Making Growth Inclusive: The role of mining in the post-2015 development agenda for Africa

David Doepel
Chair, Africa Research Group
Murdoch University
COMMON AFRICAN POSITION (CAP) ON THE POST-2015 DEVELOPMENT AGENDA

- Structural economic transformation and inclusive growth
- Science Technology and Innovation
- People Centred Development
- Environmental sustainability, natural resource management and disaster management
- Peace and Security
- Finance and Partnerships
COMMON AFRICAN POSITION (CAP) ON THE POST-2015 DEVELOPMENT AGENDA

• Structural economic transformation and inclusive growth
• Science Technology and Innovation
• People Centred Development
• Environmental sustainability, natural resource management and disaster management
• Peace and Security
• Finance and Partnerships
Pillar One: Structural economic transformation and inclusive growth

Inclusive growth that reduces inequality
Sustainable agriculture, food self-sufficiency and nutrition
Diversification, industrialization and value addition
Developing the Services Sector
Infrastructure development
K. C. Chakrabarty, former Deputy Governor of RBI.

Inclusive growth as the literal meaning of the two words refers to both the pace and the pattern of the economic growth.

Inclusive growth approach takes a longer term perspective as the focus is on productive employment rather than on direct income redistribution, as a means of increasing incomes for excluded groups.

Inclusive growth may also make the poverty reduction efforts more effective by explicitly creating productive economic opportunities for the poor and vulnerable sections of the society.
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- **WHITE**
  - All Day Freshness
  - Antibacterial Deodorant Bar Soap

- **SPRING WATER®**
  - All Day Freshness
  - Antibacterial Deodorant Bar Soap
INCORPORATED UNDER THE LAWS
OF THE STATE OF CALIFORNIA
**Wells Fargo & Company (WFC) - NYSE**

**47.86 ↓ 0.39 (0.81%)** Feb 5, 4:01PM EST

After Hours: **47.86 0.00 (0.00%)** Feb 5, 7:44PM EST

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<td>EPS (ttm):</td>
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<tr>
<td>Div &amp; Yield:</td>
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Quotes delayed, except where indicated otherwise. Currency in USD.
Perth to Adelaide
Lack of water necessitated the use of dry blowing to separate gold and soil.

Courtesy of West Australian Newspapers uncredited images from archival and contemporary sources.
GOVERNMENT CONDENSERS, COOLGARDIE.

(Coolgardie Goldfield's)
JOHNNIE'S LITTLE TOY

Johnnie wanted something to play with,
Something to hang on the wall,
Something that he might be proud of,
And so he has ruined us all.
Shewing Two Pipes jointed together.
Grain Harvest in 2013 15.1 million tonnes – record year
3 cubic kilometres
50 million ozs gold
“Using Natural Resource Wealth to Improve Access to Water and Sanitation”

Ryan Admiraal¹, Ana Rita Sequeira¹, Mark McHenry¹, David Doepel¹, Lário Hercúlano², Fraydson Conceição², Amélia Monguela², Kevin Urama³, Ornélie Manzambi³

¹Murdoch University, Australia
²University of Eduardo Mondlane, Mozambique
³Quantum Global Research Lab, Switzerland

• Support for fieldwork provided by:
  Administration of Water Supply and Sanitation Infrastructure (AIAS)
  Provincial Directorate of Public Works and Housing (DPOPH) of Nampula
WHO strengthens focus on water, sanitation and hygiene to accelerate elimination of neglected tropical diseases

STOCKHOLM, GENEVA | 27 August 2015 – The World Health Organization (WHO) today unveiled a global plan to better integrate water, sanitation and hygiene (WASH) services with four other public health interventions to accelerate progress in eliminating and eradicating neglected tropical diseases (NTDs) by 2020.

“Millions suffer from devastating WASH-related neglected tropical diseases – such as soil-transmitted helminthiasis, guinea-worm disease, trachoma and schistosomiasis – all of which affect mainly children” said Dr Maria Neira, WHO Director for Public Health, Environmental and Social Determinants of Health.

