

The Effects of Artisanal Mining on Irrigation Farming

The Case of Umzinyathini Irrigation Scheme in Umzingwane District, Southern Matabeleland, Zimbabwe

F Moyo, T Ndlovu and B Francis

National University of Science and Technology, Zimbabwe

T M Ncube

NUST/Gwanda State University, Zimbabwe

ABSTRACT

This article aims to show that competing demands on environmental resources have, more often than not, exacerbated vulnerability of poor rural agricultural communities. Artisanal and small-scale mining and irrigation-based farming are the main sources of rural livelihood used to cope with vulnerability in the drought-prone Mawabeni rural communities of Umzingwane District in Zimbabwe. Irrigation farming in Umzingwane District depends heavily on sustainable water supply and unpolluted land. Similarly, artisanal mining (ASM) depends on water for panning processes. Poor people's vulnerability often increases when irrigation development demand and artisanal mining operations compete for resources such as time, labour and water. The article explores the effects of ASM activities on sustainable agriculture productivity with specific focus on the irrigation scheme in Umzingwane District of Southern Matabeleland. A qualitative descriptive survey design and purposive sampling technique were used to select the study area, participants and to analyse data. The article concludes that ASM has caused a radical shift of able-bodied labour from irrigation farming to ASM thereby decreasing the productive capacity of the irrigation scheme. Notwithstanding the presence of locally-based extension officers from the Ministry of Lands, Mechanisation and Extension Services and traditional leaders who are instrumental in the provision of institutional support and guidance as well as access to external support and attracting social networks with farming inputs, the ASM activities have impacted negatively on farming in Umzingwane District.

INTRODUCTION

Scholars have in various empirical studies noted the negative ramifications arising from artisanal mining (ASM) to several livelihood-related factors and elements (Mudyazhezha & Kanhukamwe 2014), with Matabeleland South province being one of the areas brought to the fore in that light. According to Mudyazhezha & Kanhukamwe (2014), mineral extraction contributes positive to the socioeconomic fabric of many African countries but has also contributed to the deterioration of environmental quality. Hence, ASM has been branded the most destructive industry in the world. There has been a rapid shift from traditional rain-fed agriculture to other livelihood options, with these both good and grey livelihoods have arisen. One of the potential threats brought to light include diversification into ASM gold mining in Umzingwane district, which, while providing employment and livelihoods to many, poses ecological disaster risk problems. Results from the study were derived from responses drawn from 100 per cent Umzinyathini Irrigation Scheme membership, Mawabeni Ward 3.

Hilson (2016) argues that in sub-Saharan Africa ASM employs tens of millions of people directly and most ASM activities are informal because registration is often costly and bureaucratic. The consequential illegality, along with the sector's numerous social ills and environmental impacts has overshadowed the importance of illegality, in particular regarding the number of subsistence farmers that now rely on ASM for their disposable incomes (Hilson 2016). Dreschler (2001) and Phiri (2011) who enumerate the negative impacts of ASM in Umzingwane District, include deforestation, land degradation, deterioration of water and air quality, depletion of water resources, loss of grazing land and the overall reduction in biodiversity. Phiri (2011) further notes that the practice has also become the worst enemy of water, air and the general biodiversity posing a threat to the ecosystem survival. Reinforcing the above, Nkuli (2008) posits water is one of the most essential constituents of the human environment and generates development in socio-economic issues crucial to society in general and more specifically for industries, and agricultural activities. Although it is agreed water is an economic good, it is also a social good, finite, non-substitutable and vital to all forms of life (ICWE 1992; Nkuli 2008). The last three elements make water distinct from any other commodity as a good that should be conserved and treasured (ICWE 1992; Nkuli 2008). This article examines the effects of artisanal mining on irrigation farming productivity as well as the communities' reliance on the latter for livelihoods.

ARTISANAL MINING AND IRRIGATION FARMING UMZINYATHINI

Drought has played a role in constraining cropping output through rain-fed agriculture



(Mabhena 2010) hence irrigation farming has been adopted by some farmers in Umzingwane District. While Hilson (2016) explores the symbiosis between ASM and subsistence farming in sub-Saharan Africa, this article explores the flipside argument, that is, the effects of ASM on irrigation farming communities, paying particular attention to Umzingwane District. Irrigation farming has the potential to be the mainstay of rural economy in Southern Africa if it is supported by input supply, technology transfer, effective extension services, and friendly credit systems. Rural livelihoods are basically anchored on a multiplicity of livelihood sources; however, in Umzingwane, Mining and Agriculture are the main sources of livelihoods for the communities. Off-farm activities such as ASM and out-migration to neighbouring countries are an indication of multiple livelihood strategies used by individuals, families and households in Southern Matabeleland (Mabhena 2010). Without multiple livelihood strategies, farming has become unsustainable as a main source of livelihood, especially given the established dependence on multiple sources of livelihoods (Mabhena 2010).

ASM is becoming a key part of many rural economies in Sub-Saharan Africa. "Economic difficulties caused by policies introduced under 'Structural Adjustment Programmes' have galvanised strong links between artisanal mining and subsistence farming" (Hilson 2016:4). However, ASM's economic contribution at the household level continues to be almost entirely overlooked (Reardon 1997). The scholar further notes that early landmark studies on livelihood diversification in Tanzania, Ghana, Burkina Faso and Sierra Leone failed to mention ASM as one of the alternative sources of livelihood (Bryceson 1996; Ellis 1998). Paradoxically, these countries are now locations of ASM economies (Hilson 2016).

As a way of hedging against disaster risk associated with farming, many farmers work seasonally, by moving between mining and agriculture throughout the year. For instance, Hilson (2016) argues that up to 30 per cent of those engaged in ASM in the Mozambican townships of Massa and Manica use earnings to supplement their seasonal farming income. Furthermore, "studies in Liberia indicate that many rural inhabitants use rice grown for food production to attract labour for mining activities" (Hilson 2016:4). There is need to recognise the inseparable linkages between farming and mining. For instance, in countries such as Ghana and Burkina Faso, strong links between ASM and Agriculture have produced a platform for wealth creation (Hilson 2016). Hilson (2016) argues that capital and labour routinely flow between both activities and the resulting earnings are used to finance the construction of bigger houses, send children to schools, and to pursue other business ventures. Many rural families generate disposable income from ASM and use portions of these earnings to sustain their farm activities (Hilson 2016). The linkages with agriculture have intensified in the face of challenges brought on by structural adjustment in the 1980s and 1990s. However, despite this strong evidence

of rural diversification, much development policy continues to view rural household as solely agricultural.

Mining is barely mentioned in most of the early landmark analyses on livelihood diversification and where it mentioned the role it plays at household level is not clarified. Hilson (2016) declares “the omission of ASM from seminal reviews, is even more perplexing when many of the countries examined (Including Tanzania, Ghana, Burkina Faso and Sierra Leone) are today the locations of the region’s most dynamic ASM economies” (Brycerson 1996; Ellis 1998; Hilson 2016). Although ASM is at the heart of a complex livelihood diversification dynamic now firmly rooted across sub-Saharan Africa (Hilson 2016), a poor understanding of ASM has sparked widespread condemnation of its activities.

