

Mayimele, Nsovo

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Socioeconomic Challenges for Occupational Health and Community Development in Mining Regions: A Policy Framework for Integrating Food Interventions

Nsovo Mayimele (corresponding author, MayimeleNN@tut.ac.za),  PhD, Tshwane University of Technology, Department of Pharmaceutical Sciences, Faculty of Science, Tshwane University of Technology, South Africa

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Abstract: *The integration of nutritional interventions, including food-based strategies and evidence-based supplementation, into occupational health and community development represents an unexplored policy imperative for addressing the socioeconomic challenges experienced by South African mining regions. These socioeconomic challenges include poverty, high unemployment, household food insecurity, inadequate housing with limited cooking facilities, local food economies dominated by unhealthy options and the intergenerational transmission of ill-health and deprivation that undermine both worker productivity and community resilience. By examining policy and proposing coherent integration mechanisms, this review deepens the theoretical basis of understanding of these socioeconomic challenges through the strategic alignment of nutritional support with occupational health mandates and community development investment, thereby addressing root causes rather than symptoms of malnutrition. An integrative analysis of approximately 110 sources, including policy documents and international case studies was done. This paper employs public health nutrition and integrated policy analysis to identify shortcomings in mining communities and propose actionable policy integration mechanisms. The findings reveal a disconnection between policies such as the Integrated Nutrition Programme (INP), occupational health legislation, and Social and Labour Plans. This disconnection has resulted in missed opportunities for multi-sectoral solutions for mining regions. The review advances a conceptual framework for policy integration that advocates for specific levers within occupational health, community development and national governance (e.g., joint inter-departmental directives). It further highlights the potential role of responsibly regulated micronutrient supplementation to address deficiencies exacerbated by mining work. The barriers identified include institutional silos, limited accountability mechanisms within the mining industry and weak enforcement of existing provisions. These barriers are analysed alongside enablers such as corporate social responsibility structures and growing stakeholder awareness. The paper concludes with recommendations for short-term pilot programs and stakeholder forums; medium-term policy alignment and capacity building; and long-term structural reforms to ensure equitable food systems and universal health coverage. This synthesis provides an essential evidence base for policymakers, industry leaders, labour unions and communities to collaboratively transform the South African mining sector from a site of nutritional risk into a catalyst for nutritional equity and sustainable development.*

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INTRODUCTION

The South African mining sector stands as a cornerstone of the nation's socioeconomic architecture, contributing approximately 8% to the national GDP and employing over 450,000 individuals directly, with valuable multiplier effects throughout associated supply chains and regional economies ([McMahon & Moreira, 2014](#); [Sorensen, 2011](#); [Ibrahim & Vo, 2020](#)).

It is historically based on the mineral-led growth model of the 19th and 20th centuries. This sector has been pivotal in shaping national development, yet it remains a site of socioeconomic challenges, simultaneously generating wealth that introduces health and social inequities ([London, 2007](#); [Morrice & Colagiuri, 2013](#); [Von der Goltz & Barnwal, 2019](#)). The issue of nutrition emerges as a neglected nexus linking occupational safety, worker productivity and community development. This review argues that the nutritional policies, occupational health legislation and community development frameworks within the South African mining sector may represent a policy failure, one that perpetuates cycles of ill-health, undermines economic potential and violates the socioeconomic rights of mining communities ([Hargreaves et al., 2022](#); [Boatemma et al., 2018](#); [Kistnasamy et al., 2018](#)).

The global and national imperative to address malnutrition is unequivocal. Adequate nutrition is a fundamental human right and a prerequisite for optimal physical and mental development, immune competence and functional capacity in the entire life course ([Puri et al., 2023](#); [WHO, 2022](#)). Conversely, malnutrition in all its forms constitutes a leading risk factor for the global burden of disease, eroding human capital, stifling economic growth and exacerbating social inequalities ([Boatemma et al., 2018](#); [Ansah et al., 2025](#)). South Africa contends with the "triple burden" of malnutrition, a legacy of its colonial and apartheid past, contemporary food systems and socioeconomic disparities ([Olanrewaju et al., 2022](#)). This manifests as persistent child stunting and micronutrient deficiencies alongside one of the highest rates of adult obesity and associated non-communicable diseases (NCDs) such as hypertension and diabetes ([Nyirenda et al., 2025](#)). This nutritional crisis is not evenly distributed; it

