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The Competing Nature-Based Livelihood-Strategies: Artisanal Small-Scale Mining (ASM) Perspectives in Agricultural-Communities in Umzingwane District, Zimbabwe

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Abstract

Traditionally, southern Matabeleland is a cattle-producing region of Zimbabwe, punctuated by crop farming as key livelihood strategies. With the increasingly rampaging climate change effects on rain-fed agriculture, dwindling grazing pastures and competing ecosystem-based livelihoods, agricultural communities have diversified into artisanal small-scale gold mining (ASM) in the same region. This practice has brought conflicting livelihood strategies together in what scholars describe as the tragedy of ecosystem services. Artisanal mining, rain-fed agriculture, as well as irrigation-based farming are ecosystem-based rural livelihoods for coping with vulnerability of rural communities in drought prone areas. Scantily regulated, ASM often negatively affects other land-use activities, to the detriment of sustainable livelihoods and food security. The article explored the convergence of communal farming and ASM, and analysed the perspectives of ASM among agricultural communities in Umzingwane district of southern Matabeleland. A qualitative approach and case study design was used alongside purposive sampling technique to select the study area and the study participants. Data collection instrument triangulation strengthened the quality of data and validity of findings. The study concludes ASM and small-scale irrigation and communal farming are paradoxical, pulling together and apart. On one hand, proceeds from artisanal-gold-mining pay for labour in rain-fed communal and irrigation farming while surprisingly artisanal gold miners provide a major market for irrigation produce. However, ASM is notorious for competing and degrading farming ecosystems in pursuit of sustainable livelihoods. This manifests through encroaching ASM activities that elbow irrigation and communal farmers from fertile lands, threatening livelihoods and food security in Umzingwane district. Results show there exists embedded complementarity among irrigation, rain-fed and ASM despite conflicting regulatory frameworks. The article recommends the harmonisation of policies to build on this relationship while abating the negative competitive aspects between the livelihood strategies to strengthen the synergies for the sustainability of the two.

Keywords: *Artisanal small-scale mining; irrigation farming; competing livelihoods, conflict*

1.1 Introduction

Artisanal Small-scale Mining (ASM) Yirenkyi (2008); Opoku-Ware (2010) and irrigation farming have recently become cogs and cornerstones of rural economies (Kwateng 2012); Gilbert and Albert 2016). The two strategies often play crucial seasonal balances for many livelihood baskets (Osman, Afele, Nimo, Gorleku, Ofori, & Abunyewa, 2022; Mensah *et al.,* 2015). While co-existing and sharing most factors such as labour income, water and other resources, the two are often separated and antagonised by institutions governing them. One cannot ignore the relationship existing between the them. For instance, the International Labour Organization (ILO, 1999) argues when subsistence farming fails to produce enough crops, the next rung up the economic ladder, due to lack of opportunities for other wage employment, has often been artisanal small-scale mining. In many developing countries, agricultural land is dominated by mining companies and by implication, most agricultural lands are now mining company concessions (Aidara, 2013). Many farmers have lost access to agricultural lands while rural communities have been left without access to land and good quality water sources (Aidara, 2013; Arah, 2015).

In their research on mining, pollution and agricultural productivity, scholars argue between 1998/99 and 2005, agricultural productivity decreased by almost 40% in areas closer to mines (Aragon & Rud, 2012; Aidara, 2013). This reduction is attributed to high risks of conflict due to competition for land, mineral rights, and water sources (Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF), 2010). Policy-makers have placed "little value on the prevailing pattern of de-agrarianisation unfolding in sub-Saharan Africa" and failed to "concede the rapid growth of ASM is a response to the unviable state of smallholder farming" (Banchirigah & Hilson, 2010, p. 159). This paper presents competing artisanal gold mining, small-scale rain-fed, and irrigation communal farming, paying attention to Umzingwane District's Umzinyathini Irrigation.

1.2 Statement of the problem

With the rampaging climate change phenomena has come the necessity to adapt irrigation farming for food security and livelihoods among rural communities. While seen as the future of agricultural production due to the uncertainty of rain-fed agriculture, unabated competition from

increasingly pervasive artisanal small-scale mining (ASM) attracts resources away from irrigation farming activities. Not only that, the ASM sector enjoys institutional superiority and thus threatens communal and irrigation farming, which is at the mercy of mining legislative frameworks. The current mining law supersede all laws governing other land-uses in communal areas; hence communities in mining districts are at the mercy of mining explorers and artisanal gold miners. Miners use the Mines and Mineral Act of 1961 (Chapter 21:05) to practice indiscriminate gold mining in communal agricultural areas in defiance of the RDC Act, the Environment Management Act, and the Communal Lands Act and the Traditional Leaders Act governing the exploitation of natural resources in communal lands. Although necessary for sustainable livelihoods, the convergence of livelihood strategies, competing land-use interactions mar this potentially rewarding relationship. There is need therefore to harmonise sectoral policies to maximise synergies while minimising conflicts between the two sectors.

1 .3 *Literature Review*

1.3.1 Benefits of Artisanal mining in Communal Agriculture in Africa

The International Labour Organisation (ILO) (1999); cited in Economic Commission for Latin America and the Caribbean (ECLAC) (2000) estimates the number of workers involved in artisanal small-scale mining (ASM) could be as high as 13 million worldwide and 1.6 million in Latin America and the Caribbean (Hentschel *et al.*, 2002; Quiroga, 2002; Hilson, 2009; Schure *et al.*, 2011). To estimate the economic value of this activity, the ECLAC (2000) suggests assuming a monthly salary of US$150 per worker. Based on this calculation, ECLAC (2002) and Quiroga (2002) posit that small-scale mining contributes more than US$2 billion yearly to the economy of the continent. For regional economies, this is an important flow of funds that underpins the significance of the sector. In Brazil, small-scale gold miners (*garimpeiros*) have been able to modify government policies and have consistently produced as much gold as formal companies, or more (Quiroga, 2002; Hentschel *et al.*, 2002). However, on the downside, small-scale mining is also a source of resource-curse political violence and environmental degradation (Guiroga, 2002).