Support for agriculture disappeared in sub-Saharan Africa during the implementation of the Structural Adjustment Programmes (SAPs). Also, “One of the more extreme cases, Malawi, began to institute World Bank/IMF initiated reforms in the mid-1980s, phasing out all subsidies for fertilisers by the 1994/95 season” (Hilson 2016:11). Many studies have captured the synergies between ASM and farming in sub-Saharan Africa. For instance, “Mozambique, proceeds from small-scale gold mining at Chazuka have enabled individuals to buy fertilisers and others crucial farm inputs” (Dondeyne & Ndunguru 2014:12). Inseparable linkages (flows of capital and labour) between agriculture and ASM can also be found in the Northern Region (Hilson *et al.* 2013), Brong-Ahafa Region (Hilson 2011), and Eastern Region of Ghana (Hilson & Garforth 2013).

Current discourse indicates that small-holder agriculture and ASM complement each other (Hilson & Garforth 2013). For instance, in rural Sierra Leone, artisanal diamond mining activities have long been interconnected with seasonal farming economy (Hilson 2016). In the Niassa and Manica townships of Mozambique, an estimated 30% of inhabitants engage in ASM to “complement earning from agriculture, which is mainly practised in the rainy season” (Mondlane & Shoko 2003:265). In Zimbabwe, gold panning used to be primarily a dry season activity and its upsurge has been attributed to seasonal droughts (Maponga & Meck 2003). Mining activities upstream interfered with the river system, thereby, reducing water-flow rate, thus, denying communities adequate water for their livelihoods (Ncube-Phiri *et al.* 2015). Further to that, ASM in Umzingwane destroys the best land for cultivating crops thereby depriving communities their main source of livelihoods (Ncube-Phiri *et al.* 2015).

For this article, data collection tools such as key informant interviews, Focus Group Discussions (FGDs), questionnaires and non-obtrusive field observations along with a



review of secondary related literature focused on the knowledge, attitudes and perceptions (KAP) on the effects of ASM on irrigation farming. Thematic content analysis informed the qualitative aspect of the data analysis, which was presented using a mixed approach to aid and abet the strengths and limitations, respectively, of using just one approach.

RESULTS AND DISCUSSION

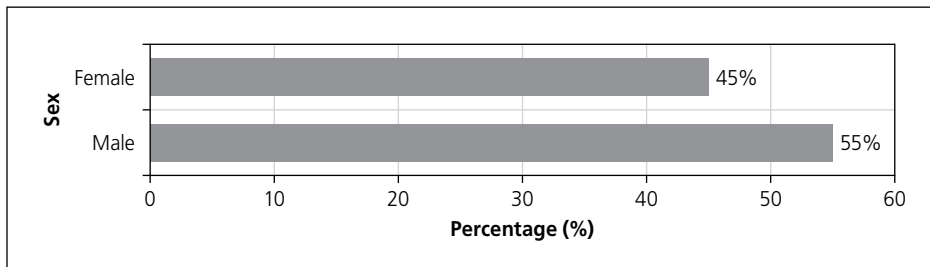
The main results of the study alongside some of the key emergent themes are presented in this section. Thirty-one (31) plot-holders at Umzinyathini Irrigation Scheme responded to the study through self-administered questionnaires. Results of the study reflect intersections between ASM and Umzinyathini Irrigation Scheme wherein positive effects on one hand are not necessarily beneficial to the other. The core emergent themes in the study include demographic information of respondents; effects of ASM on Irrigation Farming (IF); Irrigation scheme membership; allocated plot sizes vis-à-vis size used for agricultural purposes; sources of water for irrigation farming; reliability of water supply sources; benefits from plot; effects of ASM on Irrigation Farming at Umzinyathini; adequacy of water source for irrigation, consumption, and ASM; effects of ASM on water quality; competition for labour between ASM and irrigation; adequacy of water for year-round irrigation; challenges faced by irrigation plot holders in achieving sustainable irrigation farming; negative effects of ASM on irrigation farming; agency for water quality testing; and, role of traditional leaders and recommendations to mitigate negative externalities of ASM.

Demographic Data

Respondents Disaggregated by Sex

Results shown in Figure 1 indicate the dominance of males over females within the irrigation scheme membership representing 55% males against 45% for females. These

Figure 1: Respondents Disaggregated by Sex



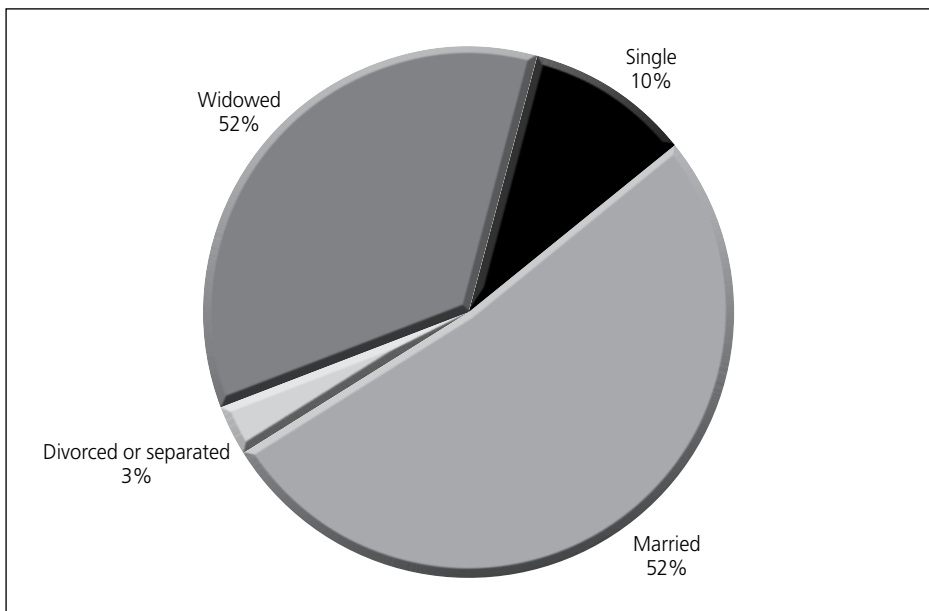
Source: Authors' Primary Data

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.

Respondents Disaggregated by Marital Status

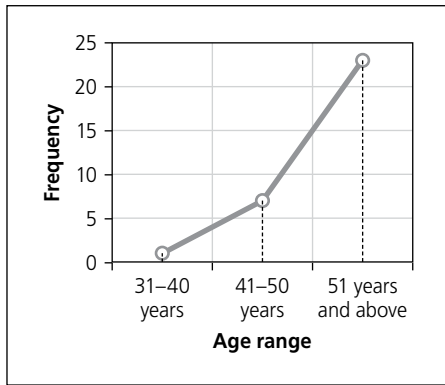
According to the results of the study, there are more married irrigation members than other marital statuses, with 52% of the total respondents married; followed closely by widowed members (35%). This could be implied by the nature of work involved in irrigation, where human and natural capitals are 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.