disproportionately burdens vulnerable populations, including those dependent on the mining sector for livelihoods ([Bhorat et al., 2024](#); [Betty Matshingane, 2017](#)). Within the context of mining, the implications of this triple burden are valuable. The mining workforce is exposed to socioeconomic challenges such as hazardous environmental, physical and psychosocial stressors. The labour is characterised by physical exertion, exposure to dust, heavy metals, noise, vibration and often, extended periods of shift work and migrant labour arrangements ([Rikhotso et al., 2022](#); [Wolska et al., 2022](#)). In such a demanding environment, optimal nutritional status is a matter of general health and a determinant of occupational safety, resilience to occupational diseases like silicosis and tuberculosis, cognitive alertness and overall productivity ([Asare et al., 2022](#); [Milošević et al., 2025](#)). A malnourished worker is more susceptible to fatigue, injury and infection, posing a direct risk to themselves and their colleagues ([Alsaidan, 2025](#)). Furthermore, poor nutrition exacerbates the risk and severity of NCDs, which are increasingly prevalent in the mining workforce, creating a dual burden of communicable and non-communicable diseases that overwhelms occupational health services ([Marimuthu et al., 2023](#); [Basu et al., 2025](#)).

The challenges, however, extend beyond the mine gate. Mining in South Africa has historically been underpinned by a migrant labour system, which fractures family structures and creates distinct community dynamics ([Goetz, 2022](#); [Kourouma et al., 2023](#)). Miners, often living in single-sex hostels or informal settlements near shafts, experience barriers to accessing nutritious food. These include limited time due to long shifts, a predominance of unhealthy ready-made and takeaway food options in mining towns, inadequate food storage and preparation facilities in lodgings and the financial pressure to remit earnings to distant families, often at the expense of their own dietary quality ([Muthelo et al., 2022](#); [Govender et al., 2017](#); [de Sousa & Paim, 2023](#)). Consequently, dietary patterns are frequently characterised by excessive energy, salt and sugar intake coupled with insufficient dietary diversity and inadequate intake of essential vitamins and minerals ([Todorova et al., 2024](#); [Souza et al., 2025](#)). Simultaneously, the communities from which miners

migrate or which spring up around mines bear a heavy burden. These communities often experience a distorted local economy overly dependent on a single industry, environmental degradation and strained public services ([McGranahan et al., 2022](#); [Devrath et al., 2025](#)).

High levels of food insecurity are reported, with families left behind by migrant workers or those in mining towns facing inflated food prices and limited access to diverse, fresh produce ([Haile et al., 2024](#)). The health of the miner and the health of the community are linked i.e. illness or injury affecting a breadwinner leads the household into more poverty and food insecurity, while poor community health and nutrition affect the pool of potential labour and the social stability required for mining operations ([Dzinamarira et al., 2024](#)). This creates a cycle where mining, while providing income, can simultaneously undermine the foundational health and nutritional status necessary for sustainable development. Despite the evidence of these interlinked challenges, the policy response in South Africa has been marked by limited of strategic coherence. At the national level, several relevant policies exist. The Integrated Nutrition Programme (INP), housed within the DoH, provides a framework for addressing malnutrition through the health system ([Manji et al., 2023](#)).

The National Policy on Food and Nutrition Security outlines a multi-sectoral approach to food insecurity ([Boatemma et al., 2018](#); [Kushitor et al., 2022](#)). Furthermore, the Mineral and Petroleum Resources Development Act (MPRDA) mandates mining companies to develop Social and Labour Plans (SLPs) that include elements of community development and comprehensive occupational health and safety legislation is enforced ([Kistnasamy et al., 2018](#); [Amponsah & Agyemang, 2024](#)).

The failure lies in the almost complete absence of intentional linkages between these policy streams. Nutrition is siloed within the health sector's INP, with minimal operational connection to the DMR's oversight of occupational health or SLPs ([Hargreaves et al., 2022](#); [Chilenga et al., 2025](#)).

Occupational health legislation, such as the Mine Health and Safety Act, focuses predominantly on traditional physical hazards (dust, noise, accidents) with scant recognition of diet as a modifiable risk factor influencing susceptibility to these very hazards

([Milani-Bonab et al., 2023](#)). Similarly, while SLPs require investment in community development, these initiatives rarely prioritise or integrate evidence-based nutritional interventions that could address the root causes of poor health and poverty ([Ngqangashe et al., 2022](#); [Spiller et al., 2025](#)).

