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

David Doepel, Chair, Africa Research Group, Murdoch University
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Further information contact d.doepel@murdoch.edu.au

In 2012 when Murdoch University submitted a number of proposals to the Australian Government to look at aspects of the mining sector in Africa and how our Australian experience might inform the policy debate here and the practice on the ground, one of the deliverables we wrote down was to present at Mining INDABA in 2016 on our findings – at the time I wrote that I remember thinking that's so far into the future that I don't have to worry about it. 1) We probably wont win the grant(s) and 2) I probably wont be involved. Well we did win not one but four – and it turns out I am still involved. So it gives me very great pleasure today and it is with a great deal of humility that I have the honour of presenting the work of a very large group of people who have spent from then till now answering the research questions that we laid out in the proposals.

I wish to acknowledge at the outset that without support from the Australian government through the ADRAS research program – none of what I share with you today would have been possible. And for that we are very grateful.

To frame our conversation I will describe a little bit the background for this body of research. The inspiration for it, if you will, and how, in particular our Australian experience of the extractive sector put us in dialog with African partners and how we generated the research questions that we did.

I then will talk about three of the research programs that focused on water, environment, and cross-linkages and finally address what I think our potential research directions might be as suggested by what we have uncovered thus far.

But before I do perhaps let me suggest a definition of “inclusive growth” so you can then judge if what we have found can contribute to it.

COMMON AFRICAN POSITION
The CAP was developed in anticipation of a post- 2015 development agenda – if you are familiar with the millennial goals you can see how different these are -

PILLAR ONE
In particular is the focus on growth – economic activity as the means by which negative aspects of society particularly those related to poverty and inequality can be addressed.

**CHAKRABARTY SLIDE**
And it does so via a focus on productive employment and all that that entails.

**HISTORY SLIDE**

INSPIRATION – from history – because 'The prize of all history is the understanding of modern times.' (Frank K Crowley).

In 1848 Gold was found at American River in California. Men came initially from all across the US and then from all over the world to make their fortunes.

In the early 1840s, California was a place that only a handful of Americans had seen. San Francisco had just a few hundred residents.

The news of gold was just another fantastic tale–too unlikely to be believed. And then came Sam Brannan but he never mined for gold. Although he did, so the story goes, run through the streets of San Francisco with a bottle of gold dust shouting about it and showing it to every person he could find. However he didn't do that until he had purchased every pick axe and pan that money could buy. A metal pan that sold for twenty cents a few days earlier, was now available from Brannan for fifteen dollars. This is a picture of the general store where he sold them and its inside – and most likely his 15 dollar pan hanging on the wall.

Eventually, the gold rush would make him its first millionaire and a poster child for the mining services sector.

Around 1872, a cloth seller received a
letter from one of his customers, Jacob Davis, a Reno, Nevada tailor. Already popular with the miners this fabric that the cloth seller was peddling was known for its wearability. But Jacob has taken it one step further. In his letter, he disclosed the unique way he made pants for his mining customers.

It was through the use of rivets at points of strain to make them last longer. Davis wanted to patent this new idea, but needed a business partner to get the idea off the ground. The cloth seller was enthusiastic about the idea. The patent was granted to Jacob Davis and Levi Strauss & Company on May 20, 1873;

And blue jeans as we know them today were born

This New York butcher decided one day to walk to California. There, Phillip Armour eventually started his own business, employing out-of-work miners to construct sluices, which controlled the waters that flowed through the mined rivers. In only a few years, Armour had turned his business into a profitable enterprise, earning himself about $8,000 by the time he had turned 24. He then took those profits and opened a meat market to feed the miners and later moved to Chicago where he set up a meat processing plant. His name was Phillip Armour, and the Armour meat packing company became and still is one of the largest in the US.

He was a tough boss – union breaker but also an innovator – used all of the by-products including the fat – rendered it and made soap and created this brand: (DIAL)

It is also true that the assembly line he developed for the butchering of carcasses, so more of a
disassembly line where each person did one task was the inspiration for another innovator - Henry Ford.

One of Armour’s neighbors literally on Main St in Placerville, was an enterprising wheelbarrow maker who went by the very imaginative name of wheelbarrow Johny. He too had gone to California to seek his fortune hunting for gold – but joined the mining services trade instead.

After six years of hard work and saving, he left California and went back home and capitalized his family’s wagon-making business. He saw the writing of the wall for horse drawn carriages and started making horseless carriages this one is actually electric – 1902 – he made it for Thomas Edison

He then made them gasoline powered: here’s one a Studebaker from the 1950s. Because the man’s name was John Studebaker.

