitative patterns was reached at approximately the 40th response, consistent with empirical guidance by Guest *et al*. (2006) [22] and Malterud *et al*. (2016) [35]. Thus, the sample was deemed adequate for descriptive analysis and pattern identification within the case study. Semi-structured interviews were conducted with 1) Kalulushi Municipal Council, 2) Zambia Environmental Management Agency (formerly ECZ), 3) Mopani Copper Mines as a regional comparator, and 4) the District Development Coordinating Committee. Participants for interviews were selected purposively based on their direct involvement in mine closure governance.

Respondents were selected using a multi-stage sampling strategy. Purposive sampling was used to identify former mine employees and government officials. Snowball sampling was employed to access former miners not reachable through institutional channels. Simple random sampling was used to select general community households from residential areas in Kalulushi.

All questionnaires were administered face-to-face to maximize comprehension and completion rates. The instruments were pilot-tested with 10 individuals outside the primary sample. Minor wording adjustments were made to improve clarity before full deployment. Informed consent was obtained from all participants prior to data collection.

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4.4 Data analysis and ethical considerations

Quantitative data from structured questionnaires were analysed using frequency distributions and descriptive statistics, presented as counts and percentages and where appropriate organised in cross-tabular form. Qualitative data from semi-structured interviews and open-ended questionnaire responses were analysed through thematic analysis following Braun and Clarke's (2006) [5] six-phase procedure: familiarisation with data; initial code generation; theme construction; theme review; theme definition and naming; and reporting. Triangulation was achieved through integration of findings across both strands, with convergent findings treated as corroborating evidence and divergences examined for contextual explanations.

Ethical approval was secured from the University of Zambia School of Mines Research Ethics Committee. Informed consent was obtained from all participants prior to data collection, and participation was voluntary with the right to withdraw without consequence clearly communicated. All data were anonymised at the point of collection and stored with access restricted to the research team. Participant organisations are identified in the text only to the extent agreed in the consent process.

5. Results

5.1 Demographic characteristics of respondents

The sample was predominantly male (74.6 per cent; n = 47), with women comprising 25.4 per cent of respondents (n = 16). Whilst this gender composition reflects the historical male dominance of formal mine employment on the Zambian Copperbelt, it is acknowledged as a limitation of the sample's representativeness with respect to women's specific experiences of post-closure impact, a point revisited in the discussion. The majority of respondents were married (65.1 per cent; n = 41), with 34.9 per cent single (n = 22). The modal age group was 31 to 35 years (30.2 per cent; n = 19), followed by 36 to 40 years (23.8 per cent; n = 15), indicating that most respondents were of peak working age and had direct experience of mine employment or its immediate economic spillovers. The full age distribution is presented in Table 1.

Table 1: Age distribution of respondents (n = 63)

Age Group (Years)	n	%	Remarks
20-25	6	9.5	Youngest cohort; limited mine employment tenure
26-30	10	15.9	Early career; transitional life-stage
31-35	19	30.2	Modal group; direct mine employment experience
36-40	15	23.8	Mid-career; highest domestic responsibilities
41-45	5	7.9	Approaching mid-life transition threshold
46-50	5	7.9	Pre-retirement; limited retraining uptake
50+	3	4.8	Oldest cohort; pension eligibility relevant
Total	**63**	**100.0**	

The educational profile of the sample was high: 84.1 per cent held tertiary-level qualifications (n = 53), with the remaining 15.9 per cent having completed secondary education. All respondents had received at least primary schooling. This credential profile suggests the former mine labour force would face particular structural difficulty in transitioning to informal or subsistence-level alternatives that do not reward formal qualifications. By duration of residency, 34.9 per cent had lived in the district for eleven or more years (n = 22), positioning them well to assess long-term socio-economic change, whilst 31.7 per cent had resided for one to five years (n = 20) and 20.6 per cent for less than one year (n = 13).