In sub-Saharan Africa, artisanal and small-scale mining employs tens of millions of people directly (Hilson, 2016; Hentschel *et al.,* 2002). Most

of the region's ASM activities are informal because registration is costly and bureaucratic (Hilson, 2016; Hentschel *et al.*, 2002). Resultantly, illegality, along with the sector's numerous social ills and environmental impacts, have overshadowed its importance, in particular its significance to subsistence farmers who now rely on ASM for disposable incomes (Hilson, 2002; Hentschel *et al.*, 2002). Artisanal small-scale gold mining in Zimbabwe contributes to improved rural livelihoods through earnings that enable the acquisition of agricultural inputs to improve production (Mutero, 2017, p.98). Hence, rural communities use ASM to boost agricultural inputs like fertiliser and seeds in preparation for farming seasons. That way, the improvement of agriculture helps establish food security and improves rural development (Scoones, 2009; Mutero, 2017).

1.3.2 Negative Externalities of ASM in Communal Agriculture in Africa

In Africa, artisanal small-scale mining competes against farming activities, in the process rendering communal farming lands unproductive and unusable (Hayes, 2008; Yeboah, 2008; Ocansey, 2013; Anoah-Frimpong, 2013). This drives more people from farming to ASM, leading to environmental degradation of fertile lands for crop farmers and pastoralists (Chimponyo and Mupfumi, 2012; Agyemong and Ontoyin, 2014, Mudyazhezha and Kanhukamwe, 2014; Mujere and Isidro, 2016). Discourse on livelihoods acknowledges ASM contributions to sustainable development although environmental degradation remains an ever-present threat and undesirable externality (Hinton, Veiga and Veiga, 2003, Kitula, 2006; Tom-Derry, Dagben and Cobbina, 2012; Gandiwa and Gandiwa, 2012). That way, ASM robs rural communities of Africa of prime agricultural land and decent livelihood for women (Emmanuel, 2013; Muchadenyika, Chatiza and Nyaunga, 2015). Similarly, literature indicates that environmental damages to soil, landscapes, and river pollution characterised by severe abandoned open-pits scattered in rural farming territories lead to loss of forest resources, wildlife habitat, and agricultural crop land (Timsina, Hardy, Woodbury, Ashton, Cook-Patton, Pasternack & Martin, 2022; Funoh, 2014; Bhebhe, 2009). Furthermore, ASM in Zimbabwe is well known for water pollution through polluting water sources for farming, horticulture, livestock, and domestic use and usurping land (Muchadenyika *et al.*, 2015; Dhuri, 2016, Chandiwana, 2016).

In the same vein, extensive damage to large tracks of farmlands and forest has led to a rush to acquire land illegally for small-scale mining in Ghana, resulting in loss of farm land, which has adversely affected both cocoa production and food crop production (Crawford and Botchwey, 2016). Experience shows that most forest reserves, farms and agricultural lands under village, common property or open access regimes are degraded through indiscriminate tree cutting, burning of grasslands to facilitate mining with a vuvuzela (Mabhena, 2010). Socially, ASM causes conflicts pitting local mining and migrant mining gangs with locals arguing for zoning or the territorialisation of ASM activities to prevent migrant miners from 'invading' local spaces for gold, resulting in the displacement of local communities (Arah, 2015). Gutu (2017) posits that illegal miners are often violent and threaten other land users, hence, communities and local artisanal miners are hostile to migrant mining gangs from other provinces. These are accused of plundering perceived God-given natural resource heritage, theft of livestock, house-breaking, rape and robberies, spearheading social evils and causing un-wanton deforestation (Mutero, 2017).

1.3.3 The Nexus between ASM and Communal Agriculture (Rain-fed and Irrigation Farming) as Livelihood Strategies

Agriculture and mining are main economic activities in rural Zimbabwe, although siltation and open cast miners pose a serious threat to animals and people (Bhebhe, 2010). Literature opines ASM and sustainable farming are important contributors to rural livelihood with the potential to alleviate poverty and (Amponsah-Tawiah & Dartey-Baah, 2011; Bagah, Angko and Tanyeh, 2016). However, to leverage these rural livelihood strategies, technical, policy and financial, and organisational support are needed. In early 2000s, proceeds from gold sales in Zimbabwe reportedly 'lubricated' communities and resettled farmers' agricultural activities, helping them purchase fertilisers. At Chazuka in Mozambique, such income enabled individuals to buy fertilisers and crucial farm inputs (Mutero, 2017; Dondeyne and Ndunguru, 2014; Maponga and Ngorima, 2003). Inseparable flows of capital and labour between agriculture and ASM were also found in the Northern Ghana (Hilson *et al.,* 2013), Brong-Ahafo Region (Okoh and Hilson, 2011) and Eastern Ghana regions (Hilson and Garforth, 2013). In Liberia, many agro-families grow rice to attract and feed labourers recruited specifically to mine for diamonds (Hilson and van Bockstael, 2011 and 2012). In

Cameroon, where poor markets and impenetrable forest constrain agricultural development, ASM is largely seasonal but is increasingly important for individual and household incomes (Bakia, 2014; Schure *et al.* 2011). Hilson (2016) argues that Government officials frequently argue that ASM's informality is largely due to individuals deliberately avoiding securing licences.