Two businessmen also looked west and saw opportunity. Sensing the unsettled atmosphere in California—they offered what many miners desperately wanted: stability. The offered secure, honest banking, transportaton, even mail delivery.

They were Henry Wells and William Fargo. Their company, Wells Fargo, became a giant in the banking industry. Current Market cap 243 billion.

All of these stories are about businesses created in and around mining. But are not
Let's follow this trail further and see where it leads. About this time 1849 – there began to be rumours of gold in a place even more remote and out of the way than California. The town was Ballarat in Victoria and the country was Australia.

When eight tonnes of Victorian gold arrived at London's port in April 1852, the Times of London declared: '... this is California all over again, but, it would appear, California on a larger scale...' It is no accident that my ancestor Frederick Doepel left Germany for Australia in July of 1852 and went to Ballarat along with 90,000 others. Provincial cities like Ballarat and Bendigo grew, bringing railways, roads, libraries, theatres, art galleries and stock exchanges. And Melbourne became one of the most prosperous cities in the world. This is a picture of the town hall being built in 1870.
And then just as the gold rush there slowed there were rumours again of gold in an even more remote place which came to be known as Kalgoorlie. And here my grandfather on my mother’s side of the family moved along with tens of thousands of others from the Eastern states and overseas.

Here it is on the map – notice the “dog leg” for the road. This is the main highway between Perth our capital city and Adelaide – the capital city of South Australia – its not a straight line.

But there was a very big issue. You can see a miner panning for gold here – so here’s a question for you- what’s distinctive about the way he is panning? - not using water. Because there wasn’t any, well not quite right – there wasn’t any freshwater. There was a brackish water aquifer.

The government of the day understood that without infrastructure in this case water supply there could be no real development and so they built the world’s largest desalination plant. Here’s a photo of it in 1902.

If you can read the caption of the photo – what technology were they using to make fresh water? And how did they boil the water – what do you see stacked in front? Wood. They had two problems with this solution. The aquifer was finite – and so was the wood. They effectively sucked it dry and burned all the trees.
So these two gentlemen came up with an audacious plan – and clearly because I am showing you pictures of their statues it is probably the case that their plan worked. These two visionaries from our state – the Premier and the chief engineer devised a plan to bring water to the mine – from the dams at the coast – 600km – we now have statues to honour them but not so fast because at the time – most people thought it a reckless idea.

And even more reckless than that they wanted Australians to build it - they wanted local content – – now the money had been borrowed from the British and they had strings – our money our engineering company. The Engineer CY O’Connor held his ground – and found someone in Victoria to do the job.

His name was Mepham Ferguson – and he did more than just build a pipeline – he patented a whole new way of laying pipe – The story goes he was struggling with the project was staring at his wooden desk and noticed the dovetail joint and had a eureka moment – Not only was it more efficient and cheaper to lay – because it didn’t have the traditional rivets it reduced drag and reduced the power needed to pump the water by 20%. 
And so they built the factory in Western Australia which became a manufacturing hub up until the great depression. The town was Maylands, now almost an inner suburb of Perth.

And the water flowed and still flows. Sadly the engineer didn’t take the constant ridicule and committed suicide before the project was completed. But his legacy and the vision of the premier created infrastructure that has sustained that mining community for more than 100 years.

And something else as well. The land between the coast and the mine at that time had been marginal pastoral grazing land. With the advent of the pipeline and the railway that ran alongside it and the towns that grew up along its length agriculture was transformed as well.

Today we have the goldfields and the golden fields of wheat. In 2015 announced on Feb 1 - 13.6 million tonnes of wheat – 80% of which is exported. Bread from stones.

This last example helps us transition to a modern approach to mining policy. My examples from California are really about American can do attitude and was the work of individuals. They nevertheless illustrate how linkages and diversification can be created often in unexpected and lasting ways.

In WA we saw something different – something purposeful something planned. And while initially they were ill-equipped to respond to this influx of people they did solve the water issue. And also began to tackle the next big issue – mine safety.
We won't explore that today other than to say that numerous – what we call royal commissions - were set up as early as 1905 looking at matters such as ventilation, protection of abandoned shafts, hours of employment and examination of engine drivers other Royal Commissions on Pulmonary Diseases Amongst Miners (1910) highlighted the high incidence of occupational diseases in the industry. This focus on mine safety continues today and indeed one area of diversification in our economy and an export earner are the number of companies focused on mine safety innovation.