This policy disjuncture means that the resources allocated to occupational health and community development by both the government and mining companies are missing an opportunity to control nutrition for multiplicative health and development gains ([Breuer et al., 2023](#); [Brunet-Jailly, 2022](#)).

This limitation is administrative and it reflects a neglect of the social determinants of health (SDH) within sectoral policy. The WHO defines SDH as the conditions in which people are born, grow, live, work and age, shaped by the distribution of power and resources ([WHO, 2022](#)).

The mining sector is a contributor to these conditions all of which are fundamental determinants of nutritional status ([Shiquan et al., 2022](#)). A policy framework that fails to connect the sector's influence on SDH to nutritional outcomes is limited and ineffective. The overarching objective of the paper is to conduct a comprehensive, systematic analysis of the policy frameworks necessary for the effective integration of nutritional interventions into occupational health and community development strategies within the South African mining sector. To achieve this, the study is guided by a series of research questions. First, it seeks to examine the current national and sectoral policies pertaining to nutrition, occupational health and community development in South Africa, identifying shortcomings and opportunities for integration specific to the mining context. Second, it aims to determine which theoretical and conceptual frameworks are most salient for understanding and enabling policy integration. Third, the review investigates what practical mechanisms and models for integration can be identified from international best practices and from case studies within the South African mining sub-sectors (platinum, gold and coal). Fourth, it analyses the principal barriers and enablers to implementing integrated policies. Finally, based on the preceding analysis, the review synthesises policy recommendations for all relevant stakeholders, including government departments, mining

corporations, labour unions and civil society, to advance this integration agenda. The scientific novelty of this work is threefold. First, it synthesises a body of literature in public health, nutrition science, occupational medicine, development studies and mining policy into a cohesive analysis of the mining-nutrition nexus. Second, it applies integrated policy analysis lenses to the problem of nutrition in a high-impact industrial sector ([Ackers & Grobbelaar, 2022](#); [Gajdzik et al., 2024](#)). Third, it moves beyond problem identification to generate a context-specific framework for policy action, incorporating governance, financing and monitoring considerations.

The practical significance of this review is substantial, as it aims to serve as an evidence-based roadmap and advocacy tool for multiple stakeholders. For policymakers in the Department of Mineral Resources (DMR), the Department of Health (DoH) and the Department of Social Development, it provides a clear analysis of policy incoherence and offers a blueprint for effective inter-departmental collaboration.

For mining companies and industry bodies, it outlines a compelling business case for integrated nutrition interventions while providing actionable models for implementation within Corporate Social Responsibility (CSR) frameworks and Social and Labour Plans (SLPs) ([Marimuthu et al., 2023](#); [Serfontein-Jordaan & Dlungwane, 2022](#)).

For labour unions and worker representatives, it arms them with evidence to advocate for nutritional wellbeing as a component of occupational health and fair working conditions. For community organisations and non-governmental organisations (NGOs), it provides a structured framework to hold both the government and the mining industry accountable for the nutritional health of affected populations and to meaningfully participate in the design of contextually appropriate interventions. Ultimately, this work seeks to contribute to breaking the entrenched cycle of malnutrition in South Africa's mining regions, thereby supporting the health of workers, the resilience of communities, the long-term sustainability of the industry and the progressive realisation of the constitutional right to health and a healthy environment for all citizens.

ANALYTICS, THEORETICAL AND CONCEPTUAL FRAMEWORK

This section establishes the foundational analysis, theoretical underpinnings and conceptual architecture necessary to interrogate the integration of nutritional interventions into occupational health and community development policies within the South African mining sector. As a review paper, this analysis synthesises a broad corpus of approximately 110 primary research sources, including peer-reviewed articles, policy documents, case studies and grey literature, sourced from databases such as Scopus, Web of Science and PubMed, with a temporal focus from 2000 to 2025 to capture both foundational policy developments and contemporary challenges ([Whittemore & Knafl, 2005](#)). The methodological approach is an integrative review, chosen for its capacity to incorporate diverse study designs to generate a comprehensive, holistic understanding of the phenomenon and inform practice and policy development.