5.2 Employment and livelihood impacts

Post-closure employment outcomes were markedly adverse. Formal sector employment was reported by 30.6 per cent of respondents, with informal sector activity accounting for 8.1 per cent and self-employment for 3.2 per cent; a further 3.2 per cent reported complete unemployment. These figures require careful interpretation. The 30.6 per cent formal employment rate likely includes respondents employed in sectors wholly unrelated to mining and therefore not directly attributable to the closure. The 8.1 per cent informal rate and 3.2 per cent self-employment rate almost certainly mask survivalist activity, including petty trading, casual labour, and subsistence gardening, rather than stable income generation.

Respondents identified three principal barriers to livelihood recovery with near-equal frequency. Lack of capital was cited by 19 respondents; absence of skills training by 17; and the limited availability of employment opportunities outside mining by a further 17. This barrier configuration is internally reinforcing in ways consistent with the poverty trap dynamics described in the development economics literature (Haney and Shkaratan, 2003) [23]: without capital, business formation is impossible; without transferable skills, competitiveness in a constrained formal labour market is minimal; and a poorly diversified local economy limits demand for whatever skills are held. Key informant interviews corroborated this pattern, with one community leader describing a 'closed loop of dependency' in which former miners' technical skills had no market value in the post-closure economy, whilst they lacked the agricultural knowledge and financial reserves required to transition to alternative livelihoods.

5.3 Institutional responses: Government, corporate, and civil society

Institutional support following mine closure was evaluated across three actor categories. Among the 26 respondents who provided direct responses to questions on governmental assistance, 84.6 per cent reported receiving no form of support. Social welfare transfers were reported by 15.4 per cent of this sub-sample; only 3.8 per cent had accessed job training programmes; and an equally small proportion had received any direct financial assistance. The full distribution is presented in Table 2.

Table 2: Institutional support received following mine closure (respondents who provided direct responses, n = 26)

Support Type	% (n = 26)	Interpretive Note
No assistance received	84.6	Near-universal institutional disengagement
Social welfare transfers	15.4	Limited and inconsistent provision
Job training programmes	3.8	Negligible reach; inadequate duration
Direct financial aid	3.8	Episodic; no structural programme
NGO / civil society support	3.3	Effectively absent at community scale

Civil society and non-governmental organisation support was even more limited in reach. Only 3.3 per cent of respondents reported having accessed NGO assistance, whilst 39.3 per cent stated explicitly that no such support had been available to them. The remainder expressed uncertainty, suggesting that awareness of available support mechanisms was itself absent. These figures compare unfavourably with evidence from comparable closure contexts. Marais and colleagues (2018) [38] document that approximately 45 per cent of households affected by mine closure in South Africa's Free State Goldfields accessed at least one form of government support within two years of closure. That rate remains inadequate by international standards, yet it is more than three times the rate recorded in Kalulushi District.

Corporate closure obligations were assessed through documentary analysis and key informant evidence. Chibuluma Mines Plc had not published or implemented a comprehensive community-facing closure plan at the time of the study. The most substantial documented corporate intervention was a remediation payment of K8 million for environmental damage to 42 households displaced by tailings dam construction, a sum incommensurate with the breadth of community disruption and representing an ad hoc payment rather than a programmatic closure commitment. Semi-structured interviews with municipal officials characterised the corporate closure response as 'minimal and reactive', with engagement occurring only following community advocacy rather than from proactive planning.

5.4 Environmental perceptions and contamination concerns

Community perceptions of environmental change revealed widespread uncertainty rather than confident assessment. When asked whether they had observed changes in soil quality and crop productivity attributable to mining-related contamination, 20.3 per cent of respondents affirmed that they had (n = 12), 22.0 per cent reported no observed change (n = 13), and 57.7 per cent indicated that they were unable to make a determination (n = 38). Approximately 30.4 per cent of respondents believed that mining activities had caused adverse environmental changes in Kalulushi District, whilst 14.3 per cent disagreed. Health concerns associated with proximity to former mine infrastructure were reported by approximately 24 per cent of respondents.