Figure 2: Respondents Disaggregated by Marital Status



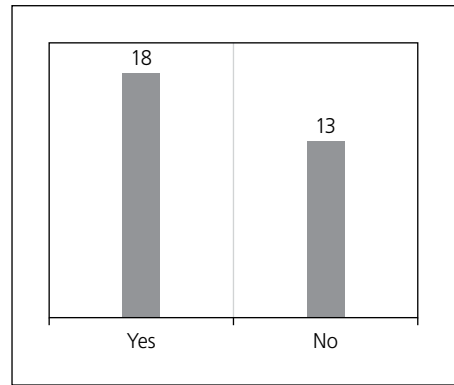
Source: Authors' Primary Data

Figure 3: Age-Range of Household Head



Source: Authors' Primary Data

Figure 4: Effects of Age on Irrigation Farming



Source: Authors' Primary Data

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 figure 3. On the contrary, FGDs highlighted that younger respondents preferred quicker returns provided by artisanal gold mining compared to ‘seasonal’ irrigation 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.

The study found that the irrigation scheme was dominated by men and women played a secondary role. The study 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.

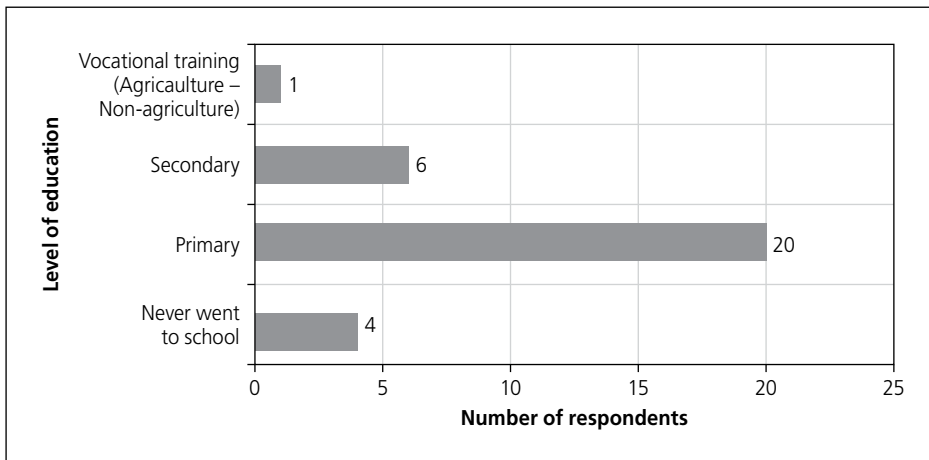
The study found that the majority of irrigation farmers were married while widows followed as second best option. This finding resonates with the nature of work involved in irrigation, where human and natural capitals are dominantly necessary for livelihoods strategies; hence those households with more human capital potentially reap more. The study established a relationship between age and participation in irrigation farming

where older community members participated more actively in irrigation farming than younger and able-bodied members.

Respondents' Level of Education

Having noted that the majority of irrigation plot holders have attained primary education (20 respondents), this study established that irrigation farming in this community is linked with the participants' advanced age-range (see figure 3) where older household heads tended to participate more than younger one. This study draws inferences that 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, hence more attention towards irrigation.

Figure 5: Respondents' Level of Education



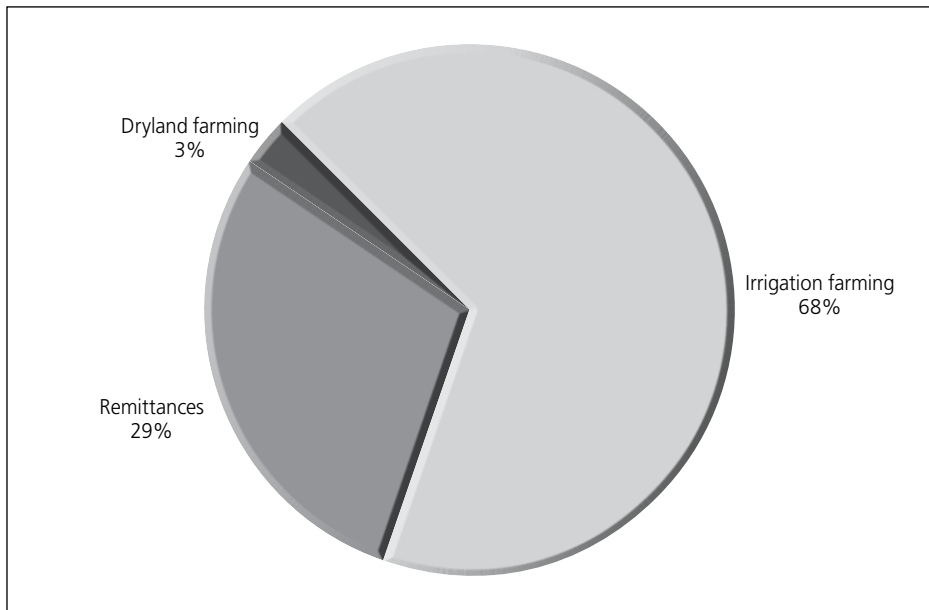
Source: Authors' Primary Data

It is this study contention that both irrigation farming and ASM are labour intensive livelihood strategies preferred by many rural folks for their rudimentary tools and techniques. However, it is important to note that ASM and Irrigation farming are not limited to rural folks.

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;

Figure 6: Livelihood Sources



Source: Authors' Primary Data

and lastly 2% for dry land farming respectively. The response rate and membership of irrigation is rather indicatively deceptive and not necessarily telling one with regards to 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. The data while noting the significance of irrigation in the drought-prone district, it is not reflective of reality on livelihood strategies prevailing in Umzingwane.

Results from the study show that there are three main livelihood sources for Umzinyathini community that list irrigation farming; remittances; and, dry land farming, all of which are complementary in their nature and thus comprise a basket of livelihood strategies also catering for seasonality challenges in each strategy. While the results above do not necessarily show cattle ranching and artisanal mining as livelihood sources, interviews and FGDs, however revealed that villagers of Umzinyathini Irrigation scheme largely depend on artisanal gold mining for livelihoods but fear mentioning it to “outsiders” for fear of being arrested since most of it is predominantly illegal. On rearing of cattle, the respondents seem not to treat rearing of cattle as a livelihoods source, but rather as a cultural identity and practice where every homestead had cattle albeit not mentioning them.