The analytical process followed a structured, multi-stage protocol, as illustrated in Figure 1.

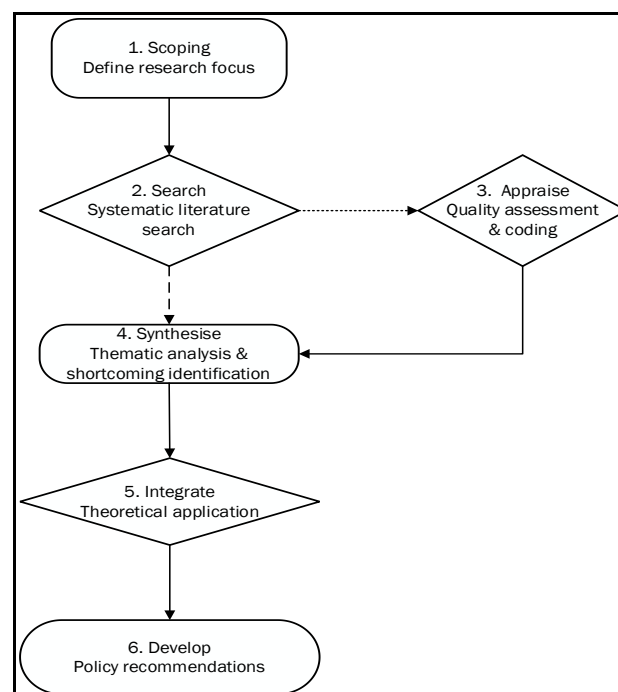


Figure 1. Schematic of the Integrative Review and Analytical Process

Source: developed by the author based on [Whittemore & Knafl \(2005\)](#).

This began with a systematic scoping of the literature to map the field, followed by a critical appraisal of sources, thematic synthesis to identify constructs and relationships and finally, the application of theoretical lenses to interpret findings and construct a coherent conceptual framework.

A thematic synthesis of the reviewed literature reveals several dominant, interlocking themes that characterise the current state of knowledge and practice. These are summarised in Table 1, which delineates the main findings, supporting evidence and the shortcomings that this review seeks to address.

Table 1. Regional benchmarking (selected economies as region proxies)

Analytical Theme	Findings from Literature	Representative References	Identified Knowledge/Policy shortcoming
1. Nutritional Epidemiology of Mining Populations	High prevalence of food insecurity (affecting ~20% of mining households); dietary patterns marked by high energy, salt, sugar and low micronutrient density; elevated rates of obesity, hypertension and Type 2 diabetes compared to national averages.	Govender et al. (2017) ; de Sousa & Paim (2023) ; Todorova et al. (2024) ; Nyirenda et al. (2025) ; Basu et al. (2025)	Limited longitudinal cohort studies; minimal data on micronutrient status (e.g., iron, vitamin A); limited gender-disaggregated analysis of dietary intake and food security.
2. Occupational Health Nexus	Poor nutrition is a co-factor in fatigue, increased injury risk, reduced resilience to respiratory diseases (TB, silicosis) and impaired cognitive function essential for safety. Nutritional status modulates the toxicokinetics of occupational exposures (e.g., heavy metals).	Asare et al. (2022) ; Milošević et al. (2025) ; Alsaidan (2025)	Occupational health risk assessments do not routinely include nutritional status as a variable. No formal guidelines exist for nutritional support as part of TB or silicosis management in mines.
3. Community Development Dynamics	Mining towns experience distorted local food economies, environmental degradation affecting local agriculture and strained public services. Migrant labour system disrupts household food production and care structures.	Goetz (2022) ; Devrath et al. (2025) ; Kourouma et al. (2023) ; McGranahan et al. (2022)	Community Development components of Social and Labour Plans (SLPs) rarely feature targeted, evidence-based nutrition programs. Impact assessments fail to measure nutritional outcomes.
4. Policy Analysis	Existence of strong standalone policies (INP, Food Security Policy, MHSA) but valuable siloing of operational coordination between DMR, DoH and DSD. Mining codes focus on acute safety, not chronic health determinants like diet.	Kistnasamy et al. (2018) ; Hargreaves et al. (2022) ; Chilenga et al. (2025) ; Amponsah & Agyemang (2024)	Absence of a "Mining and Nutrition" policy directive. Weak accountability mechanisms for enforcing the health-related aspects of SLPs.
5. Economic & Business Case	Malnutrition leads to productivity losses, increased absenteeism/presenteeism and higher company healthcare costs. Preliminary ROI models from other sectors suggest nutrition interventions can be cost-effective.	Marimuthu et al. (2023) ; Humphries & Thomas (2023) ; Both et al. (2025)	Scarcity of cost-benefit analyses nutrition interventions in the SA mining context. Business case not effectively communicated to industry leadership.
6. Equity and Human Rights	Women, youth and families of migrant laborers bear a disproportionate burden of food insecurity and poor health outcomes. Access to nutritious food is a socioeconomic right often compromised by mining activities.	Betty Matshingane (2017) ; Nisbett et al. (2021) ; Dzinamarira et al. (2024)	Limited of human rights impact assessments focused on nutrition. Limited participatory governance models that include vulnerable groups in food system planning.