Critically, the dominant finding here is not the 30.4 per cent who identified contamination but the 57.7 per cent who could not assess the question at all. This proportion does not reflect environmental resilience; it reflects the complete absence of systematic environmental monitoring, independent testing, or community environmental communication programmes. No soil, water, or air quality baseline survey has been conducted at the Chibuluma Mine closure site, leaving residents without the scientific information needed to assess their own risk exposure. The significance of this monitoring absence is discussed further in Section 6.3.

5.5 Economic diversification preferences

Despite documented institutional failure, adaptive intent among respondents was markedly high. An overwhelming 96 per cent indicated willingness to undergo vocational retraining and skills development, with only 4 per cent expressing disinterest. Agriculture was the most frequently cited preferred livelihood alternative at 68 per cent, followed by small and medium enterprise development at 54 per cent. These preferences are coherent given the district context: Kalulushi has available agricultural land; subsistence and smallholder farming are culturally familiar; and SME activity in service provision represents a realistic pathway for an educated but technically displaced workforce. Table 3 presents the diversification preferences alongside key enabling conditions the evidence base identifies as necessary for each sector.

Table 3: Economic diversification preferences and enabling conditions identified by respondents (n = 63)

Preferred Livelihood Sector	% Respondents	Key Enabling Conditions Required
Agriculture / smallholder farming	68	Extension services, seed capital, market linkages, soil quality assurance
Small and medium enterprises (SMEs)	54	Microfinance, business training, regulatory simplification
Vocational skills retraining (any sector)	96	TEVETA capacity, employer linkages, stipend support

Read alongside the evidence of institutional failure, these figures demonstrate that the barriers to livelihood recovery in Kalulushi District are structural rather than motivational. The community has a solid human capital baseline encompassing educational attainment, industry experience, and strong adaptive intent, as well as a clear willingness to engage with post-closure transition. What is absent is the institutional infrastructure of capital provision, skills training, agricultural extension, and market linkages needed to convert that intent into sustainable alternative livelihoods.

6. Discussion

6.1 Institutional abandonment as the dominant dynamic

The Kalulushi District findings describe a pattern that can reasonably be characterised as institutional abandonment: the near-complete disengagement of state, corporate, and civil society actors from their formal and informal obligations to affected communities following mine closure. The statistic that 84.6 per cent of respondents received no governmental support is not simply a quantitative data point. It measures directly the gap between legislative intent and operational delivery. Zambia's Mines and Minerals Development Act No. 11 of 2015 mandates mine closure planning, and successive national development strategies have articulated commitments to employment protection and social welfare. In the case of Chibuluma Mine, those commitments were not met.

This pattern aligns with Laurence's (2011) [32] characterisation of closure management as regulatory theatre, and it extends that critique into both the civil society and governmental domains. Owen and Kemp (2016) [43] have shown that social licence commitments made by mining companies during operational phases are rarely operationalised into post-closure support, and the Chibuluma evidence confirms this in a Zambian context. What distinguishes the Zambian situation from South African or Australian closure contexts is the near-complete absence even of the limited governmental transfer payment systems that partially buffer post-closure distress in those settings. A 45 per cent government support access rate in South Africa's Free State Goldfields (Marais *et al*., 2018) [38] is itself inadequate by just transition standards, but it is more than three times the rate recorded in this study.

Viewed through the SLF, the mechanisms of abandonment become precise. Mine-specific skills lose market value and human capital erodes. Infrastructure is decommissioned and physical capital is withdrawn from community use without conversion planning. Employment termination without transition income drains financial capital. Ongoing environmental contamination without monitoring or remediation degrades natural capital. Workplace networks and collective bargaining institutions dissolve with the mine workforce, weakening social capital. Because no institutional counter-measures were implemented, all five of these depletions are cumulative and mutually reinforcing rather than partially absorbed.