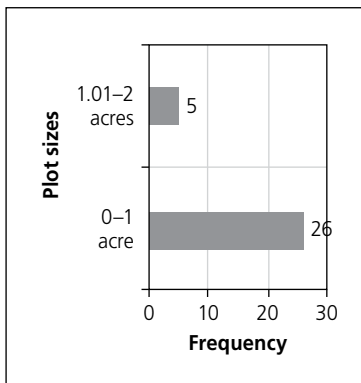
From the study emerged that the dominant sources of livelihood strategies comprised irrigation farming followed by remittances from regional and international diaspora; and lastly

dry land farming. The article argues that despite the significance of irrigation farming in the drought-prone district, it is not reflective of the 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 to the livelihood alternatives and options open to the Mawabeni Community of Umzingwane District. The study revealed that rampant ASM and rearing cattle are part of the livelihood basket though not openly identified by the households that also participate in irrigation farming. 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 as a livelihood or business. Paradoxically, the article revealed 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 most of it is predominantly illegal.

Allocated Plot Sizes

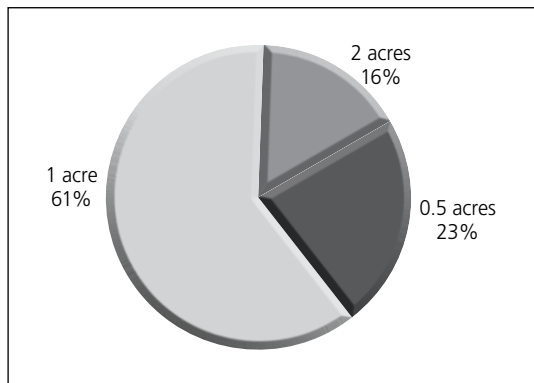
Results highlight that the majority of plot-holders who have between 0–1 acre were (84%) while those with 1.01–2 acres were represented by 16%. These plots are utilised for agricultural purposes as depicted by Figure 8. Of the acreage indicated above, the figure 9 shows that 61% of acreage was held by those with 1 acre while those with 2 acres utilise a meagre 16% and those with 0.5 acres use 23% of the total held respectively. Inputs frequently emerged as the main constraint hampering the full utilisation of land held by plot holders. However, inputs alone cannot tell the fuller story, there are other crucial forms of capital such as time and human capital in the form of man-hours spent on other livelihoods than irrigation farming, for instance artisanal gold mining, remittance collection compete in terms of time and therefore man-hours that could be potentially deployed to irrigation acreage, a form of opportunity cost.

Figure 7: Allocated Plot Sizes



Source: Authors' Primary Data

Figure 8: Plot size for Agriculture Purposes



Source: Authors' Primary Data

The study revealed that the majority of plot holders were allocated 0–1 acres, while the minority of the plot holders had plots ranging from 1.0–2 acres. Those allocated 1 acre utilised 61% of the acreage held, while those allocated 2 acres utilised a meagre 16%. Furthermore, those allocated 0.5 acres utilised 23% of acreage held. These findings reflect that the allocated plot sizes are not fully utilised at the Umzinyathini Irrigation Scheme. The study further found that lack of adequate farm inputs and competition for labour were identified as the main constraints hampering full utilisation of the land held by plot holders. Thus, the article calls for crucial forms of capital such as time and human capital in the form of man-hours spent on other livelihoods than irrigation farming, for instance artisanal gold mining, remittance collection compete in terms of time.

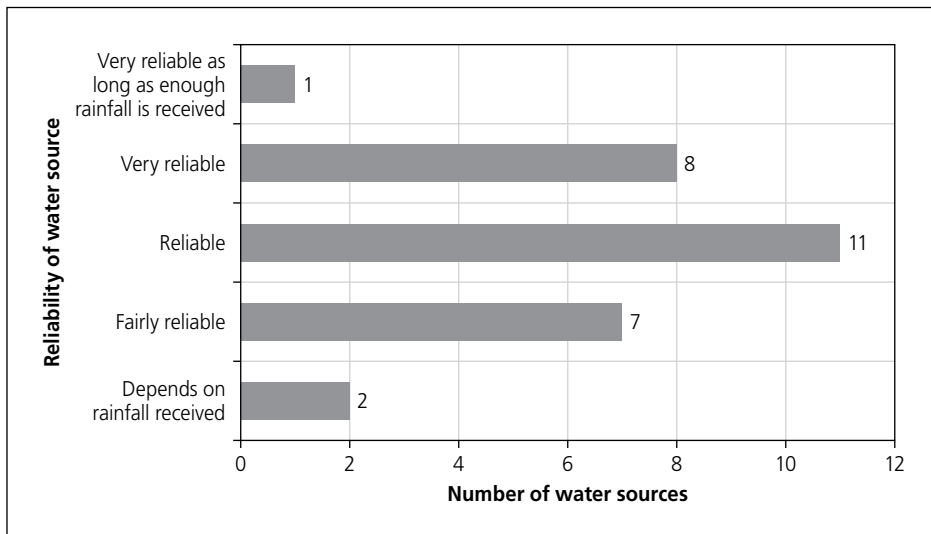
Source of Water for Irrigation Farming

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.

Reliability of Water Supply Source

Results from the study generally point to a reliable source of water supplies for the irrigation with virtually all respondents alluding to various levels of adequacy of water supplies ranging

Figure 9: Reliability of Water Source



Source: Authors' Primary Data

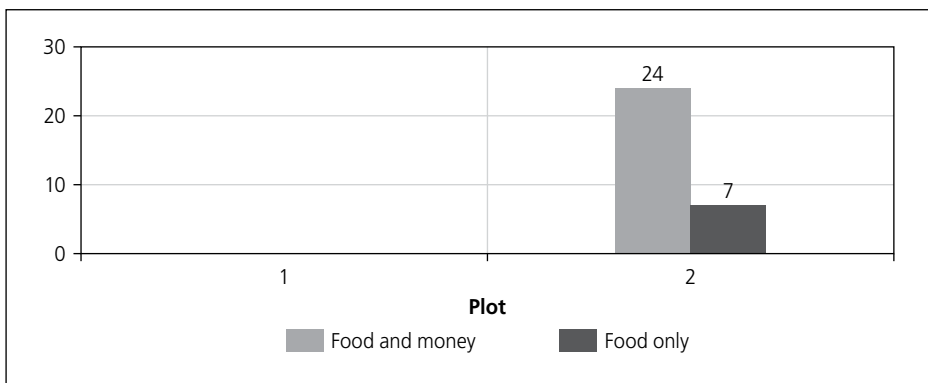
from fairly reliable, reliable, very reliable, and reliable based on rainfall received. However, Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) data indicate that the degree of water reliability at the irrigation scheme is due to a fact that Zimbabwe National Water Authority (ZINWA) also depends on the same reservoir (Umzingwane Dam) for domestic supplies to the community; hence, it ensures that there is always adequate water. However, while it emerged that ZINWA does not pay royalties to irrigation plot-holders for water drawn from their reservoir, the involvement of ZINWA in fact also aids the irrigation scheme members through sustainable water supply hence uninterrupted supplies.