Source: developed by the author based on the literature review.

Theoretical Lenses for Integration

To move beyond descriptive analysis and towards a framework for integration, this review employs two complementary theoretical lenses.

Public Health Nutrition and the Social Determinants of Health (SDH) Framework

The Public Health Nutrition perspective shifts the focus from individual dietary behavior to the food environment and systemic factors shaping food choice and nutritional status. This aligns with the WHO's SDH framework, which posits that health outcomes are primarily determined by upstream factors such as income, education, physical

environment, social support and health services ([World Health Organization, 2022](#)). The mining sector is a proximal determinant of these very conditions in host communities ([Shiquan et al., 2022](#)).

Table 2 shows social determinants of health in mining communities.

Therefore, addressing nutrition in mining communities is about providing nutrition education or food parcels as it requires interventions that target these sector-shaped determinants. This lens justifies policy actions such as mandating living wages, investing in local agro-ecology as part of SLPs, regulating the food retail environment in mining towns and ensuring decent housing with cooking facilities.

Table 2. Social determinants of health in mining communities

Determinant	Description
Income and Social Stratification	Wage levels, employment security and wealth distribution via royalties and CSR
Physical Environment	Air and water quality, housing conditions and access to green space for agriculture.
Social and Community Context	Disruption of social networks through migration and community cohesion.
Food Systems	Shapes local food availability, affordability and desirability through its economic dominance and logistical footprint (Cole & Broadhurst, 2022).

Source: developed by the author.

Integrated Policy Analysis (IPA) Framework

The incoherence evident in Table 1 necessitates a lens that is designed to analyse and promote policy coherence. Integrated Policy Analysis (IPA) provides this toolset.

IPA examines the interactions, synergies and conflicts between policies in different sectors (e.g., mining, health, agriculture, labour) and levels of governance ([Lobczowska et al., 2022](#); [Ackers & Grobbelaar, 2022](#)).

It moves beyond siloed thinking to ask: How do mining policies create externalities for nutritional health? How can health policy instruments be used in influencing mining practices?

The main concepts from Integrated Policy Analysis (IPA) applied in this review include several dimensions. First, Policy Integration is examined as the deliberate process of creating coherence between different sectoral policies to achieve shared objectives, such as improved health and sustainable

development. This integration can occur horizontally, in national departments, or vertically, from national policy directives down to local implementation through instruments like Social and Labour Plans (SLPs) ([Breuer et al., 2023](#)).

Second, Institutional Analysis is employed to scrutinise the formal mandates, available resources and underlying incentives of institutions to understand both the barriers to and opportunities for effective sectoral collaboration ([Gajdzik et al., 2024](#)).

Conceptual Framework for Integration

A conceptual framework for integration is proposed for synthesising the thematic findings (Figure 2).

This framework posits that achieving nutritional well-being in mining communities is the central goal, which requires simultaneous and synergistic action in three traditionally separate policy domains, underpinned by strong governance and accountability.