1.3.4 Strategies to mitigate the negative effects of Artisanal mining on Sustainable Agriculture through rain-fed and irrigation farming

Policy makers, development planners and practitioners, humanitarian and development agencies, academics and international community need to devise best strategies to position ASM as a sustainable livelihood without causing environmental degradation that threatens sustainable agriculture, particularly irrigation farming. African countries need to enact appropriate policies, legal and institutional frameworks to achieve a sustainable integrated use of natural resources (Mwakaje, 2012). Chhatre (2013) argues while opportunities for sustainable development, poverty alleviation, and improved environmental protection exist, such outcomes will rarely be achieved under current conditions of corruption and weak governance, hence the need to strengthen relevant institutional frameworks. Enabling harmonious governance outcomes for ASM and irrigation farming requires understanding of 'institutions' involved, which are the "regularised patterns of behaviour that emerge from underlying structures or sets of rules in use" (Schure *et al.*, 2011; Leach *et al.,* 1999:266).

2. Methodology and Sampling

The study is located within the interpretivism research paradigm, it adopted a qualitative research approach for its utility in a case study research design (Creswell, 2003), which Hawa-Abdullah and Raman (2001) argue was developed primarily in social science research and involves an in-depth analysis of a social phenomenon. Hawa-Abdullah and Raman (2001) further posit this type of research embraces naturalistic, ethnographic, participant observational, and case study aspects. This study analyses the nexus between the artisanal gold mining and irrigation farming using the case of Umzinyathini Irrigation Scheme in Umzingwane District paying particular attention to the knowledge, attitudes, and perceptions of communal farmers and irrigation farmers

towards artisanal small-scale mining (ASM) and its effects on their irrigation activities. As its driving thrust, this paper sought to respond to the pertinent question: What are the challenges faced by irrigation plot-holders in achieving sustainable irrigation farming? It also set out to answer the question: What institutions are vital in mitigating negative effects of artisanal mining on sustainable irrigation agriculture? Lastly, the paper sought to understand: How the relationship between two livelihoods strategies such as communal agriculture (rain-fed and irrigation farming) and artisanal gold mining affect the achievement of livelihood and food security in communal areas?

Data collection focused on knowledge, attitudes and perceptions (KAP) on the nature of the relationship between ASM and irrigation farming, both of which are two of Umzingwane District's foremost livelihood strategies. The study used a sample size of 40 purposively selected participants from diverse backgrounds, including communal farmers, members of Umzinyathini Irrigation Scheme, Rural District Councils Officials, the District Administrators officials, Sector ministry officials, Artisanal gold miners, Traditional leaders, and Zimbabwe Republic Police and Environmental Management Agency officials. Key informant interviews were conducted during COVID-19 imposed national lockdowns in March 2021; Focus Group Discussions (FGDs) among irrigation farmers and ASM with strict observation of COVID-19 social distancing and face-masking protocols covering mouth and nose while they loafed at home. Researchers self-administered semi-structured questionnaires to elicit data from EMA and ZRP while non-obtrusive observations were made on interactions between ASM and irrigation farming that precipitate towards misunderstandings and violent conflicts. Face-to-face basis interviews were done due to unavailability of digital platform like ZOOM and Google Meet among rural folks while using WhatsApp platforms created scepticism among potential respondents, hence that option was not chosen. With researchers providing relevant information to all respondents, those who chose to participate did so from an informed position.

No participant was offered any incentives to participate to avoid influencing their responses, which could potentially affect the reliability and validity of the findings when juxtaposed with a review of secondary related literature. Researchers faced limitations in that they could not scientifically ascertain the extent to which ASM has affected farmers through soil and water samples for heavy-metal or lead poisoning due to the usage of mercury, cyanide, and sulphuric acid in gold processing. The

study scope did not entail taking scientific samples for tests, while COVID-19 protocols made it impossible to travel between communities to elicit their views. The limited quantitative data obtained from semi-structured self-administered questionnaire was analysed using descriptive statistics while Thematic Content Analysis informed the qualitative aspect of the field data (Creswell, 2012).

3. Results and Discussion

3.1 Demographic Data: Respondents Disaggregated by Sex

Results indicate the dominance of males over females within the irrigation scheme membership representing 55% males against 45% for females. Such statistics is skewed in favour of males, highlighting a potentially patriarchal society within which the irrigation scheme operates. This could be explained by masculinity dominance and control of financial resources hence male domination of irrigation farming represented by 55%. This is consistent with findings by Gaidzanwa (2005). The results also indicate a bias towards masculinity and human capital to which irrigation work tends to plead due to hard labour required. However, despite their inferior representation, women in Umzinyathini Irrigation have braved the masculine domain of irrigation to inching closer to an equal membership with their male counterparts.

3.2 Respondents Disaggregated by Marital Status

Results of the study show that there are more married irrigation members than other marital statuses, with 52% of the total respondents married; followed closely by widowed members (35%). This could be implied by the nature of work involved in irrigation, where human and natural capitals are dominantly necessary for livelihoods strategies, hence those households with more manpower (human capital) potentially reap more. Lesser percentages of single (10%) and divorced/separated (3%) are thus represented in the irrigation scheme membership and are presumed to pursue other livelihood strategies requiring less human and natural capitals where married and widowed are tied down to their community and hence have limited choices.