The study indicated that irrigation plot holders totally relied on water drawn from Umzingwane Dam without supplementary alternatives. The study has shown that the source of water for irrigation was reliable based on the amount of rainfall received in the water catchment area. The study also established that the degree of water reliability was influenced by the fact that ZINWA also depends on Umzingwane Dam for domestic supplies to the community, hence it ensures that there is always adequate water at the bulk water reservoirs that are located in the irrigation scheme. Surprisingly, the study found that ZINWA does not pay royalties to the irrigation plot holders for water drawn from their reservoir. Despite, this situation, the study has shown that the involvement of ZINWA in fact also aids the irrigation scheme members through sustainable water supply hence uninterrupted supplies.

Benefits from Plot

Having noted the adequacy of the water supply source for the irrigation, results also indicate that 77% of the respondents get their food and income from irrigation while 23% relied on the source for the food supplies as benefits from the irrigation scheme (see figure 10).

Figure 10: Benefits from Plot



Source: Authors' Primary Data



The study has indicated that irrigation plot holders' benefits from the irrigation through income and food supplies. However, factors such as wild animals and lack of agricultural inputs which include seeds, fertilisers, tractor and disk-plough were identified as some of the major impediments to the full utilisation of the land allocated to the members. The study has also shown that the utilisation of the allocated plots could be improved through the provision of inputs and related subsidies by government and related agricultural agencies.

Impediments from Utilisation of Full Plot Area

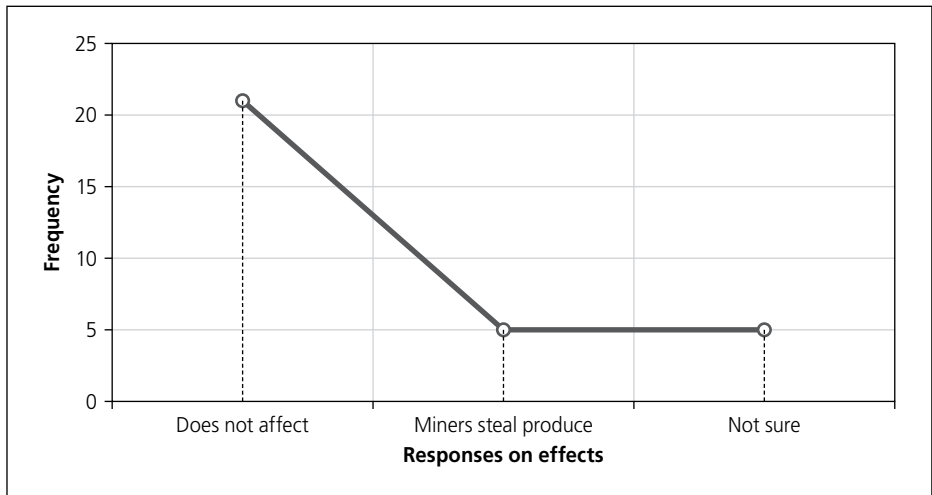
On factors limiting the full utilisation of allocated size, respondents were of the view that expanding production to use the whole plot would mean more losses to pest such as wild animals and lack of agricultural inputs to sufficiently cover the broader area of the irrigation plots, which include seeds, fertilisers, tractor and disk-ploughs. The study also sought to establish what the irrigation plot-holders felt could be done to improve the utilisation of all allocated plots and the results reflected a myriad of views bordering around provision of inputs and related subsidies by government and related agencies.

Irrigation Farming as a Livelihood Activity

Effects of Artisanal Mining at Umzinyathini

According to the Figure 11, there exist negative externalities between irrigation farming and ASM albeit with less pronounced where 21 respondents (68%) arguing that ASM

Figure 11: Irrigation Farming as a Livelihood Activity



Source: Authors' Primary Data

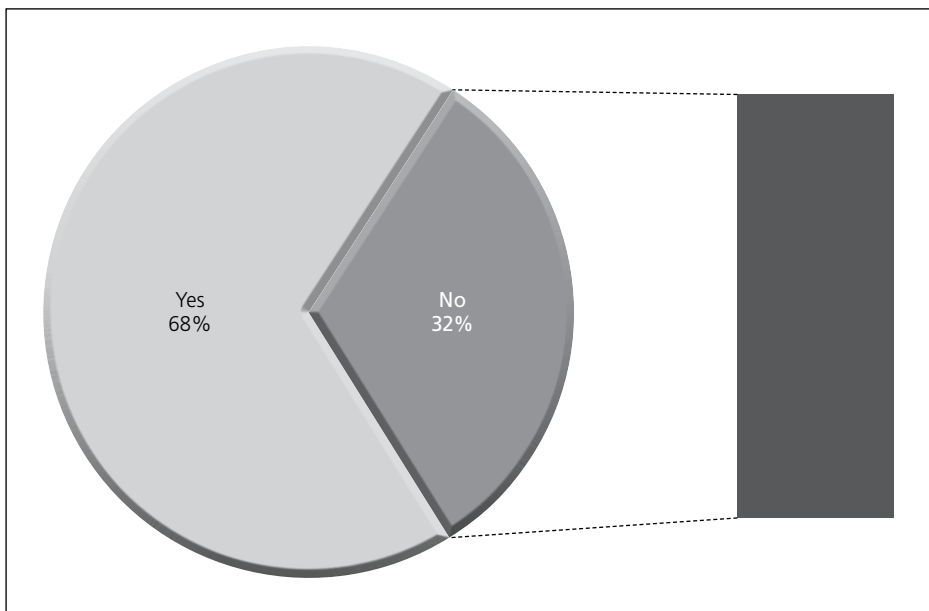
does not affect irrigation farming and 5 respondents (16%) lamented that ASM miners were stealing their irrigation produce. A further 16% said they were not sure if there was an effect from ASM.

The study found that artisanal gold mining does not directly affect irrigation farming; however, the study has shown that artisanal gold miners were stealing the irrigation produce from their plots. The study further found that there was adequate water for the community's consumption, irrigation and artisanal miners such that no amount of utilisation by one party affected the other negatively. The study has shown that water supply had been adequate at the dam to allow all-year-round irrigation farming although they were not currently using it to that extent (all-year-round irrigation) due to financial constraints to access adequate farming inputs.

Adequacy of Water Source for Irrigation, Consumption and Artisanal Mining

The study revealed that 68% of the respondents felt there was enough water for the community's consumption, irrigation and artisanal miners such that no amount of utilisation by one party affected the other negatively. Thirty-two per cent (32%) of the respondents

Figure 12: Adequacy of Water Source for Irrigation, Consumption and Artisanal Mining



Source: Authors' Primary Data

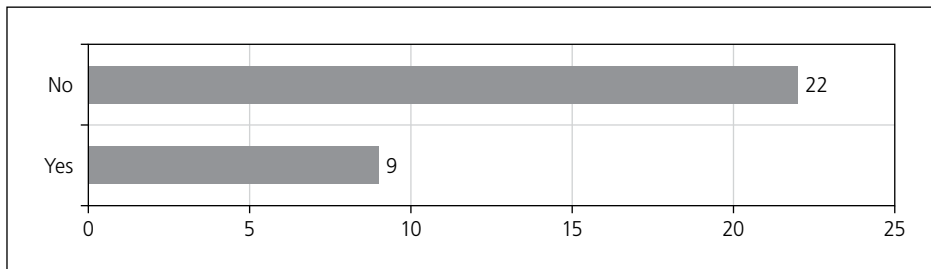
said water was not adequate to cater for all the needs of the users that include community consumption; irrigation scheme and artisanal mining activities. It also emerged from the study's empirical data that the same reservoir (Umzingwane Dam) is used by Zimbabwe National Water Authority (ZIMNWA) for service provision towards which residents paid bills, lending credible logic behind there is so far sustainable water supply.