6.2 The self-reinforcing poverty trap

The three-barrier configuration of capital, skills, and employment found in this study describes a poverty trap in the technical sense: a condition in which the resources required to escape poverty are themselves casualties of poverty (Haney and Shkaratan, 2003; World Bank, 2002) [23, 51]. Former miners cannot establish businesses without capital; cannot compete for formal employment without transferable skills; and face a local economy too narrowly composed to generate demand for qualifications they hold. Mining generates highly sector-specific human capital that commands wage premiums within the sector but carries minimal value outside it. This specificity makes the trap particularly severe for individuals who invested their working careers in mine-specific trades.

Regional comparisons confirm that this configuration is a structural feature of sub-Saharan African mine closure rather than a Zambia-specific anomaly. Besa and colleagues (2019) [4] document identical barrier patterns in Kalumbila District, and Kalul Ndaguba *et al*. (2023) [29] find the same in multiple Copperbelt closure sites. Al *et al*. (2016) [2] identify analogous dynamics in Jordanian mining contexts. What distinguishes Chibuluma is the completeness of institutional disengagement: in comparable African cases, some degree of governmental or corporate transition support was documented, however inadequate in scale. Kalulushi District occupies an extreme position on the spectrum of post-closure institutional failure.

The educational profile of respondents adds a further layer to this analysis. With 84.1 per cent holding tertiary qualifications, this is not a low-skilled workforce that one might expect to face inherent constraints in adapting. These are people who have demonstrated the capacity for skilled industrial labour and who, by their own account, are willing to retrain. The constraints are structural rather than motivational, and this finding challenges narratives that attribute post-closure poverty to workforce human capital deficits. Attention belongs instead on the absence of capital, training infrastructure, and market development.

6.3 Environmental uncertainty as a governance failure indicator

Perhaps the most policy-significant finding of this study is that 57.7 per cent of respondents were unable to assess changes in local soil quality and crop productivity. This does not represent a community that has evaluated its environmental situation and found no cause for concern. It represents a community from which the informational basis for any environmental self-assessment has been withheld. No systematic soil, water, or atmospheric quality monitoring has been conducted at the Chibuluma Mine closure site. No independent environmental assessment has been commissioned by ZEMA or by Chibuluma Mines Plc. As a result, residents cannot know whether the land on which they farm, the water they consume, and the dust they breathe meets safety standards, not because contamination is absent, but because it has not been measured.

This governance vacuum is particularly concerning given the weight of regional scientific evidence. Kribek and colleagues (2023) [31], through systematic geochemical analysis of soils, drainage networks, and vegetation across Zambian Copperbelt mining districts, document heavy metal concentrations, among them lead, copper, cobalt, and cadmium, substantially exceeding WHO soil quality guidelines at sites with geological and operational histories comparable to Chibuluma. Lupanga (2020) [34] documents analogous contamination across Copperbelt soils more broadly, and Dusengemungu and colleagues (2022) [17] identify soil lead and copper concentrations above international health thresholds at mine waste sites in Kitwe and Mufulira, less than 50 kilometres from Kalulushi. The pathways connecting these concentrations to human health outcomes through dermal exposure, mine dust inhalation, food crop uptake, and groundwater contamination are well established in the toxicological literature (Tchounwou *et al*., 2015) [49].

Applied to the Chibuluma site, where tailings storage facilities and waste rock dumps remain in place without mandated monitoring, the 57.7 per cent uncertainty finding becomes a governance failure indicator rather than a measure of environmental safety. The 2025 Kafue River spill event (Kille and Zimba, 2025) [30] reinforces this reading: an acid mine drainage event at an operating mine poisoned a major river system and disrupted potable water supply to three urban centres overnight, demonstrating that environmental risk from Zambian mining is active and uncontained. These findings collectively demand urgent remedial action rather than reassurance.