“Solutions exist, such as access to safe water, managing human excreta, improving hygiene, and enhancing targeted environmental management. Such improvements not only lead to improved health, but also reduce poverty.”
The Importance of Improved Water, Sanitation, and Hygiene in Developing Countries

**Health Impacts:**

<table>
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<th>Rank</th>
<th>Cause of Death</th>
<th>Number of Deaths</th>
<th>Percentage of Deaths</th>
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<tr>
<td>1</td>
<td>HIV/AIDS</td>
<td>1,088,000</td>
<td>11.7%</td>
</tr>
<tr>
<td>2</td>
<td>Lower respiratory infections</td>
<td>1,039,000</td>
<td>11.2%</td>
</tr>
<tr>
<td>3</td>
<td>Diarrhoeal diseases</td>
<td>603,000</td>
<td>6.5%</td>
</tr>
<tr>
<td>4</td>
<td>Malaria</td>
<td>554,000</td>
<td>6.0%</td>
</tr>
<tr>
<td>5</td>
<td>Stroke</td>
<td>437,000</td>
<td>4.7%</td>
</tr>
</tbody>
</table>

Table: Leading causes of death in Africa Region *(World Health Organization 2012).*
The Importance of Improved Water, Sanitation, and Hygiene in Developing Countries

**Economic Impacts:**

- Savings in terms of health costs alone making investment in water, sanitation, and hygiene (WASH) cost-effective, particularly in those regions where incidence of diarrhoeal diseases are a leading cause of death (*Evans et al.* 2004).

- Even under pessimistic data assumptions, the total socio-economic benefits of water supply and sanitation interventions outweigh the costs in all developing world regions. For the Africa region, the benefit-cost ratio (BCR) is estimated to range between 2.1 and 5.7 (*Hutton et al.* 2007), and for Mozambique *Hutton (2012)* estimates the BCRs for interventions required to reach the Millennium Development Goals (MDGs) to be 3.3 for water and 1.71 for sanitation.

- For Mozambique, the International Monetary Fund (IMF) estimates that at least 1.2% of GDP is lost per year due to inadequate sanitation (*Armas 2014*).

- Less time missed from work, greater educational opportunities,
The Water and Sanitation Situation in Mozambique

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<td>Rural</td>
<td>40%</td>
<td>54%</td>
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<tr>
<td>Urban</td>
<td>30%</td>
<td>60%</td>
</tr>
<tr>
<td>Improved Sanitation:</td>
<td></td>
<td></td>
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<tr>
<td>Rural</td>
<td>25%</td>
<td>39%</td>
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<tr>
<td>Urban</td>
<td>38%</td>
<td>50%</td>
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Table: Estimates of improved water and sanitation usage for rural and urban areas as estimated by the Republic of Mozambique (2010) and World Health Organization-UNICEF Joint Monitoring Program (2013)
The Need for Investment in Water and Sanitation

• Mozambique is ranked 178 out of 187 countries on the 2013 Human Development Index (Human Development Report Team 2014).
• Mozambique's infrastructure needs are among the highest in Southern Africa with a significant increase in spending needed to address deficiencies (Domínguez-Torres and Briceño-Garmendia 2011).
• Mozambique is in desperate need for an increase in WASH services and their sustainability (Montgomery et al. 2009). Hutton (2012) suggests that Mozambique would need to spend roughly $1 billion USD annually to meet and sustain the MDG targets for water supply and sanitation.
• Rural and peri-urban areas tend to be unattractive investment destinations for private WASH projects unless they are bundled with other investments (Budds and McGranahan 2003).
What Does this Have to Do With the Extractive Industries?

• Mozambique has seen steady economic growth over the last decade with an average growth in GDP of 6.85% per annum and a growth of more than 7% every year since 2010. Over that time period, natural resource rents have comprised an average of 14.98% of GDP (World Bank 2015).

• Over the period 2011-2014, it was anticipated that mining would roughly triple in value from 5,022 million MZN ($118.2 million USD) to 14,978 million MZN ($352.4 million USD). Massive reserves of liquefied natural gas (LNG) deposits in the offshore Rovuma Basin are anticipated to boost this significantly with production estimated to commence in 2019 with full-scale production being reached by 2036 (Segura et al. 2014).

• Mozambique has significant opportunity to use this natural resources wealth to address its infrastructure needs, particularly in the areas of water and sanitation.
What Does this Have to Do With the Extractive Industries?