Effects of Artisanal Mining on Irrigation Farming

Generally, respondents agreed that artisanal mining had effects on irrigation water quality. A follow up question requiring expounding generated several explanations. Respondents argued that if and when artisanal gold miners use chemicals, then at that point artisanal gold mining activities affect water quality as demonstrated by the fish they kill within the water source (Umzingwane Dam) and would even destroy crops. This, they argued once happened some time ago but was a thing of the past now. Other respondents were however not sure if artisanal gold mining activities affected irrigation water quality while other felt that it was artisanal gold miners whose activities were responsible for the massive siltation of rivers that feed into the dam (Umzingwane Dam) supplying the irrigation scheme, hence even if they did not use chemicals to wash their gold, their activities still affected the quality of irrigation water farmers received downstream. Respondents justified their responses about effects of artisanal mining on the quality of water by noting that water is piped from Umzingwane Dam to their irrigation scheme.

The study has shown that artisanal gold mining's use of chemicals negatively affects the quality of water in Umzingwane Dam, and has also negatively affected the aquatic life and crops at the irrigation scheme. Furthermore, the study indicated that artisanal gold activities were responsible for the massive siltation of rivers that feed into the dam (Umzingwane Dam) supplying the irrigation. The article argues that even if the ASM miners do not use chemicals to wash their gold, their activities still affect the quality of water farmers received downstream.

Figure 13: Effects of Artisanal Mining on Water Quality



Source: Authors' Primary Data

Competition for Labour

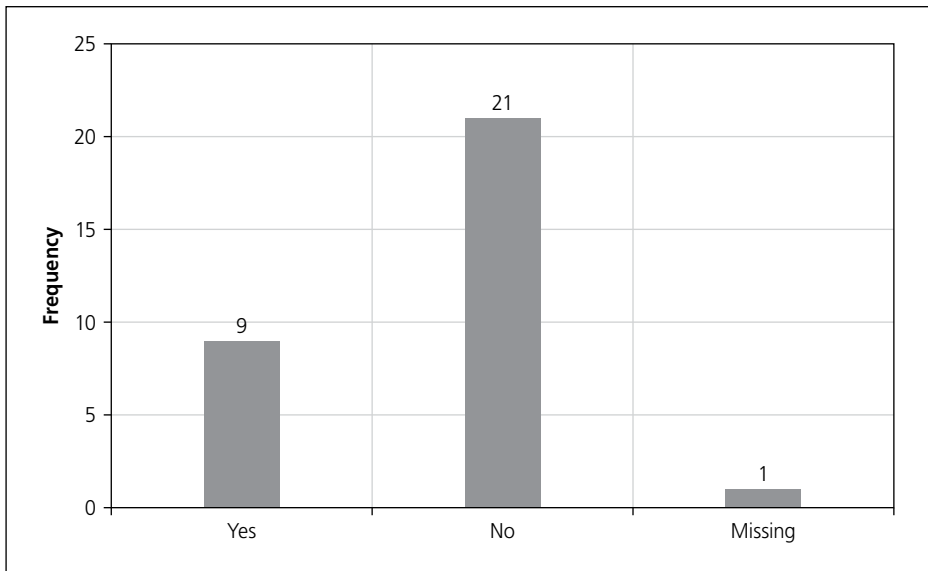
When queried on the form of competition that existed between artisanal gold mining and irrigation farming, respondents generated various explanatory views where they stated that:

“Instead of working on the plots they go for panning labour; labour- able bodied young men go to panning where there is quick money; Lack of casual labour; none; none that I know 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 with quick returns; the able bodied go to gold mining instead of farming because farming has no money; and young men go to mining instead of working in plots”.

The above highlights the fact that able bodied young men who represent potential labour for irrigation are attracted away from it by ASM which offers quicker returns than irrigation. The study also highlights the synergies between irrigation farming and ASM where a variety of views included those who felt there was dependence on money realised from ASM for irrigation inputs that include paying for casual labour (provided by ASM miners during days of scarce production), and ASM as major market for irrigation produce.

Seeing that irrigation produce is seasonal, ASM always provide source of extra labour when irrigation gets busier, for example during rainy seasons when ASM is difficult to

Figure 14: Competition for Labour: ASM & Irrigation



Source: Authors' Primary Data

undertake hence the pick of irrigation farming draws from ASM's downturns. 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. On what could be done to enhance the relationship between irrigation and artisanal gold miners, the study established that ASM miners are generally desirable among irrigation farmers for want of their income as a market for farming produce and source of casual labour during busier seasons. Otherwise, farmers would ordinarily not entertain them anywhere near the irrigation scheme for fear of their illegality and destructive activities. Irrigation farmers strongly felt an informal relationship was best as closely relating with ASM had in the past seen the destruction of water canals, siltation of the dam, and theft of their produce.

The study has indicated that there is competition for labour between artisanal gold mining and irrigation farming, where potential labour for irrigation are attracted away from irrigation farming. The study has also shown that there is a complementary relationship between artisanal gold mining and irrigation farming, where money from artisanal gold mining was used to pay labour for irrigation farming and artisanal gold miners provide the major market for irrigation produce. The study further indicated that when artisanal gold mining is difficult to undertake, artisanal gold miners provide extra labour when irrigation gets busier and sometimes the household members split into irrigation farming and artisanal gold mining by age, with younger men preferring artisanal gold mining while older generated go for irrigation farming.

Adequacy of Water for Year-Round Irrigation Farming

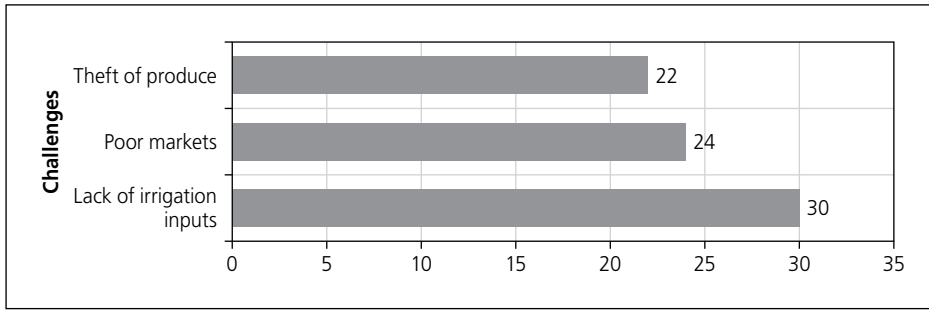
All Umzinyathini Irrigation Scheme respondents were of the view that water supply had been adequate at the dam to see the irrigation through all-year-round farming although they were not currently using it to that extent (all-year-round irrigation) due to financial constraints to access adequate farming inputs.