3.3 Age of Household Heads

The ages of the irrigation household heads tended to be more among the 51yrs and older than the age-range 41-50 years (7) and 31-40 years (2), implying the limited opportunities for older groups due to age and therefore more commitment to the irrigation scheme. Younger members of the community would in such a case have alternative employment and livelihood sources hence lesser commitment. Results from this study demonstrate a relationship between age and participation in irrigation scheme with older respondents tending to participate more in irrigation work than lower age-ranges as highlighted in the Figure 3 above. On the contrary, FGDs indicate that younger respondents preferred quicker returns provided by artisanal gold mining compared to 'seasonal' irrigation and rain-fed cropping. This result implies dwindling reliance on rain-fed agriculture due to recurrent droughts in Umzingwane District, hence increased dependence on irrigation farming due to unavailability of other alternatives such as employment.

3.4 Dominant Sources of Livelihoods at Mawabeni Ward, 3

Of the three main livelihood sources / strategies, the study established that irrigation farming has a dominant stranglehold over other alternative livelihood sources, with a 76% of total respondents; followed by 22% for remittances from regional and international Diaspora; and lastly 2% for dry land farming (rain-fed cropping) respectively. The response rate and membership of irrigation is rather indicatively deceptive and not necessarily telling one with regards the livelihood alternatives and options open to the Mawabeni Community of Umzingwane District, where there is acknowledged rampant artisanal gold mining across households that also participate in irrigation and the traditional rain-fed cropping. The views from the participants, while noting the significance of irrigation in the drought-prone district, is not reflective of reality on livelihood strategies prevailing in Umzingwane.

Results from the study show there are three main livelihood sources for Umzinyathini community that list irrigation farming; remittances; and dry land farming (rain-fed cropping), all of which are complementary in their nature and thus comprise a basket of livelihood strategies that also caters for seasonality challenges in each strategy. While results above do not necessarily show cattle ranching and ASM as a livelihood sources, interviews and FGDs, revealed that villagers largely depend on ASM for

livelihoods but fear mentioning it to 'outsiders' for fear of being arrested since most of it is predominantly illegal. Regarding rearing cattle, respondents do not consider rearing of cattle as a livelihoods source, but rather as a cultural practice where every homestead had cattle albeit not mentioning them.

3.5 Source of Water for Irrigation Farming

Deriving from a list of potential water suppliers that included Umzingwane river; Ncema dam; Umzingwane Dam; Borehole water; Mayfer Dam (Insiza), the study unravelled that Umzinyathini Irrigation farmers rely on water drawn from Umzingwane Dam wholly without supplementary alternatives.

3.6 Competition for labour between Irrigation Farming and Artisanal mining

Results in Figure 1 below indicate that there is competition for labour between irrigation farming and artisanal gold mining in Mawabeni area of Umzingwane District. When queried on the form of competition that existed between artisanal gold mining and irrigation farming, respondents generated various explanatory views where they stated that:

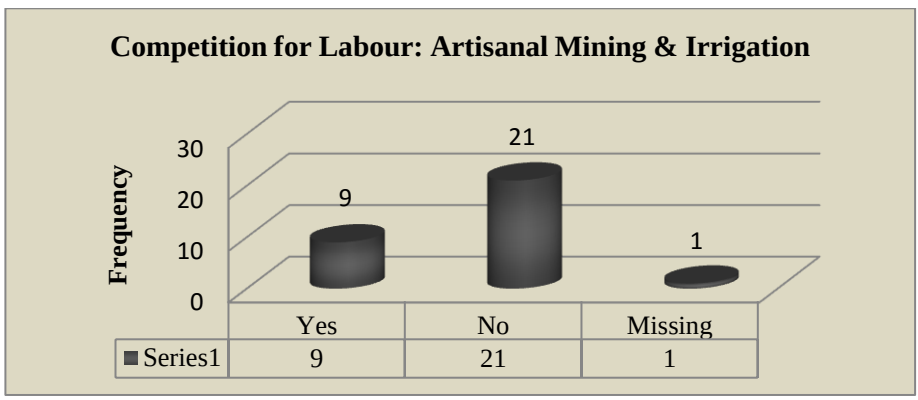
> Instead of working on plots they go for panning labour; labour-able bodied young men go to panning where there is quick money; On lack of casual labour; I am not aware of shortage of causal labour, we used to hire young men to help out. Some young men who should be helping parents in farming opt for gold panning instead of working in plots for quick returns (Interview with the member of Umzinyathini Irrigation Committee, 2021).

The above narratives highlight how able-bodied young-men who represent potential labour for irrigation are attracted away from irrigation by artisanal mining where there tends to be quicker returns. Those who felt they depended on ASM proceeds for irrigation inputs argued they paid for casual labour (by artisanal miners during days of scarce production) while ASM provided major markets for irrigation produce. Results show close synergies among ASM, irrigation and rain-fed agricultural production. Seeing that irrigation produce is seasonal, artisanal miners always provide source of extra labour when irrigation

gets busier, for example during rainy seasons when artisanal gold mining is difficult to undertake. Sometimes household members split into irrigation farming and artisanal gold mining by age, with younger men preferring artisanal gold mining while older generations go for irrigation farming.

The article sought to establish what the irrigation scheme members felt can and should be done to enhance the relationship between irrigation and ASM, and noted the following concerns: That 'migrant artisanal gold miners' are generally desirable among irrigation members who appreciate them as a market for irrigation produce. Irrigation members strongly felt informal ties between ASM and communal farming activities were best, as closely relating with 'foreign artisanal gold miners' had in the past resulted in the destruction of water canals, siltation of the dam, and theft of their produce. Paradoxically, some of the farmers were practising local artisanal miners themselves who utilise both sources of livelihoods as resilience option in the case of climate change crisis.