• Mining activity frequently occurs in regions where nearby communities have insufficient access to clean water and improved sanitation.

• Mining is a water-intensive endeavour, particularly for lower grade ores, so it has the potential to affect water availability and quality for local communities if not managed appropriately (Szyplinska 2013, Global Water Intelligence 2011a).

• Mining and associated economic activity can lead to rapid population growth (ABS 2007, Petkova et al. 2009, Carrington and Pereira 2011). These effects can be far-reaching (e.g. Beira Corridor, Nacala Corridor).

• Mining projects increasingly must invest in water infrastructure for their needs. It is estimated that global spending on water infrastructure by mining companies over the period 2011-2014 will have doubled from $7.7 billion USD to $13.6 billion USD (Global Water Intelligence 2011b).
The Small Towns Water, Sanitation and Hygiene Programme in Nampula

NAMWASH
• Formed through a joint partnership of:
  • Australian Government
  • UNICEF Mozambique
  • Government of Mozambique

• Implemented by:
  • UNICEF Mozambique
  • Administration of Water Supply and Sanitation Infrastructure (AIAS)
  • Provincial Directorate of Public Works and Housing (DPOPH) of Nampula

• Ran from January 2012 to June 2014 and included varied WASH interventions benefitting five towns (peri-urban) along the Nacala Corridor that are anticipated to experience significant growth over the next 25 years.
Sanitation and Hygiene Promotion in Ribáuè

Sanitation and hygiene interventions included a community-led total sanitation (CLTS) and participatory hygiene and sanitation transformation (PHAST) approach, leading to:

- 1,170 improved latrines (with appropriate superstructure and handwashing station) built by households,
- 25 disability-specific latrines, and
- gender- and disability-specific latrines for four schools, three public markets, and the Ribáuè Rural Hospital and Namiconha Health Centre
Piped Water in Ribáuè

Rehabilitation and expansion of piped water gravity-fed system consisting of:
• rehabilitated dam to supply water to the town,
• rehabilitated 100 m³ water tower in the town centre,
• 5 km of large diameter pipe for main pipeline,
• 11 km of small to medium diameter PVC pipe for distribution network, and
• rapid filtration water treatment plant, along with chlorine dosing equipment.

Delivery to households in the form of:
• 170 yard taps and
• 10 water kiosks
• direct connections to roughly 45 businesses and public service/council facilities
Primary Sanitation Facility Usage for Ribáuè
Primary Water Point Usage for Ribáuè
Impacts to the Community of Piped Water to the Home

- 66.86% of households in Ribáuè stated willingness to pay (WTP) for water piped to the yard with mean maximum WTP of 109.71 (105.39, 114.03) MZN per month. (Total WTP for the town is estimated at 4.66 million MZN annually.)
  - According to current tariffs, this would support a consumption of 109.05 liters of water per day (∼ 1 jerrycan per capita), slightly higher than reported average consumption of 107 liters per day.

- Pickering and Davis (2012) found that a 15 minute reduction in travel time is associated with a 41% average relative reduction in incidence of diarrhoea and an 11% relative reduction in mortality for children under the age of five.

- Cairncross and Valdmanis (2006) argue that provision of a public water point has little if any impact on health, but simply moving water to the yard (regardless of water quality) has significant health benefits, including a significant reduction in incidence of diarrhoea.
Impacts to the Community of Piped Water to the Home

• **Hutton and Haller (2007)** estimated that, as of 2004, incidence of diarrhoea was responsible for children missing 272 million days of school annually.

• For girls alone, **Hanushek and Woessmann (1999)** estimate that each year of additional schooling leads to an increase of 0.58 percentage points in GDP.

• **Dollar and Gatti (1999)** estimate that a 1% increase in secondary schooling is associated with a per capita increase of 0.3% in income.
  • Based on reported income data for Ribáuè, a 1% increase in secondary schooling from current levels would correspond to a per capita increase in income of 0.34%.
Impacts to the Community of Piped Water to the Home

• Far more substantial gains are realised strictly from “convenience time,” the time saved from not having to travel to collect water (Hutton et al. 2007).
  • This disproportionately affects adult women (more than 75% in each location).