I also mention it because growth by mining can't be considered inclusive if the workers themselves are maimed, injured, killed or suffer long-term negative health impacts.

I did mention it was an enormous amount of gold – 50 million ozs of gold. But when the grade is measured as grams per tonne – well here's the hole: 3 cubic kilometres of it – Here's one of the hills – almost 3 cubic kilometres. (less the 50 million ozs of gold). So not all of the legacy is positive. There is currently no credible plan for the closure of the superpit, other than its role as a tourist attraction – our version of the Grand Canyon.

So here then are the seeds for our research – water and mining, environment and mining and agriculture and mining – and the related question of cross-linkages and multiplier effects of economic activity. And hidden in these examples was also something else about economic multipliers – that didn't become apparent to us until we had undertaken our research – and I will finish with that as it represents I think a very exciting opportunity both for research and economic development – and it is also very vexing as well.
WATER
The research led by Dr. Ryan Admiraal was produced through a collaborative effort with colleagues from the University of Eduardo Mondlane (UEM), Quantum Global Research Lab (QGRL), and African Technology Policy Studies Network (ATPS).

WHO SLIDE
A news release from the World Health Organization (WHO) last August emphasised the importance of a renewed focus on increasing access to safe water and improving sanitation and hygiene practices in combating a number of neglected tropical diseases, and it noted that this focus on improved WASH – water and sanitation and hygiene would be expected to not only have significant positive effects for health but also be instrumental in reducing poverty.

SLIDE
The health impacts are well understood, with diarrhoeal diseases being the third leading cause of death in Africa. Mortality rates for children are disproportionately higher for such diseases, which are closely linked to poor WASH and rarely result in death in developed countries. Countries with poor water and sanitation conditions have greater incidence of cholera and other water borne diseases as well, and these have significant impacts on health and education.

SLIDE
The economic benefits of improved (WASH) are not as well understood but we know that savings in terms of health costs alone make investment cost-effective. The benefit-cost ratio under a variety of water supply and sanitation (WSS) intervention scenarios is estimated to range between 2.1 and 5.7. In Mozambique, the country where our research was concentrated, the (IMF) estimates that at least 1.2% of gross domestic product (GDP) is lost per year due to inadequate sanitation. Additionally, less time missed from work, greater educational opportunities, and other indirect benefits from access to improved WASH increase earning potential.

SLIDE - MOZAMBIQUE
The water and sanitation situation in Mozambique as reported in the 2010 Mozambican Report on the Millenium Development Goals (MDGs) and 2013 WHO-UNICEF Joint Monitoring Programme (JMP) are shown here. We notice significant variability in these estimates. Bottom line – huge room for improvement.

SLIDE
Rural and peri-urban areas—the areas typically most in need of water and sanitation improvement—tend to be unattractive investment destinations for private WASH projects unless they are bundled with other investments.

SLIDE
So what does this have to do with the extractive industries? The growing Mozambican economy has been largely supported by the extractive
industries with natural resource rents comprising roughly 15% of GDP over the past 5 years. The extractives sector is growing with an estimated tripling of mining value over the previous four years, and the discovery of massive natural gas reserves (estimated at more than 75 trillion cubic feet of natural gas) in the Rovuma Basin in 2010 is estimated to make Mozambique one of the world’s top three LNG exporters with significant revenue anticipated within the next 8 years. This wealth provides major opportunities to address pressing infrastructure needs, particularly in the areas of water and sanitation.

SLIDE

The government needs to think carefully about how mining royalties are allocated, and it would be prudent to increasingly invest in improvements for local communities in the areas of water and sanitation.

Why? Because there is a nexus already - mining tends to occur in rural areas, and these communities typically have the lowest access to improved water and sanitation. Mining tends to require significant amounts of water, so, if proper planning and management is not in place, mining can potentially reduce water availability for the local community if they are reliant on artesian water which many are. Additionally, communities in close proximity to mining activity commonly face pressures due to population growth because of the economic opportunities associated with mining. All of this can place enormous pressure on typically inadequate water infrastructure and supply and adversely affect not only the water supply situation but also the sanitation situation for these communities. Consequently, these communities in close proximity to mining would benefit greatly from investment in water and sanitation. We are not advocating here for the mining company to usurp the role of government – but we acknowledge for local communities – seeing massive infrastructure projects going up nearby with them still drawing water from the local river or unprotected water source creates tensions that do not need to be there. The allocation of royalties also collected Federally don’t always make it back to the local community affected negatively in other ways by the activity. So education and capacity building in this area is most definitely needed.