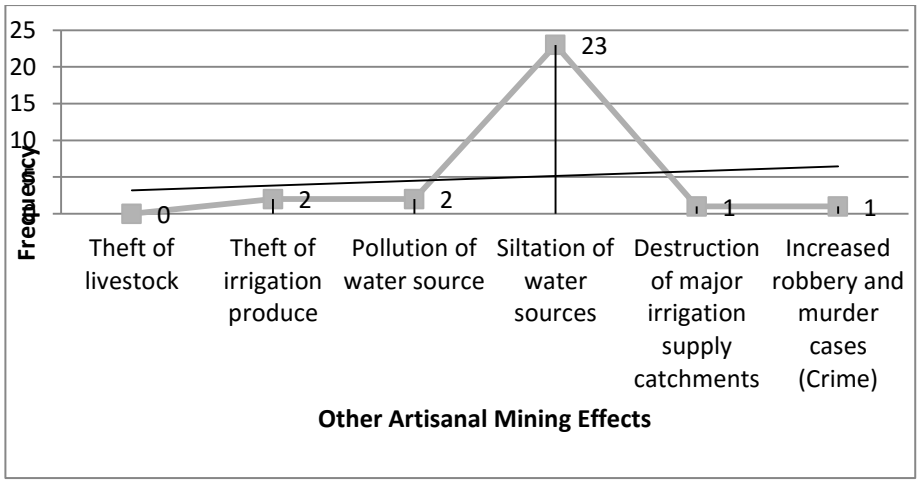
Figure 1: Competition for Labour: ASM & Irrigation



Source: Authors' Primary Data (2021)

3.7 Challenges from Artisanal Mining on Irrigation Farming in Umzinyathini Irrigation scheme

Figure 2: Challenges of Artisanal Mining on Irrigation Farming



Source: Authors' Primary Data (2021)

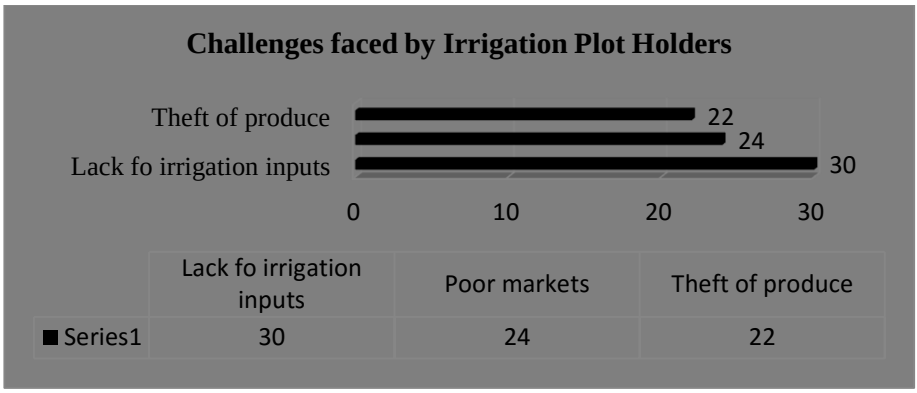
Artisanal mining by migrant miners affects local irrigation farmers in other ways than those relating to water sources. Incrementally, theft of livestock; theft of irrigation produce; pollution of water sources; and the most loathed effect being the siltation of water sources where migrant artisanal miners destroyed major irrigation supply catchments; and increased crime rates involving violence such as robbery and murder albeit periods apart. Asked if they had, as irrigation farmers approached any of the Government Agencies for remedial action regarding enumerated challenges, 97% of the respondents said they had not initiated such processes since some local artisanal miners were also irrigation members who practised both activities. A negligible 3% of the respondents did not respond to the question, hence, it was captured as missing variables.

3.8 Challenges faced by Irrigation Plot Holders in Achieving Sustainable Irrigation Farming

On the challenges faced by irrigation plot holders, the article argues that lack of agricultural inputs was a major impediment; followed closely by

poor markets; and theft of agricultural produce. These challenges are depicted graphically below:

Figure 3: Challenges faced by Irrigation Plot-holders

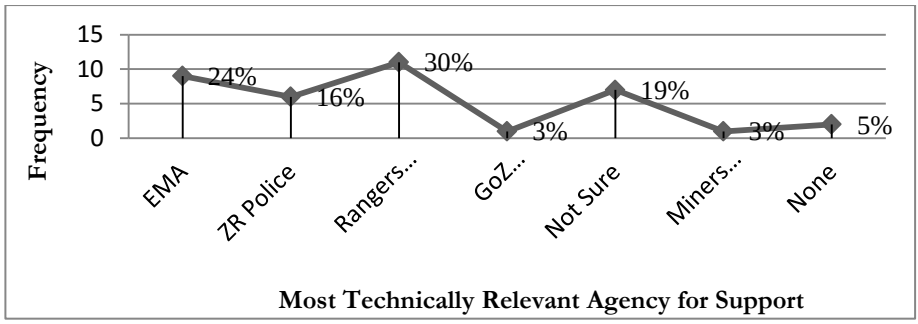


Source: Authors' Primary Data (2021)

A follow up question probed the explanation behind the adequacy of water throughout the year. Responses showed that water adequacy was largely dependent on rainfall received but noted that water has been adequate for the past 45 years. Some irrigation plot holders noted that water has always been adequate as long as there was enough rainfall; the dam had adequate water. On the most felt limitation, irrigation plot holders lamented the lack of irrigation inputs (30 times) while poor markets were represented by (24 times) and lastly theft of irrigation produce (22 times) respectively.