• Using the methodology of Hutton (2012), benefit-cost ratios (BCRs) were calculated for the town of Ribáuè that incorporated the opportunity cost associated with time spent collecting water, lost time from work due to diarrhoeal diseases, loss of productive working years due to lower life expectancy, and cost of medical services for diarrhoeal diseases.
Summary

• Not only is investment in water supply and sanitation a great need because of health implications, but it can also have important economic impacts, and based on estimated BCRs, we would estimate that minimally water supply interventions for peri-urban communities would be cost-effective, and it is likely that integrated WSS interventions would either recover or nearly recover the cost of implementation.

• Mining activity commonly occurs near and impacts communities that have some of the greatest need for water supply and sanitation improvements.

• The significant revenue brought by mining royalties and taxes provides a great opportunity to benefit communities.

• Direct involvement of extractive industry entities in WASH partnerships with governments and other agencies has the potential to further improve WASH cost effectiveness and sustainability.
Fiscal and regulatory policies for mine closure and post-mining legacy

Focus countries: Ghana, Kenya, Mozambique, Nigeria, South Africa, Tanzania, Zambia

Angus Morrison Saunders\textsuperscript{1,2}, Mark P McHenry\textsuperscript{1}, Ana Rita Sequiera\textsuperscript{1}, Hudson Mtegha\textsuperscript{3,1}, Phil Gorey\textsuperscript{4,1}, David Doepel\textsuperscript{1}

\textsuperscript{1}Murdoch University, Western Australia
\textsuperscript{2}North-West University, South Africa
\textsuperscript{3}University of the Witwatersrand, South Africa
\textsuperscript{4}Dept. of Mines and Petroleum, Western Australia

Australia-Africa Minerals Energy Group – additional collaborator
Key Themes

Physical considerations:
• What role do geo-technical conditions play in mine closure planning and post-mining land-use?
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• What role do geo-technical conditions play in mine closure planning and post-mining land-use?

Co-production potential
• Can mine dewatering be used for agriculture?
• Can mining infrastructure be used by community?
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• What role do geo-technical conditions play in mine closure planning and post-mining land-use?

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Procedural considerations:
• How can capacity for mine closure planning/implementation be harnessed efficiently?
Key Themes

Physical considerations:
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Co-production potential
• Can mine dewatering be used for agriculture?
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Procedural considerations:
• How can capacity for mine closure planning/implementation be harnessed efficiently?

Fiscal regime:
• What financial provisions are utilised for mine abandonment contingency?
Key Themes

Physical considerations:
• What role do geo-technical conditions play in mine closure planning and post-mining land-use?

Co-production potential
• Can mine dewatering be used for agriculture?
• Can mining infrastructure be used by community?

Procedural considerations:
• How can capacity for mine closure planning/implementation be harnessed efficiently?

Fiscal regime:
• What financial provisions are utilised for mine abandonment contingency?

Long-term land-use considerations:
• What is the long term post-mining legacy vision?
Physical: geo-technical conditions determine mine-closure success – 1

La Mancha gold mine rehabilitation for cattle grazing (Kalgoorlie region, Australia)

- difficult / slow progress
- shallow slopes (14-16°)
- low rainfall (260mm)
- ripping stops erosion, retains moisture, better plant growth
- [groundwater is saline]
Physical: geo-technical conditions determine mine-closure success – 2

- easy / natural regeneration is successful
- steep slope
- no special treatments
- all vegetation is natural re-growth!

Ramelius gold mill rehabilitation (Kalgoorlie region, Australia)
**Physical: successful rehabilitation example**
- Alcoa bauxite mining, Western Australia

Progressive rehabilitation to restore jarrahforest
- ongoing operations (public-owned forest resource)

Alcoa Australia successfully re-establishes a self-sustaining jarrah forest on rehabilitated mine areas, such as this former mining area at the Huntly Mine. Alcoa Australia has created the richness of plant species equal to the surrounding forests - a strong example of Alcoa’s commitment to sustainable development.
Co-production: Can mine dewatering be used for agriculture? – 1

Agriculture in Africa – Just add water(?)