But the effects are further reaching, as mining, oil, and gas activity can lead to significant economic activity in areas far from the extractive sites themselves. For instance, the Beira and Nacala Corridors have seen massive growth, and is leading to pressures on water supply. We will look in a little more depth at the Nacala Corridor, (our mining & agriculture - about Beira Corridor.)

Despite these particular challenges that can be brought on by mining, mining operations can possibly provide part of the solution through the infrastructure that is introduced during the development/construction phase. Increasingly, mining project must invest in water infrastructure for their needs, and 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. This provides
an opportunity for shared use of this infrastructure by both mining companies and local communities, and researchers at the Columbia Center for Sustainable Investment are investigating this.

SLIDE

We will use a case-study of work funded by the Australian government. It ran from January 2012 to June 2014 and included different levels of WASH interventions for five towns along the Nacala Corridor. These towns are anticipated to experience significant growth of the next 25 years.

Today I will report on just one town of Ribáuè, which experienced the most significant interventions.

SLIDE

For the town of Ribáuè, sanitation and hygiene interventions included 1,170 households building improved latrines with an appropriate superstructure (walls and roof) and handwashing station, 25 households receiving disability-specific latrines, and appropriate facilities being provided to schools, public markets, and health services.

In the area of water, the town benefitted from the rehabilitation and expansion of a derelict piped system from colonial times. Specifics of this system are as presented here, and the key results were delivery of water to households in the form of 170 yard taps and 10 water kiosks.

What we endeavoured to do was to better understand these benefits of investment in water and sanitation.

SLIDE - locations

Fieldwork was carried out in the town of Ribáuè as well as the city of Nampula and the town of Liupo. These represent locations with quite different growth trajectories and economic prospects, and this is possibly attributable to the location of Ribáuè and Nampula along the Nacala Corridor (which largely follows the yellow line going to the Port of Nacala) and the town of Liupo off the Nacala Corridor. If we look at the town of Ribáuè, it has a projected growth rate of 140% over the next 25 years, a growth rate roughly 3.5 times higher than the city of Nampula.

SLIDE

Focusing specifically on the town of Ribáuè, if we compare primary sanitation facility usage in September of 2012 (before NAMWASH) and November of 2014 (after NAMWASH), we observe a significant increased in improved latrines and improved traditional latrines and a sharp reduction in the use of traditional latrines. Practice of open defecation also appears to have dropped, suggesting a significant improvement.

SLIDE

If we compare primary water point usage in September of 2012 (before NAMWASH) and November of 2014 (after NAMWASH), we observe a significant
increase in the use of yard taps and water kiosks and an almost halving in the use of unprotected wells as primary water points. Since the time of fieldwork in November of 2014, the number of yard taps has increased by roughly 60%, and a total of 320 households have yard taps with more than 50 yard taps lined up for installation over the next three months. This means that what we observe here significantly understates the current use of piped water.

SLIDE
Now, although I would love to talk about both water supply and sanitation, I will only be focusing on water supply.

As noted, there has been steady increase in the uptake of yard taps for Ribaue, and this is likely to be sustained with a mean maximum WTP for yard taps sufficient to cover reported household daily consumption. By comparison, average maximum WTP in Liupo (75 MZN per month) would only support 45.40 liters per day according to tariff structures in Ribaue, while average WTP in Nampula is higher (roughly 160 MZN per month) and would support roughly double the consumption as for Ribaue.

We did a fair bit of analysis to examine the validity of these values and see how average maximum WTP might correspond to actual payments, and these suggested that the WTP values we obtained for Ribaue would actually be conservative.

Piped water to the home (whether through yard taps or household connections) is important in terms of reducing incidence of diarrhea as well as reduced childhood mortality. Importantly public water points, regardless of the improvement in water quality, have little impact on health but simply getting a water point to the yard has significant health effects. This is because closer proximity leads to increased water consumption with much of the additional water being used for hygiene purposes, and hygiene is what tends to have the largest impact on diarrhoeal diseases.

It is important to note that the greatest impacts of WASH interventions are achieved when all are delivered in tandem. However, for the purposes of this talk, we will only focus on some of the impacts of piped water (and particularly piped water to the home). This is not to diminish the importance of investment in sanitation and hygiene but strictly due to time and the fact that

SLIDE
The impacts are more subtle than that, though, because several studies have shown the impacts of diarrhoea on education, and these have significant impacts on income and GDP. Using income and education data reported for Ribauë and adjusting for gender, we found that a 1% increase in secondary schooling from current levels would correspond to a per capita increase in income of 0.34%. For each additional 1% increase, the incremental return on income becomes larger.