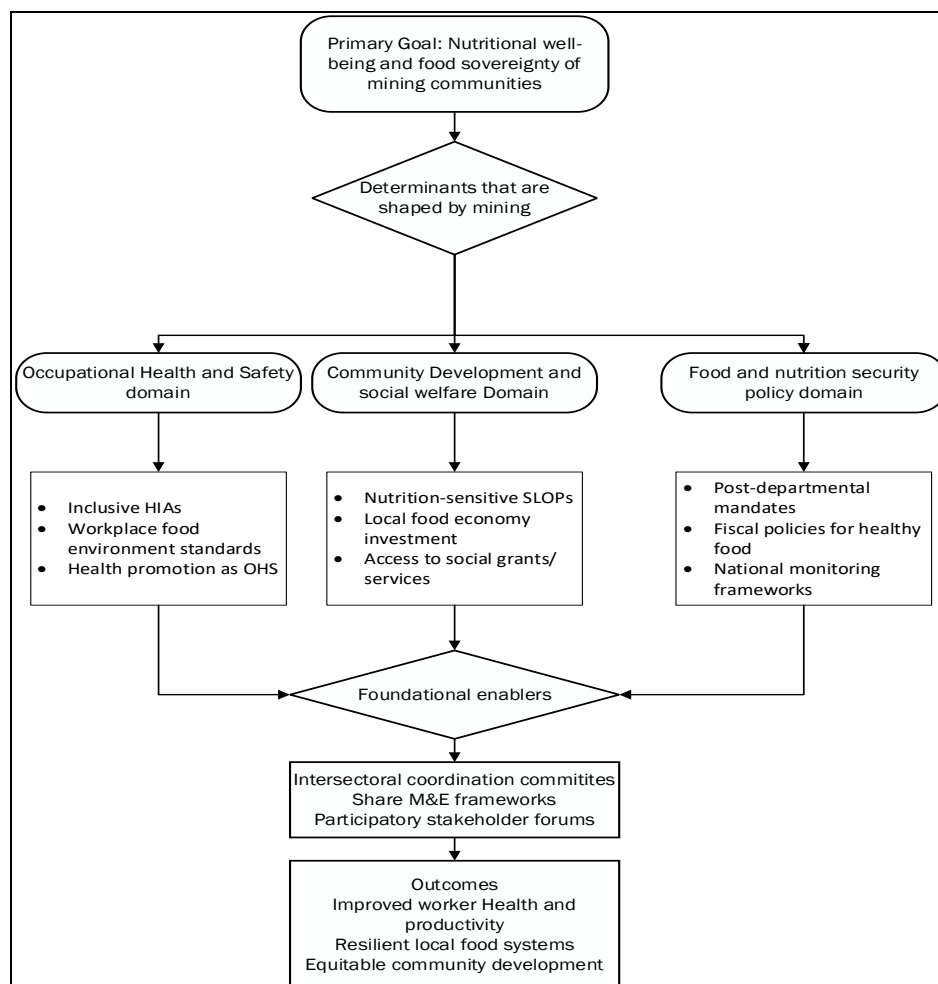


Figure 2. Conceptual framework for integrating nutrition into mining sector policy

Source: developed by the author.

Operationalising the Framework: From Theory to Policy Levers

The conceptual framework presented in Figure 2 must be translated into concrete, policy levers in three interconnected domains to move from theory to practice. Within the Occupational Health and Safety Policy Domain, integration necessitates moving beyond viewing nutrition as merely a personal lifestyle choice to recognising it as a determinant of workplace safety and productivity. Specific levers include the mandatory integration of nutritional status assessments into routine occupational health screenings and comprehensive Health Impact Assessments (HIAs) for new and existing mining operations (Chanchitpricha, 2015; Dietler, 2020; Blåhed & San Sebastián, 2022). Furthermore, the on-site food environment must be regulated. This involves setting and enforcing

nutritional standards for mine canteens and vendor contracts to ensure the consistent availability, affordability and promotion of healthy food options. Workplace nutrition education, counselling and support services must be recognised and funded as a component of legislated occupational wellness programs, rather than remaining a discretionary Corporate Social Responsibility (CSR) initiative.

At the National Food and Nutrition Security Policy Domain, a higher-order, policy directive is required. The Department of Mineral Resources (DMR) and the Department of Health (DoH) should collaboratively develop and issue a joint directive on "Mining and Nutrition," providing a unified policy signal and operational guidelines for all subordinate entities and industry actors. National fiscal and regulatory tools must be strategically employed to shape the food environment in mining regions; this could include tax

incentives for retailers stocking healthy foods, subsidies for fortified staples, or regulations limiting the density of fast-food outlets in mining towns. Finally, national data systems, particularly surveys like the South African National Health and Nutrition Examination Survey (SANHANES), must be strengthened to routinely collect, analyse and disaggregate data specifically for mining populations, thereby generating the evidence base necessary for targeted policy and monitoring (Boatemma et al., 2018).