[If mine dewatering could be used for agriculture, it could transform regional economies and provide important food security]
Co-production: Can mine dewatering be used for agriculture? – 2

Hamersley Agricultural Project (Pilbara region, Australia) surplus water from Marandoo iron ore mine
• 835ha of irrigated pasture for cattle
• + water supply for Tom Price township
• estimated mine life = 20 years
**Co-production:** Making use of mine dewatering is mine-site specific

Mine water treatment is an important research area
- many technologies/processes in development
- situation depends on physical/chemical characteristics

Acid mine drainage remediation options: a review

Copper removal from effluents by various separation techniques

MONO/DI-AMMONIUM PHOSPHATE FERTILISERS AS DRAW SOLUTIONS FOR FORWARD OSMOSIS DESALINATION

Heavy metals (Cd, Pb, Cu, Zn) in mudfish and sediments from three hard-water dams of the Mooi River catchment, South Africa
Co-production: Can former mining infrastructure be used by the community?
Former coal mining (Rietspruit, South Africa)

Ongoing challenges:
• creating job opportunities
• maintaining services (e.g. road maintenance, rubbish collection, water supply)

Aerial view during operations (2001)

Local people now live in former mine-worker houses
Procedural: capacity for mine closure planning/implementation

Common theme throughout research:

• In all 7 African nations, governance capacity was identified as a key concern (+ literature for the whole continent)
• This is also true for Australia!
• Environmental leading practice is in the first instance the responsibility of the mining company
  • key role of government/community is to verify compliance with regulation and agreed performance
**Procedural: cooperative governance**

Efficient use of available government capacity, Western Australia

- combined Mining/Environmental agency mine-closure guidelines
  - overlaps are avoided
  - each agency may set legal conditions

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**Memorandum of Understanding**

between the

Department of Mines and Petroleum

and the

Environmental Protection Authority

in relation to the referral of

Mineral and Petroleum (Onshore and Offshore) and

Geothermal Proposals
Mining bonds commonly used worldwide (and used in Western Australia until 2013)

The bonds system does not cover the true cost of rehabilitating abandoned mines, and increasing bonds to cover the full rehabilitation costs would impose a significant financial impact upon the mining industry'. [estimated only 25-30% of actual rehabilitation costs]

Bonds discourage investment by tying up significant funds that could be used for developing a mining project and also have to be applied to the specific mine for which the security is held, they cannot be used to address the problem of legacy abandoned mines'
Fiscal: financial contingency for future abandoned mine-sites – central fund

Mining Rehabilitation Fund (WA)

- each mining company pays a 1% of rehabilitation liability estimate per tenement into central fund
  - former bonds returned to miners >> stimulates economy?
  - facilitates progressive rehabilitation
- government can use any money in fund to rehabilitate abandoned mines
- policy developed in consultation with mining industry
Fiscal: financing rehabilitation of legacy mine-sites – central fund

Mining Rehabilitation Fund (Western Australia)

- interest used to rehabilitate legacy and abandoned mine sites
8.2.3.2 Trends in water quality

pH varied slightly throughout the year, but was higher in the bottom waters during stratification (Figure 19). This suggests that some SRB activity may be occurring.

The erratic changes in pH over the seasons may be influenced by the extraction of large quantities of water for testing purposes for the new Collie PowerStation. The conductivity may also be influenced by water extraction, although during stratification, evapo-concentration of the epilimnion is probably responsible for the differences between top and bottom (Figure 19).

Collie region, Australia – former coal mines

- water is scarce – 15 new lakes
- small catchments, deep water, low nutrients, acidic (pH 3-4)
- high in metals (Al, As, Cd, Fe, Hg, Mn, Ni, Pb)
- recreational use (e.g. camping, boating, swimming)

Figure 18. Aerial photograph of Blue Waters taken from Google Earth (imagery dated 2007/2008).

- health impacts – sore eyes, skin irritations/rashes, headaches, sore throats
- when Local Government close access, local people destroy fences and enter anyway

Plate 1. Recreation users from Collie camping, riding, swimming and marroning around Lake Black Diamond, November 2009.
Long-term land-use: Consider the social and environmental legacy of mining

Kalgoorlie Superpit (gold mine), Western Australia

- pit has engulfed much of former city of Boulder
- mining to end in 2016 – What should be done?