Challenges in Achieving Sustainable Irrigation Farming

On the challenges faced by irrigation plot holders, the study learnt that lack of agricultural inputs was a major impediment; followed closely by poor markets; and, theft of agricultural produce. These are depicted graphically below.

A follow up question probing the explanation behind the adequacy of water throughout the year generated responses that stated that water adequacy was largely dependent on rainfall received but noted that water has been adequate for the past 45 years. Some

Figure 15: Challenges faced by Irrigation Plot-holders



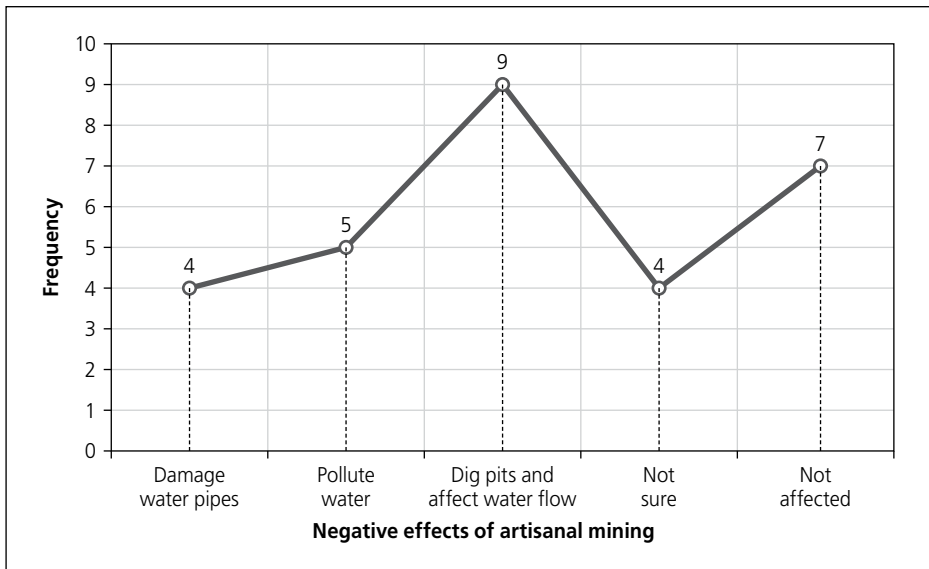
Source: Authors' Primary Data

irrigation plot holders noted that water has always been adequate as long as there was enough rainfall; the dam had adequate water in it. A mode was sought to establish the most felt challenge (recurring) limitation faced by irrigation plot holders where the most lamented challenge was that of lack of irrigation inputs (30 times) while poor markets were represented by (24 times) and lastly theft of irrigation produce (22 times) respectively.

Negative Effects of Artisanal Mining on Irrigation

On negative effects to irrigation farming emanating from artisanal gold mining, respondents had mixed views: A majority (29%) of the respondents accused artisanal gold

Figure 16: Negative Effects of Artisanal Mining



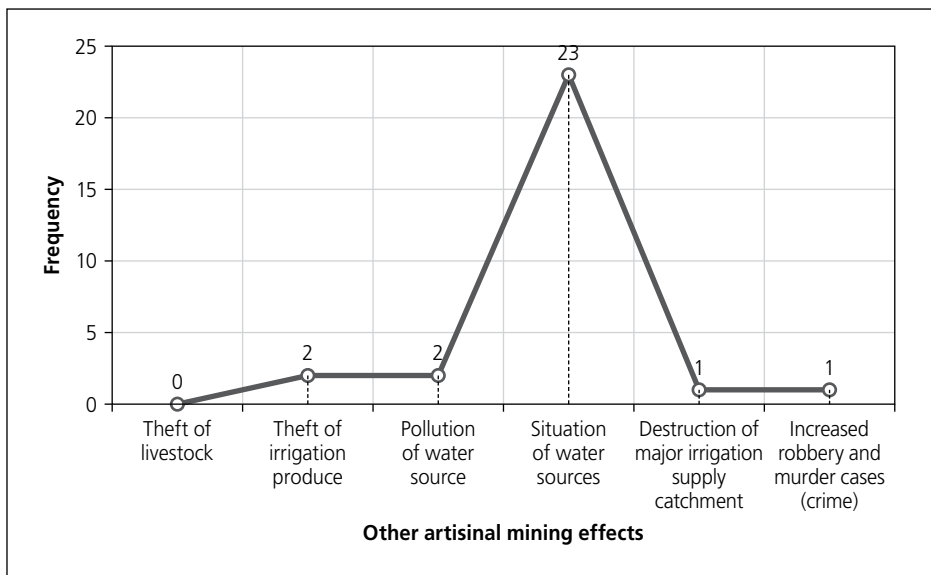
Source: Authors' Primary Data

miners of digging pits that affect water flow processes; 23% felt they were not affected by artisanal gold mining activities; 16% complained that artisanal gold miners polluted water they used for irrigation through their gold cleaning processes which involves chemicals such as cyanide and mercury among others. Lastly, 13% bemoaned the fact that artisanal gold miners damage water pipes; and not sure respectively.

Other Effects of Artisanal Mining

Artisanal mining was found to be affecting farmers in other ways than the those relating to water sources and processes as enumerated below: Incrementally, theft of livestock; theft of irrigation produce; pollution of water sources; and the most loathed effect being the siltation of water sources where ASM miners were accused of destroying major irrigation supply catchments; and, increased crime rates involving violence such as robbery and murder although periods apart.