The central role of governance

As illustrated by the converging arrows in Figure 2, these discrete policy levers are unlikely to succeed in isolation. Their effectiveness is wholly dependent on a foundational enabler i.e. multi-level governance and accountability architecture. This governance framework must actively orchestrate intersectoral action.

First, it requires the establishment of formal intersectoral coordination mechanisms. This could take the form of joint technical working groups or steering committees that bring together officials from the DMR, DoH, Department of Social Development (DSD) and Department of Agriculture, with a mandate to oversee and align policies affecting mining community health (Plagerson & Stuart, 2024). Such structures are vital for resolving jurisdictional conflicts, pooling resources and developing joint implementation plans.

Second, effective governance demands a shared Monitoring and Evaluation (M&E) framework. Stakeholders from different sectors must agree on a common set of outcome indicators, such as those proposed in Table 2, to track progress toward shared nutritional well-being goals. This moves accountability beyond reporting on isolated activities (e.g., "number of gardens established") to measuring collective impact on health and food security outcomes (e.g., "reduction in household food insecurity s") (Gamakulu, 2016). This shared M&E system ensures all actors are accountable to the same objectives.

Third and fundamentally, governance must be participatory and inclusive. Legally empowered multi-stakeholder forums should be created at mine, district and provincial levels. These forums would provide a structured platform for workers,

community representatives, labour unions and civil society organisations to jointly review SLP performance data, occupational health statistics and community needs assessments alongside company and government officials (Mukinda et al., 2010). This transforms accountability from a top-down administrative exercise into a dynamic social process, giving a direct voice to those most affected by mining operations and ensuring that interventions are responsive to local realities and priorities. Without this triad of coordinated structures, shared measurement and participatory oversight, even the most well-designed policy levers risk remaining inert documents, failing to translate into tangible improvements in the nutritional well-being of South Africa's mining communities (see Table 3).

Table 3. Proposed indicators for monitoring integrated policy outcomes

Domain	Outcome Indicator	Data Source / Measurement
Occupational Health	Prevalence of miners meeting minimum dietary diversity score.	Annual bio-metric screening + survey.
	Rate of lost-time injuries potentially linked to fatigue/nutrition.	Enhanced OHS reporting systems.
Community Development	% of SLP expenditure allocated to nutrition-sensitive activities.	SLP audit and public disclosure.
	Household Food Insecurity Access Scale (HFIAS) score in mining communities.	Biannual community survey.
Multiple	Existence & meeting frequency of a tripartite (Gov-Company-Community) health & nutrition committee.	Policy documentation & minutes.
	Stunting rates among children under 5 in mining districts.	District Health Information System.

Source: developed by the author based on Gamakulu (2016).

This analytical and conceptual foundation provides the necessary toolkit to assess current policies, interpret case studies and formulate concrete, theory-

informed recommendations for achieving the much-needed integration of nutrition into the heart of South Africa's mining sector governance.

DISCUSSION

This comprehensive review has systematically examined the policy governing the integration of nutritional interventions into occupational health and community development within the South African mining sector. The analysis reveals a valuable and persistent disconnect between policy intent and practical implementation, characterised by different mandates, institutional silos and a neglect of nutrition as a fundamental determinant of both worker safety and community resilience. Despite a foundation of standalone national policies these frameworks operate in parallel with minimal strategic alignment or operational coordination ([Boatemma et al., 2018](#); [Kistnasamy et al., 2018](#)).

The consequence of this division is a bureaucratic inefficiency as it manifests directly in the sustained high prevalence of food insecurity, the escalating burden of diet-related non-communicable diseases among miners and their families and the compromised productivity and safety that undermine both human welfare and economic output in mining regions ([Nyirenda et al., 2025](#); [Asare et al., 2022](#)).