3.9 Which Institutions are likely to give technical advice on dealing with Artisanal Mining Challenges?

Figure 4: Most Technically Relevant Agency for Support

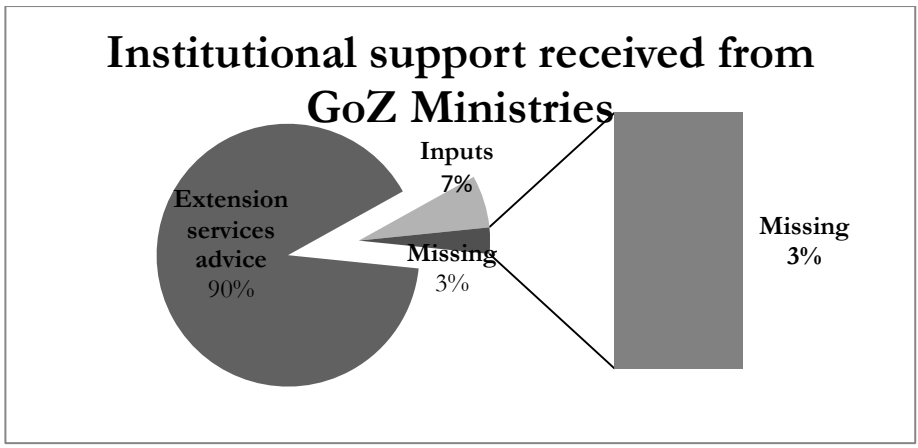


Source: Authors' Primary Data (2021)

The Figure 4 above depicts technically relevant agencies irrigation scheme members felt had a role to play in resolving challenges they faced. Eleven (11) respondents felt that Bulawayo City Council (BCC); Rangers (35%); followed by nine (9) who felt Environmental Management Agency (EMA) (29%); while seven (7) respondents (23%) were not sure which of the agencies was responsible for addressing their challenges. A group comprising six (6) respondents (19%) of the respondents felt Zimbabwe Republic Police were the correct agency to deal with the challenges they raised against negligible responses from those who routed for no one's intervention, implying they felt everything was okay and there was no need for any intervention (7%); 1 respondent (3%) called upon the Central Government of Zimbabwe (GoZ) and another one (3%) felt the Miners Association were responsible for finding remedial action respectively especially with regards to foreign artisanal miners who do not have respect for the local natural resources and customs.

3.10 Institutional support received from Government of Zimbabwe

Figure 5: Institutional Support received from GoZ Ministries



Source: Authors' Primary Data (2021)

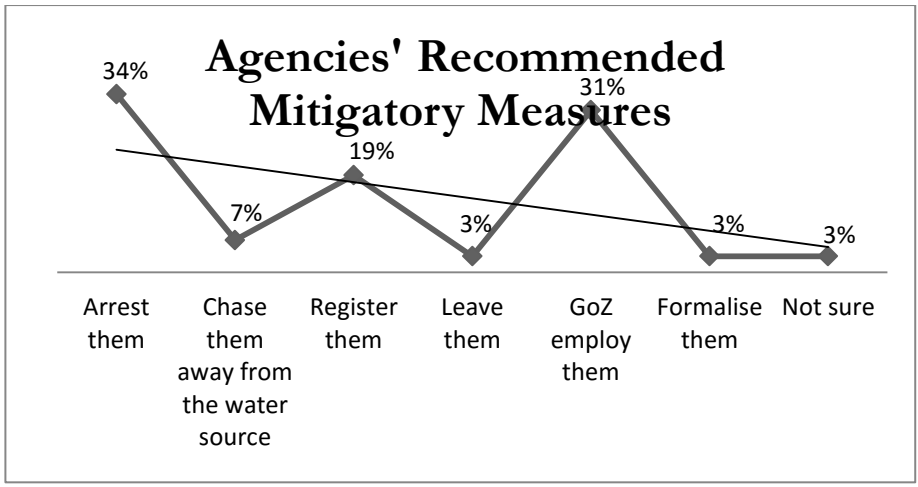
Intervention envisaged was mostly in the form of agricultural extension services and technical advice as depicted by a 90% response from irrigation farmers who responded while 7% felt there was need for agriculture inputs to scale up irrigation production and year-round farming. Three variables were missing as depicted by Figure 5 above. The above results suggest the need for the Ministry of Agriculture and Mechanisation to expand the agriculture input-subsidy process through the Government Command Agriculture initiative if rural irrigation and rain-fed farmers in Zimbabwe are to achieve food security.

3.11 Role of Traditional Leadership on Problems faced by irrigation Plot-holders

In-depth interviews highlighted that while respondent from the Umzinyathini Irrigation Scheme felt Traditional leaders had no role to play on irrigation matters, irrigation activities remain within the jurisdiction of specific Traditional leaders for guidance; access to external support and attracting social networks with farming inputs. Respondents' irrigation issues could still be resolved through the irrigation management committee in consultation with traditional leadership of the area.

3.12 Institutional Measures to Mitigate Negative Externalities of Artisanal Miners

Figure 6: Recommended Measures to Mitigate Negative Externalities of Foreign Artisanal Miners



Source: Authors' Primary Data (2021)

For recommendations, the study learnt that a majority of the respondents (36%) recommended the arrest of foreign artisanal gold miners operating within Umzingwane Dam catchment areas as they were responsible for heavy siltation and therefore reduced water-holding capacity against 32% who recommended that the Government of Zimbabwe (GoZ) must in fact employ such local and migrant artisanal miners. While at that, a further 16% felt the GoZ should register and formalise the artisanal gold miners' operations, a feeling that was also mutual for another 3% of the respondents totalling (19%) for those willing to see artisanal gold miners formalised (Government must register them plus formalise them). Other recommendations include those who felt there were no negative externalities known from artisanal mining activities (3% and a similar 3%) who said they were not sure what recommendations to make, jointly accounting for 6% (see Figure 6 above). These results reinforce the notion that there is a close nexus between the artisanal gold mining and irrigation and rain-fed agriculture.