6.4 Community resilience as unrealised institutional capital

The 96 per cent retraining willingness rate, read alongside the strong preferences for agriculture and SME development, provides a striking counterpoint to the evidence of institutional failure and community distress. In post-mining communities where institutional responses have been more adequate, including targeted retraining programmes, accessible microfinance, and agricultural

extension services, adaptive intent of this magnitude has translated into meaningful livelihood recovery. Research in Australian coal communities (Haslam McKenzie *et al*., 2023) [24] and Chilean copper-producing regions (Castro *et al*., 2011) [7] documents the positive role of well-resourced transition programmes in converting community willingness into durable economic diversification.

The Kalulushi case shows that adaptive capital exists: the community is motivated, formally educated, and oriented toward realistic alternative sectors. What is absent is the institutional architecture of capital access, skills training, market linkages, and regulatory facilitation necessary to mobilise that capacity. This diagnosis points directly towards the policy interventions discussed in Section 7. It also provides a corrective to narratives of post-closure passivity or dependency: this is not a community that has disengaged from its own future, but one that has been denied the resources to act on its own capacity.

A limitation of the results also requires acknowledgement here. The underrepresentation of women at 25.4 per cent of respondents means that this study cannot claim to have captured the specifically gendered experience of post-closure disruption. International evidence indicates that women in mining-dependent communities experience distinct and often more severe post-closure impacts, including loss of informal service economy livelihoods, increased domestic care burdens as male partners face mental health deterioration, and diminished access to the networks through which employment information circulates (Nixon *et al*., 2016; Franks, 2010) [42, 19]. Future research at this site should specifically oversample women to address this gap.

7. Policy Implications

The findings of this study carry direct implications for mine closure governance in Zambia and in comparable mining-dependent economies across sub-Saharan Africa. Five priority areas are identified.

First, Community Benefit Agreements (CBAs) should be established as a legal prerequisite for mining licence grant in Zambia, with post-closure transition funding obligations embedded as binding contractual commitments enforceable by the Ministry of Mines and Minerals Development. Companies required to contribute to community transition funds from the outset of extractive operations, rather than negotiating support ad hoc at the point of closure when corporate financial capacity is typically diminished, would generate the capitalised reserves necessary for meaningful post-closure intervention. Pilot CBA frameworks in Canada and Australia (Owen and Kemp, 2016) [43] provide adaptable precedents for the Zambian institutional context.

Second, the environmental governance vacuum surrounding Chibuluma and comparable former mine sites requires urgent remediation. The Zambia Environmental Management Authority should commission independent baseline surveys of soil, water, and air quality at all former mine sites and active tailings storage facilities in the Copperbelt, with findings communicated to affected communities in accessible formats and local languages. Mandated annual environmental compliance audits with publicly available results would provide the informational foundation currently absent from community environmental self-assessment. Chibuluma's existing tailings infrastructure, which has not undergone independent environmental assessment, is the most immediate priority.

Third, a coordinated multi-stakeholder transition structure should be established in Kalulushi District, bringing together the Municipal Council, District Commissioner's office, relevant government line ministries, civil society organisations, and private sector actors. A dedicated transition coordinator position, resourced through a combination of government and mining company contributions, should be mandated to develop and implement a Kalulushi-specific post-mining economic plan with annual reporting against measurable targets. Generic national diversification strategies are insufficient without district-level planning supported by ring-fenced resources and accountable delivery institutions.

Fourth, the Technical Education, Vocational and Entrepreneurship Training Authority (TEVETA) and the Citizens Economic Empowerment Commission (CEEC) should deploy programmes specifically tailored to the post-mining transition needs of Kalulushi District. Vocational training matched to the documented community preference for agriculture and SME development, combined with accessible microloan facilities offering embedded business mentoring, would directly address the capital-skills-employment trap identified in the findings. The 96 per cent retraining willingness rate provides strong policy justification for this investment and confirms a motivated and ready beneficiary population. Agricultural extension officers from the Ministry of Agriculture should be deployed to the district with specific mandates to support former mine workers transitioning into farming.