3.5km x 1.5km, 570m deep (3 cubic km) hole
- mine began as alluvial (artisanal) mining 110 years ago, then shafts, then giant open cut (from 1980s); >50M ounces of gold produced
Fiscal & regulatory policies for mine closure and post-mining legacy – Conclusions

Physical – understand geo-technical conditions to know what is possible post-mining

Co-production can succeed (e.g. use of water & infrastructure) but careful planning is needed

Procedural – maximise governance capacity efficiency

Fiscal – viable financing strategy for abandoned and legacy mine sites needed

Long-term land-use and legacy vision needed from start of mining enterprise
Bread and Stones: The Nexus Between Mining and Agriculture and How it Can Be a Positive Alliance

Part I: Equitable economic opportunities from rural mining and agricultural development

Emmanuel B Sonaiya¹, Mark P McHenry², Sola A Ajayi¹, David Doepel².
¹Obafemi Awolowo University, Osun State, Nigeria; ²Murdoch University, Western Australia.

In addition we acknowledge the support of Australia-Africa Mining and Energy Industry Group (AAMIG), the Crawford Fund, the University of the Witwatersrand, and Andalusian Mining.
Linked to the African Mining Vision Action Plan (Cluster 8)

• “...linkages between the mining and other economic and social activities are not well developed in the African mineral industry, with the exception of the transport and energy sectors.”

• One opportunity is to create deep linkages between miners and the agricultural sector during all phases of the mine.
Research Questions

What are effective modes of mutual engagement in Africa between mine operations and local agricultural interests to create new and enduring opportunities for local agricultural supply chains?

What are the major impediments to local food procurement for the extractive industries?

Can the presence of an exploration and/or mining activity jump-start agricultural development and serve as a foundation for the creation of a diversified commercial agricultural sector?
Osun State is in southwestern Nigeria, an area of 9,251 square kilometers and home to 3,423,535 people (2006 Census).

Figure by Marcel Krüger
Project Outline

• A comprehensive survey-based social mapping exercise was undertaken in the host communities around Australian controlled gold mining tenements.
• The survey incorporated demographic questions to determine the characteristics of the rural communities.
• The farming systems, markets, and agricultural supply chains in the area were ascertained.
• Opportunities for cross-linkages between the extractive industries and agriculture were explored.
• Quantitative data were collected with the use of a pre-tested and well-structured questionnaire administered to 1293 respondents.
• Qualitative data were collected with the use of focus group discussions and (FGDs) and Key Informant Interviews (KII).
• Thirty FGDs and KIIIs each were conducted in the host communities.
Mean age of respondents was around 50 as youth migrated to urban areas for greater opportunities.

The vast majority of respondents stated their annual income was around US$1,000.

26% of the respondents had no formal education, 33% had primary, 33% secondary, while only 8% had tertiary education.

Houses were largely simple small mud houses with very little in modern conveniences.

44% of respondent defecated in open areas due to lack of sanitation facilities.
• 73% of the residents used wells and 51% used boreholes for drinking water.
• 68% of residents also used streams, and in the dry season walking distances were a challenge.
• $\approx 33\%$ of the communities had no functional market, with the mean distance to the nearest market 3km.
• $\approx 66\%$ of functional markets are open spaces without structures/amenities, and 98% of the markets take place at only 5-7 day intervals.
• Only a quarter of roads were categorized as “good”.
Project Findings Summary

• Farming (traditional) is the primary occupation of 70% of the community. Only 22% were artisans.
• ≈90% of the respondents farmed areas <10 ha.
• Food staples were mixed with cocoa and oil palm.
• Vegetable farming is non-existent (despite high use of peppers, tomatoes, onion, okra, “greens”, etc.).
• External input use is almost non-existent.
• Livestock farming is largely non-commercial goat, sheep, and chickens reared for cultural events rather than a daily ration.
Project Findings

Summary

• Level of awareness about artisanal gold mining in the communities is very high but the level of stated personal involvement is less than 5%.

• There is a high level (>80%) of skepticism about the potential derivable benefits from up-scaled/industrial gold mining in the area.