4. Synthesis

4.1 Demographic Data

Gender

The article indicates that men dominated the irrigation scheme and women played a secondary role. The article further argues that despite the inferior representation of women in Umzinyathini irrigation scheme, women have braved the masculine domain of irrigation to inching closer to equal membership with their male counterparts.

Marital Status and Age of Household Head

The article argues the majority of irrigation members were married while widows had the second's best option. This finding could be explained by the nature of work involved in irrigation, where human and natural capitals are dominantly necessary for livelihoods strategies, hence those households with more labour (human capital) potentially reap more. The article noted the existence of a relationship between age and participation in the irrigation scheme with older community members participating more actively in irrigation work than younger and able-bodied members.

Level of Education

The article indicates the majority of irrigation plot holders have attained senior primary education. The article argues although most attained primary level education, their level of comprehension was relevant for their time (yesteryear) having attained Standard-6 education, which translates to limited competitiveness with younger generation for livelihood sources such as artisanal gold mining, hence more attention towards irrigation and rain-fed agriculture in Umzingwane District.

4.2 Dominant sources of livelihoods at Mawabeni, Ward 3 in Umzingwane District

The article noted that dominant sources of livelihood strategies were irrigation farming followed by remittances from regional and international Diaspora and then lastly dry land farming/ rain-fed agriculture. The article argues despite the significance of irrigation

farming in the drought- prone district, it is not reflective of reality on livelihood strategies prevailing in Umzingwane district. Considering irrigation farming as a dominant source of livelihood will be practically deceptive and not depicting the reality with regards livelihood alternatives and options open to the Umzinyathini Community of Umzingwane District. The article suggests rampant ASM and cattle rearing are part of the basket of livelihood sources though not openly identified by households that participate in irrigation farming. Thus, the article argues, culturally, villagers do not perceive cattle rearing as a livelihood source, but rather as a cultural identity and practice where every homestead had cattle albeit not mentioning them. The article argues paradoxically, as highlighted by Focus Group Discussions (FGDs) that villagers of Umzinyathini Irrigation Scheme largely depend on ASM for livelihoods but fear mentioning it to 'outsiders' for fear of victimisation by law enforcement agents since it is predominantly illegal. Thus, ASM by local farmers is illegal, which explains why rural community members did not identify it as a source of livelihood.

4.3 Sources of Water for Irrigation Farming

The article indicated that irrigation plot-holders wholly relied on water from Umzingwane Dam without supplementary alternatives. The article suggests the source of water for irrigation was reliable based on the amount of rainfall received in the water catchment area. The article established that the degree of water reliability was influenced by the fact that Zimbabwe National Water Authority (ZINWA) depends on Umzingwane Dam for domestic supplies to the community, hence it ensures there is always adequate water at the bulk water reservoirs located in the irrigation scheme. Surprisingly, the article noted that ZINWA does not pay royalties to irrigation plot-holders and the general communal farmers for water drawn from their reservoir. Despite, this situation, the article argues the involvement of ZINWA in fact aids the irrigation scheme members through sustainable water supply, hence the uninterrupted supplies.

4.4 Competition for Labour: Artisanal Mining and Irrigation Farming

The article indicates there is competition for labour between ASM and irrigation farming, where potential labour for irrigation is attracted away

from irrigation activities. The article argues there is complementarity between ASM and irrigation farming, with money from ASM used to pay labour costs by irrigation farmers while artisanal miners provide the major market for irrigation produce. This complementarity reinforces the notion that a close relationship exists among ASM, irrigation, and rain-fed farming in rural areas. The article further noted that when ASM is difficult to undertake, artisanal miners provide extra labour when irrigation gets busier, and sometimes household members split into irrigation farming and ASM by age, with younger men preferring artisanal gold mining while older generated go for irrigation farming.

4.5 Challenges faced by Irrigation Plot Holders in Achieving Sustainable Irrigation Farming

The article argues the lack of agricultural inputs; poor markets and theft of agricultural produce by 'foreign' migrant artisanal miners remain major challenges faced by irrigation plot-holders. This article suggests negative effects of ASM, particularly by migrant miners include digging pits that affect water flow, pollution of water for irrigation through gold cleaning process that involves chemicals such as cyanide, mercury, and sulphuric acid among others. Similarly, irrigation farmers accuse artisanal miners of damaging blue infrastructure such as pipes within the natural provisioning and regulating ecosystem-service producing biodiversity. Incrementally, findings revealed challenges of theft of livestock; irrigation produce; and pollution of water sources; with the most loathed effect being the siltation of water sources where artisanal gold miners are accused of destroying major irrigation supply catchments; and increase crime rates involving violence such as robbery and murder albeit periods apart.

4.6 Irrigation Institutions

The article noted that irrigation plot holders were aware of the existence of institutional establishment for the management of their irrigation scheme, although they varied on the roles played by the institutions. The article argues that irrigation scheme committee resolves conflicts between and among the scheme members. Additionally, the committee coordinates and manages Umzinyathini Irrigation scheme. However, the article noted that the minority argued that the Irrigation Management

Committee was in fact a useless lot because they were failing to establish lucrative markets for the irrigation produce.