Fifth, a statutory review of the Mines and Minerals Development Act No. 11 of 2015 is needed, focused on strengthening mine closure enforcement mechanisms, mandating publication and community consultation of comprehensive pre-closure socio-economic impact assessments, and establishing minimum community transition fund contribution rates expressed as a percentage of gross mine revenue. The Chibuluma evidence shows clearly that obligations created by the MMDA 2015, as currently written and enforced, were not discharged. Legislative strengthening alone is insufficient; the Ministry of Mines requires adequately resourced inspectorate capacity to monitor closure plan compliance and impose sanctions for non-compliance.

8. Conclusion

This study provides primary empirical evidence on the socio-economic consequences of mine closure in Kalulushi District, Zambia, through a concurrent mixed-methods investigation engaging 63 community respondents, supplemented by semi-structured interviews with institutional stakeholders and systematic secondary data analysis. The findings describe a coherent and deeply concerning pattern of institutional abandonment: an overwhelming majority of affected community members received no governmental support following closure, corporate closure obligations were minimal and unsystematic, and civil society capacity to fill the resulting vacuum was effectively absent. Environmental risk remains unquantified because post-closure monitoring was never conducted.

Viewed through the Sustainable Livelihoods Framework, the Chibuluma closure produced simultaneous depletion across all five capital assets, human, social, natural,

physical, and financial, without the institutional offsets that Just Transition principles require. The three-barrier structure of capital inaccessibility, skills obsolescence, and employment scarcity creates a self-reinforcing poverty trap that community adaptive intent alone cannot overcome. The environmental dimension remains unmanaged: the majority of community members cannot assess their own risk exposure, and the regional scientific literature provides ample grounds for treating that uncertainty as a call for urgent investigation rather than reassurance.

Set against this landscape of institutional failure, the 96 per cent willingness to retrain and the strong orientation toward agricultural and SME diversification represent a substantial reserve of unrealized adaptive capacity. What the evidence points to clearly is that the barriers to post-closure livelihood recovery in Kalulushi are structural rather than motivational. Community members are ready for transition. The institutional infrastructure of capital, training, market access, and environmental assurance is not in place to support them. Addressing this mismatch through the five policy priorities identified in Section 7, namely statutory CBA requirements, environmental monitoring, coordinated transition governance, targeted retraining and microfinance, and legislative review, is the primary policy imperative that this study advances.

In terms of scholarly contribution, this study provides community-level primary data from a sub-Saharan African context that remains underrepresented in the global mine closure literature. Its findings are directly applicable to Zambia's ongoing policy engagement with its mining-dependent communities and carry transferable lessons for comparable jurisdictions across the continent. Three priorities for future research follow from the evidence: an investigation of the barriers that mine activities present to economic diversification in adjacent sectors; environmental baseline studies with laboratory-validated heavy metal assessments at Chibuluma and comparable Copperbelt closure sites; and longitudinal evaluation of institutional transition programme effectiveness where such programmes are subsequently implemented.

9. Declarations

Author Contributions

Harrison Zulu: Conceptualisation, Methodology, Formal Analysis, Investigation, Data Curation, Writing (Original Draft), Writing (Review and Editing), Visualisation, Project Administration. Dr. Bunda Besa: Conceptualisation, Supervision, Writing (Review and Editing), Funding Acquisition. Dr. Anthony Phiri: Conceptualisation, Supervision, Writing (Review and Editing).

Acknowledgements

The authors wish to thank Dr Jewette H. Masinja (ESDA-UNZA Coordinator) for guidance throughout the research. Funding was provided by the African Development Bank through the University of Zambia. The authors are grateful to community members, government officers, and civil society representatives in Kalulushi District who contributed their time and experiences to the study.

Conflict of Interest

The authors declare no competing interests.

Funding

This research was supported by the African Development Bank, administered through the University of Zambia Environmental and Sustainable Development in Africa (ESDA) programme.

Data Availability Statement

The questionnaire instrument and anonymised aggregate data supporting this study are available from the corresponding author upon reasonable request, subject to the ethical conditions under which data were collected.

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