SLIDE
Finally, the most significant cost to households is commonly that associated with the time spent collecting in water. Adult women are the primary collectors of water
(more than 75% in each of the three locations we surveyed) and, consequently, are most adversely affected by this.

SLIDE

Here we present estimated BCRs under a three different intervention scenarios. I want to draw your attention to the scenario on the left, which corresponds to the BCR for universal coverage of piped water to the home for the town of Ribaue, which has an estimated BCR of 1.57, which corresponds to the leftmost bar. Most of the benefit for this scenario is associated with convenience time (roughly 90% of the total benefit). Next to that are two bars labeled “Low” and “High” which correspond to estimated BCRs under a conservative scenario (in which case the BCR is slightly under 1) and a more generous scenario (where the BCR is roughly 5).

We similarly calculated BCRs for scenarios that considered universal coverage of improved latrines and then an integrated water supply and sanitation intervention producing universal coverage of piped water to the home and improved latrines. Where BCRs for universal coverage of improved latrines have estimated BCRs of under 1 (even in the most generous scenario), the estimated BCR for an integrated WSS intervention is at roughly 1, meaning that it is estimated that costs are recovered.

SLIDE – SUMMARY

So, in short, investment in water (and particularly water piped to the home) has significant health impacts, but it also has economic impacts as well as implications for educational attainment, as we demonstrated briefly for the town of Ribaue. If we consider those areas which are most in need of improvements in their water supply and sanitation situation, these tend to be rural or peri-urban areas, which are the sorts of settings where mining activity commonly takes place. Finally, the revenue brought in by mining can be used to address this area of need and help these communities improve in terms of their health, socio-economic status, and education.
Environment
SLIDES – 5
Physical considerations:
Co-production potential
Procedural considerations:
Fiscal regime:
Long-term land-use considerations:

Erosion and rehab examples

Co-production – WATER
In agriculture, to state the obvious water is critical. Here is however one area where the potential role of mining infrastructure is not too good to be true. Certainly in some cases mining competes for water with agriculture, and can be a source of ground and river water contamination.
But we are quite persuaded that in many cases usage of water can be a win-win scenario.
Here’s what it could mean for the countries of Africa.
The chart on the right is the yield potential for areas suitable for the growing of maize (a staple crop in many regions) using high-inputs (fertiliser) under rain-fed systems.
The chart on the left models the same yield and inputs under irrigation. In other words - just add water - where yields can now be more than 12 tonnes per hectare (the darkest colour) in places previously considered low or even no yield.
This has the potential to be transformative for regional economies. Let alone its contribution to food security.

SLIDE
The Hamersley Agricultural Project (HAP) in Western Australia covers 835 hectares of land and takes advantage of surplus water supply generated from nearby Marandoo mining operations to grow pasture for cattle stations.
It is operated by Rio Tinto across the Pilbara.
The remainder of the water is used to support mine operations, provide a water supply for the Tom Price township, or is reinjected in to the Southern Fortescue Borefield.

The HAP is the first project of its kind in the Pilbara. It has delivered infrastructure for agriculture in a way that is small by mining standards, but enormous by agricultural standards :35 kilometres of pipe, 22 pumps and large-scale associated pumping infrastructure.
The completed project uses very large centre pivots, each able to irrigate 40 to 50 hectares of pasture land. Estimated mine life (mining below the water table) is in excess of 20 years.
SLIDE
Water is a major challenge for mining – very much like Goldilocks and the three bears – either too much or too little, but rarely just right. There are numerous underexplored options – particularly from cross-collaborations between traditionally separate industries. For example, there are 3 basic mine void closure strategies: leave an open void, fill it with wastes and soil, or use it as water storage. Innovative technical applications enable co-production of suitable water supplies and environmental protection both during mine operation and also post-decommissioning. During a mine’s life, some operations water use exceeds water resource availability, yet others require excess mine-related water to be discharged into the environment. However, minewater can be pH neutral, acidic, and contaminated with metals, as well as dissolved and suspended solids. Several processes have been used to prevent minewater contamination of ecosystems, and also to provide much needed useful and safe water. Water storage of rainfall runoff and also some groundwater into mine voids may be processed and used to increase water availability for suitable agricultural applications. For example, beneficial uses of mine voids and pit lakes post mine decommissioning may include using saline minewater for stock-watering applications. (All livestock can consume up to 3,000 mg/L TDS over the year, beef cattle can use 5,000 mg/L, horses 6,000 mg/L and adult dry sheep up to 10,000 mg/L). These activities aim to simultaneously improve water use efficiency for agricultural applications, provide freshwater for alternative applications, and reduce the volume of waste-waters to assist management of operating mines. The production of excess potable water in this context should also be rigorously examined in the context of human consumption in communities surrounding mines.