4.6.1 Institutions likely to give technical advice on dealing with artisanal gold mining challenges

The article argues the most technically relevant agencies to support irrigation plot holders include Bulawayo City Council Rangers, Zimbabwe Republic Police, Environmental Management Agency, Miners Association and the Government of Zimbabwe's Ministry of Mines. The article suggests these agencies are expected to play active roles in addressing challenges faced by irrigation plot holders and ASM for the two sources of livelihood to effectively complement each and foster social change among rural communities. The multi-ministerial agency approach has only effectively ensured the environmental management turf is inadequately regulated, to the detriment of a heavily degraded environment.

4.6.2 Institutional support received from Government of Zimbabwe (GoZ) Ministries

Extension services from the GoZ Ministry of Lands, Mechanisation and Extension Services were identified as the major institutional support given to irrigation plot holders. The article illuminates the need for the GoZ to provide farming inputs that will enable them scale up irrigation production and year-round farming in Umzinyathini irrigation scheme. The article argues that the role of traditional leaders in the irrigation matters was not clear, although the irrigation activities remain within the jurisdiction and governance domain of the traditional leaders. The article suggests that traditional leaders are instrumental in the provision of locally - based institutional support and guidance, access to external support and attracting social networks with farming inputs since they are the dominant local governance structure representing local government in rural areas as guided by the Traditional Leaders Act on natural resources within their locality.

4.7 Measures to Mitigate Negative Externalities of Artisanal Miners

The article noted that irrigation plot holders felt that the Government of Zimbabwe (GoZ) must arrest migrant ASM operating within Umzingwane Dam catchment areas as they were responsible for heavy siltation and therefore reduced water holding capacity. Viewed from a rights-based approach (RBA) and the socio-ecological systems framework (SESF), the article argues GoZ as the primary duty bearers must transform ASM into formalised small to medium-scale mining enterprises. This move would benefit the natural balance within the socio-ecological system (SES) through improved regulation, natural resource management, and local governance from which permit and taxes can, and thus should accrue to the benefit of the district, provincial and national gross domestic product, and attendant devolution-centred development processes that accrue therefrom. The tracking and monitoring of these informal mining activities would be greatly improved and accountability increased thereby.

5. Conclusion and Policy Recommendations

This section outlines the conclusion and recommends arising from the findings and related discussions thereof.

5.1 Conclusion of the Study

The article argues that participation in the irrigation scheme is characterised by age differentiation, with younger community members preferring artisanal gold mining as it is viewed as giving quicker returns when compared to 'seasonal' irrigation cropping. The article concludes that the villagers of Umzinyathini irrigation scheme largely depend on artisanal gold mining however it is practiced underground because fear of victimisation by law enforcement agents since most of it is predominantly illegal. Furthermore, the article concludes that there is a complementary relationship between artisanal gold mining and irrigation farming where proceeds from artisanal gold mining are used to pay for labour for irrigation farming and surprisingly artisanal gold miners are a major market for irrigation produce. Thus, this complementarity manifests a nexus between the two livelihoods strategies in Mawabeni area of Umzingwane district.

The article argues that when ASM is difficult to undertake, artisanal miners provide extra labour when irrigation gets busier and sometimes the household members split into irrigation farming and ASM by age, with younger men preferring ASM while older generations go for irrigation farming. Therefore, the article concludes that irrigation farming and ASM are different sides of the same coin (livelihood portfolio) since they focus on poverty reduction and economic empowerment of rural communities, albeit unconventionally. However, the article advances that ASM activities especially by itinerant migrant miners, such as surface mining (ripping in order to use a metal detector to detect gold) and digging and not reclaiming pits has caused massive siltation of rivers that feed into Umzingwane Dam that supplies the irrigation scheme. Further some negative externalities from foreign miners include increased crime rates involving violence such as robbery and murder in mining communities.

Finally, the article concludes that Bulawayo City Council Rangers, Zimbabwe Republic Police, Environmental Management Agency, Miners Association and the Government of Zimbabwe sector ministries are expected to play an active role in addressing challenges posed by ASM that make Umzinyathini irrigation plot holders fail to effectively utilise their allocated plots to improve livelihoods and food security.

5.2 Policy Recommendation

The article recommends the harmonisation of the legislative frameworks governing the irrigation farming and artisanal gold mining to reduce competitive tension between irrigation farmers and artisanal miners. Such harmonisation potentially improves the interaction between the two livelihood strategies among many rural communities since they are not mutually exclusive but complementary. However, harmonisation can only bear fruits if ASM is formalised through a regulatory policy put in place since most of them currently operate outside legal parameters governing the mining sector in Zimbabwe. Irrigation farming and ASM must both be regarded as entrepreneurial business ventures that require adequate support from local government institutional structures, funding agencies and non-governmental organisations to yield sustainable social transformation among rural communities. Training and equipping artisanal miners with socio-ecological awareness for environmentally friendly mining and processing methods that reduce pollution of water bodies used by irrigation farmers for horticulture and crop farming. The

formation of farming cooperatives and use of internal savings and lending (ISALs) by irrigation farmers can help address agricultural input challenges and poor market access. Similarly, the Presidential Agricultural Input scheme could be utilised as a back-up measure to complement farmers' efforts. The formation of an irrigation security unit in the irrigation scheme could be instrumental in addressing the issues of theft of agriculture produce by itinerant 'foreign' artisanal miners. Local farming communities even suggested corrective action be taken against foreign untraceable artisanal miners to ensure wherever possible such mining is regulated locally for accountability of actions and respect for the farming environment.

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