• ≈80% of respondents did not think large-scale mining will negatively impact air, water, their livelihood, culture, religion, security, housing, agricultural and forest resources.
Opportunities

- The widespread use of “snake tomato”, (*Trichosanthes cucumerina* L.) as a traditional local leaf vegetable and fruit that is highly nutritious with beneficial phytochemicals. As the name suggests, it can displace imported tomato, and is suitable for preserving as paste.
- Commercial mining infrastructure offtake agreements may bolster local post-harvest processing and production.
- There is potential for suitable hand tool mechanisation for aging smallholders with/out access to the electricity grid.
- The availability of (largely itinerant) labour for artisanal mining provides an advantage in terms of rural labour availability (for large mines and farms).
Results & Emerging Issues

What are effective modes of mutual engagement in Africa between mine operations and local agricultural interests to create new and enduring opportunities for local agricultural supply chains?
Due to the largely traditional methods of farming and low level of existing agricultural infrastructure, intermediary farming organisations and grower groups will likely be required to achieve agricultural supply quality and quantity advancements.

What are the major impediments to local food procurement for the extractive industries?
Local subsistence production and lack of horticultural experience in supplying the current demand for vegetables. Relatively poor demographics and level of education in communities that reflect aging populations and limited youthful labour markets.
Can the presence of an exploration and or mining activity jump-start agricultural development and serve as a foundation for the creation of a diversified commercial agricultural sector?

Yes, but it is highly dependent on the capacity and opportunities of the existing community.

There are nuances to the existence of the significant artisanal mining activity in these communities and their financial ties with local farmers. Management of the large expectation of a commercial miner to provide rural facilities that are generally the responsibility of governments. The local existing capacity to create an autonomous level of rural economic development is limited. Creativity will be required.
Bread and Stones: The Nexus Between Mining and Agriculture and How it Can Be a Positive Alliance

Part II: Extractive industry and agricultural supply chain productivity and development

Emerson Zhou¹, Mark P McHenry², David Doepel²

¹Beira Agricultural Growth Corridor (BAGC), Mozambique; ²Murdoch University, Western Australia.

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The Beira Agricultural Growth Corridor (BAGC) is a partnership between the Government of Mozambique, private investors, producers organisations, and international agencies aimed at boosting agricultural investment and promote agribusiness along the Beira corridor. (Tete, Sofala, and Manica).
Horticultural projects in Vanduzi, Manica Province, and Fonte Boa, Tsangano District in northern Mozambique. The projects work with smallholder producers who are members of farmer associations. Both locations are ideal for horticulture production:

The selection criteria for farmer associations included the need for:
• Farmer associations with access to land.
• Access to irrigation water to facilitate year-round horticultural production.
• Interest and motivation.

Crop selection was guided by an agribusiness paradigm, and for this presentation, a focus on a selection of the prospective crops under analysis: potato, lettuce, carrot, and onion. There is access to markets is through intermediaries that in turn sell mining enterprises in Pemba, Tete, and Nampula.
Some more results of the trials

<table>
<thead>
<tr>
<th></th>
<th>GM/TVC ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potato</td>
<td>2.85</td>
</tr>
<tr>
<td>Tomato</td>
<td>0.65</td>
</tr>
<tr>
<td>Covo</td>
<td>2.54</td>
</tr>
<tr>
<td>Cabbage</td>
<td>0.5</td>
</tr>
<tr>
<td>Carrot</td>
<td>2.77</td>
</tr>
<tr>
<td>Onion</td>
<td>2.73</td>
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</tbody>
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Results & Emerging Issues

What are effective modes of mutual engagement in Africa between mine operations and local agricultural interests to create new and enduring opportunities for local agricultural supply chains?

Through intermediary organisations and grower groups to assist supply quality and quantity improvements.

Need to break volume: Limited absorption capacity of market intermediaries.

What are the major impediments to local food procurement for the extractive industries?

Local food producers can meet global procurement standards cost-effectively.

Demand at the level of the mines has been variable. Recent downsizing of labour force due to external forces (falling coal prices, and uncertainty with oil and gas projects in Pemba).
Can the presence of an exploration and or mining activity jump-start agricultural development…?

Yes, but it requires collaboration and dedication from both sectors, with communication of the needs of both growers and procurers.

Selected local farmers are able to produce commercial vegetables at a profit when they have access to inputs, markets, and agronomic expertise.

However, local producers are now exposed to fluctuations and uncertainties of global commodity markets.
Artisinal Mining in Africa – Half the population of Australia
Simple bowl retort (Mozambique, CASM project, locally-made): the mercury is collected into wet sand.