Figure 17: Other Effects of Artisanal Mining



Source: Authors' Primary Data

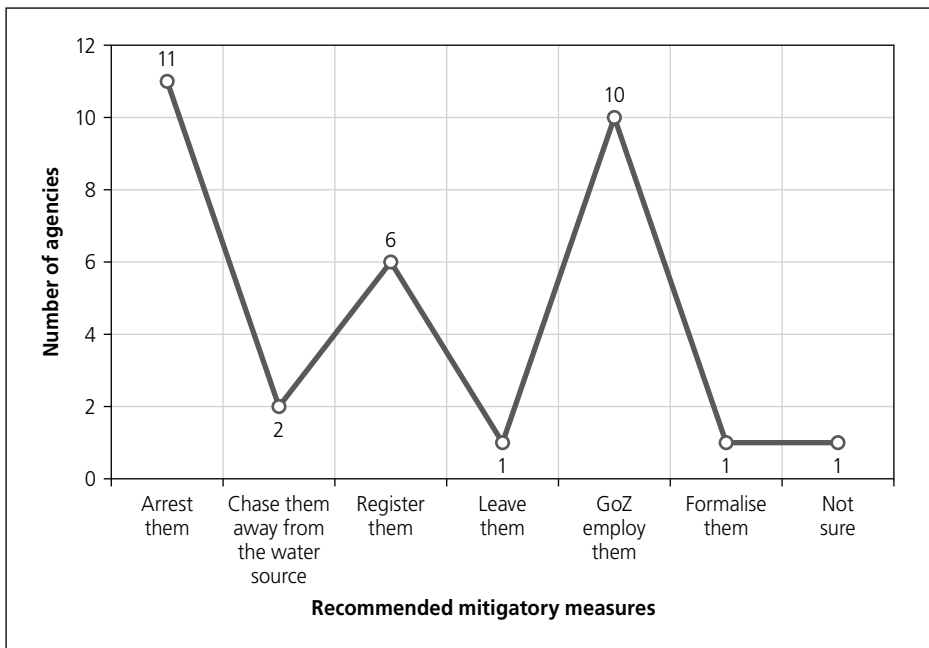
Asked if they had as irrigation farmers approached any of the Government Agencies for remedial action regarding the enumerated challenges, 97% of the respondents said they had not initiated such processes while a negligible 3 per cent of the respondents did not respond to the question hence captured as missing variables. The three per cent would probably also fall within the same category that has not initiated remedial action processes seeing that none has been proffered to date.

The study found that lack of agricultural inputs; poor markets and theft of agricultural produce were some of the major challenges faced by irrigation plot holders. The study has indicated that the negative effects of artisanal gold mining were; digging pits that affect water flow, pollution of water for irrigation through gold cleaning process which involves chemicals such as cyanide and mercury among others and similarly artisanal miners were also accused of damaging water pipes. The study noted that artisanal mining was affecting farmers in other ways than those relating to water sources and processes. Incrementally, the study indicated challenges such as theft of livestock; theft of irrigation produce; pollution of water sources; and the most loathed effect being the siltation of water sources where artisanal gold miners were accused of destroying major irrigation supply catchments; and increased crime rates involving violence such as robbery and murder although periods apart.

Measures to Mitigate Negative Externalities from Artisanal Mining Miners

For resolutions, the majority of the respondents (36%) recommended the arrest of ASM miners operating within Umzingwane Dam catchment areas as they were responsible

Figure 18: Recommended Measures to Mitigate Negative Externalities of Artisanal Miners



Source: Authors' Primary Data

for heavy siltation and therefore reduced water-holding capacity. A further 32% recommended that the Government of Zimbabwe (GoZ) must in fact employ such ASM miners. While at that, a further 16% felt the GoZ should register and formalise the ASM's operations, a feeling that was also mutual for another 3 per cent of the respondents (19%) willing to see ASM miners formalised (Government must register them plus formalise them). Other respondents were aloof to ASM, arguing there were no negative externalities known from ASM activities (3 per cent and a similar 3 per cent who said they were not sure what recommendations to make, jointly accounting for 6 per cent.

The study found that irrigation plot holders felt that the Government of Zimbabwe (GoZ) must arrest artisanal gold miners operating within Umzingwane Dam catchment areas as they were responsible for heavy siltation and therefore reduced water holding capacity. The study also indicated that GoZ must in fact employ such artisanal gold miners. The study further found that plot holders mutually felt that the GoZ must register and formalise the artisanal gold miners' operations.

The article notes that the utilisation of allocated plots ranges from 16% for capacity for 2 acres and 61% capacity for 1 acre despite uninterrupted availability of water throughout the year. It further holds that informal partnership between Umzinyathini Irrigation Scheme and ZINWA on the utilisation of water from Umzingwane Dam has resulted in sustainable water supply to the irrigation scheme and the community at large. However, the article advances that the potential of the irrigation scheme is affected by external factors such as lack of adequate farm inputs and competition for able-bodied labour from artisanal gold mining, which then pose as the main constraints hampering full utilisation of the land held by plot holders. The article, therefore, notes that there is adequate water for the community's domestic consumption, irrigation use and artisanal gold miners such that no amount of utilisation by each party currently affects the other negatively.

The article also finds that rampant artisanal gold mining and cattle rearing are also part of the basket of livelihood sources though not openly identified by the households that also participate in irrigation farming. The argument is that cattle rearing by the proudly Ndebele community of Umzingwane District of southern Matabeleland is culturally not perceived as livelihood source, but rather, as a cultural identity and practice where every homestead had cattle albeit not mentioning them. Similarly, the article argues that the villagers of Umzinyathini irrigation scheme largely depend on artisanal gold mining but fear mentioning that position to the "outsiders" for fear of victimisation by law enforcement agents since most of it is predominantly illegal. The article further notes that although the Irrigation Management Committee resolves conflict between and among the scheme members, they are ineffective as they have failed to establish lucrative markets for the

irrigation produce. It also appreciates that irrigation activities are executed within jurisdiction and governance domain of traditional leaders, however, their role is not clearly defined in the agenda of propelling Umzinyathini's productive target. The article holds that locally based extension officers from the Ministry of Lands, Mechanisation and Extension Services and 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.

The new kid on the block has resulted in the radical shift of able-bodied labour from irrigation farming to artisanal gold mining which negatively affects the productive capacity of the irrigation scheme. Therefore, the study finds that artisanal gold mining affects the irrigation farmers' production in a multiplicity of ways. The article holds these as siltation of water sources, pollution which affect the water quality for irrigation and consumption through gold cleaning process which may involve the use of mercury, damage to water pipes, theft of irrigation produce, and destruction of the major irrigation supply catchments.

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CONCLUSION AND POLICY RECOMMENDATIONS

The article concludes that Umzinyathini Irrigation Scheme is utilised by mostly married members though widows and widowers also participate actively in the scheme as part of their livelihood activities. It 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. Although irrigation farming, remittances from regional and international Diaspora and dry land farming were identified as the dominant livelihood strategy, the article concludes that it is practically deceptive and not depicting reality with regards to the livelihood alternatives and options open to the Mawabeni Community of Umzingwane District.

The article recommends for adequate provision of agricultural inputs, funding, effective and focused capacity development of the irrigation plot holders, provision of reliable transport system, professional business-oriented horticultural mentoring, aggressive marketing of the irrigation scheme through social networks and agro-based connections with farming inputs are some of the strategies that can propel the irrigation scheme to a more productive cropping path that have never been seen in the southern Matabeleland region. Finally, the article recommends for a community based governance structure for both irrigation farming and artisanal gold mining since both are strategies for enhancing livelihoods for rural communities. This noble move could motivate the community members to enforce environmentally friendly methods and best mining practices that do not result in environmental degradation and pollution of water sources in the catchment area.

ACKNOWLEDGEMENTS

The authors extend their appreciation of National University of Science and Technology (NUST) Research Board for funding the field work. Thanks to the Umzingwane Rural District Council, District Administrator and Sector Ministries, whose officials contributed to insights into the study. An appreciation also goes to Jester Dube, an Agricultural Extension Officer under the Ministry of Agriculture, who assisted with data collection.

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