The conclusion of this review is that integration is both an ethical imperative and a strategic necessity. Achieving nutritional well-being in mining communities requires a paradigm shift from viewing nutrition as a peripheral health issue to recognising it as a determinant that is central to occupational safety, economic productivity and sustainable development. This integration is feasible and can be operationalised by leveraging existing policy instruments and governance structures, but it demands intentional, structured and accountable action. Crucially, this integrated approach must encompass foundational food-based strategies and evidence-based supplementation with nutraceutical interventions where diet alone is insufficient to meet the extraordinary physiological demands and offset the specific toxic exposures of mining work. Targeted micronutrient supplementation and condition-specific nutraceuticals could play a vital role in

ameliorating deficiencies, bolstering immune function against endemic diseases like tuberculosis and mitigating oxidative stress induced by dust and heavy metal exposure ([Melián-Fleitas et al., 2023](#); [Cooklin et al., 2017](#)). The inclusion of such interventions within occupational health protocols, guided by scientific evidence and ethical oversight to prevent coercion or misuse, represents a forward-looking component of a comprehensive nutritional support system for miners.

The proposed conceptual framework and the accompanying analysis identify three foundational enablers for this transformation, which must now also accommodate the responsible integration of supplemental nutrition.

First, intersectoral coordination mechanisms must be formalised, moving beyond ad-hoc meetings to establish mandated joint technical committees between the Department of Mineral Resources, the Department of Health and the Department of Social Development, with clear authority to align policies, budgets and programmes, including guidelines for the ethical provision of supplements ([Plagerson & Stuart, 2024](#)).

Second, innovative and sustainable funding models are required, which may involve blending public health allocations, mining industry levies (such as those from the Mine Health and Safety Council) and dedicated allocations within Social and Labour Plans to create pooled resources for integrated nutrition interventions, including subsidised healthy food baskets and, where justified, quality-assured supplement programmes ([Both et al., 2025](#)).

Third, equity-focused monitoring and evaluation frameworks with shared outcome indicators must be implemented to track progress, ensure accountability within sectors and shift focus from outputs to tangible impacts on nutritional status, biomarker levels and health outcomes ([Gamakulu, 2016](#)).

CONCLUSIONS

This study acknowledges certain limitations in its design as a review. Its findings are contingent upon the availability and quality of the published literature and policy documents, which may not fully capture the implementation challenges, unofficial practices, or the nuanced perspectives of community members.

Furthermore, the dynamic nature of South Africa's political economy, mining sector restructuring and evolving health priorities, means this analysis provides a snapshot that requires continual updating and context-specific adaptation.

The path forward must be both ambitious and pragmatic. For researchers, priority areas include conducting longitudinal studies on the efficacy and cost-benefit of integrated nutrition and supplementation programmes in mining, implementing participatory action research to co-design interventions with communities and investigating the micronutrient needs and toxicant interactions relevant to South African mining contexts. For policymakers and regulators, immediate actions should include issuing a joint DMR-DoH directive on Mining and Nutrition that includes provisions for evidence-based supplementation, strengthening the nutritional components of the SLP guidelines and their enforcement and developing national standards for workplace nutrition and supplement safety. For industry and labour, the agenda involves formally incorporating comprehensive nutritional support into occupational health and safety management systems, negotiating for food security and wellness provisions in collective bargaining agreements and establishing transparent, participatory forums for community health planning. Ultimately, integrating holistic nutritional strategies into the mining sector governance represents more than a technical policy adjustment; it is a step toward social justice, preventive healthcare and sustainable development. It addresses the legacy of an extractive model that has often prioritised mineral wealth over human well-being. By safeguarding the health of workers through comprehensive nutritional support, strengthening the food systems of communities and promoting accountable multi-stakeholder governance, South Africa can begin to transform its mining sector from a source of nutritional risk and inequity into a catalyst for health, resilience and inclusive growth. This aligns with national development goals and with the constitutional commitment to the right to health, food and a safe environment, offering a practical and progressive pathway to honour these promises for some of the nation's most vulnerable and economically vital populations.

Author Contributions

Conceptualization: N. N. M.; Data Curation: N. N. M.; Formal Analysis: N. N. M.; Investigation: N. N. M.; Methodology: N. N. M.; Project Administration: N. N. M.; Resources: N. N. M.; Visualisation: N. N. M.; Writing – Original Draft: N. N. M.; Writing – Review & Editing: N. N. M.

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Conflict of Interest

The author declares no conflict of interest.

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Statement on the Use of AI Tools

The author used Grammarly AI.

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