SLIDE
RE USE - South Africa
SLIDE – Key Findings
Governance capacity
Leading practice in the first instance is the job of the mining company.

SLIDES – WA INNOVATION IN BONDS
AGRICULTURE - NIGERIA
In parallel, a corporate relationship between Murdoch University and Andalusian Mining, and the engagement of the Obefami Awolowo University (OAU) in south eastern Nigeria is investigating local agricultural systems as it intersects with the mining industry needs.
Our initial outcomes are simple, but practical, and we seek to add value in leveraging mining infrastructure and procurement for long-term agricultural supply chain productivity and development.

Harnessing natural resources in mining and agriculture is a key driver of economic growth, generating large government revenues and export earnings, leading to considerable investment, growth, employment, and social benefits. How these benefits may be leveraged in an equitable manner in rural areas is a key question. The project links with the African Mining Vision (AMV) Action Plan that identifies opportunities for cross-linkages between the extractive industries and other areas of the economy in order to create lasting benefits and more robust and resilient economies.

SLIDE
We have been investigating the links between the agricultural and mining sectors for a few years now. This year the fifth annual Africa Australia Research Forum held in Perth Western Australia released a report jointly commissioned by Murdoch and the Crawford Fund exploring where there are co-benefits and economic opportunities of investing in commercial projects that incorporate both mining and agriculture. The forum also featured research from Nigeria.

SLIDE
The collaboration between Obafemi Awolowo University and Murdoch University is primarily focussed on the last question of how mining and related activities may serve as a means to stimulate a diversified agricultural sector.

SLIDE
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SLIDE
Harnessing natural resources in mining and agriculture is a key driver of economic growth, generating large government revenues and export earnings, leading to considerable investment, growth, employment, and social benefits. However, in many locales there are significant barriers to the realisation of such a vision, including the inadequate inclusion of local stakeholders.

Within this context, the project is documenting progress and approaches including establishment of the BAGC’s methodologies and partnerships between local farmers’ groups, research institutions, and commercial food exporters. In parallel, a corporate relationship between Murdoch University and Andalusian Mining, and the engagement of the Obefami Awolowo University (OAU) in south eastern Nigeria is investigating local agricultural value chains as it intersects with the mining industry needs.

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We believe that enterprise viability serves as the basis for continued grower interest. At the farmer level, commercial viability is greatly influenced by crop yields, production costs, access to input and output markets, and marketing arrangements. This figure shows some of the crops under analysis. Gross Margin (GM) per total variable costs (TVC), largely mirrored the net income results. Our results are particularly encouraging with highly prospective results in terms of enterprise viability.

Our results are particularly encouraging with highly prospective results in terms of enterprise viability.

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**

10-12 million artisanal miners, informal illegal – half the population of Australia – staggering number of people who either earn their livelihoods or part thereof from mining – where it exists outside regular legal structures it can be dangerous, can be linked to organized crime, environmentally destructive and very exploitative of the majority of people who earn their livings this way.

And it came up regularly as an issue and a challenge – in so many of the interviews that we conducted over the last 3 years.

I remember a conversation with an Australian government employee a while ago when I was informally talking about this – and the response was well we don’t really do much with Artisinal mining – not sure if our experience is relevant. Now we do have a few prospectors still – and certainly opal mining is very artisanal still. However our mining history is a history of artisanal and informal mining.
Here’s a few of them in Kalgoorlie in 1913. So I thought I would finish and in a few sentences tell the story of one of them – not from Kalgoorlie – but originally from Saxony Germany. Hieronymous Salvator Lopez von Pereira in Saxony, Germany on October 7, 1846, a descendant of Portuguese aristocracy. At the time of his father’s death, his family was being pursued by financiers and they tried to obscure their identity by changing the family name.

He sailed to Australia after leaving the German army during the Franco-Prussian war and by the mid 1870s he was living in Victoria and worked on several pastoral properties. From there he moved around Queensland and NSW until taking work as a boundary rider on Mount Gipps station where he developed an outstanding reputation as a bushman.

While he was neither a geologist or miner. He was a very good observer - made him the first to discover minerals at a site which previous prospectors had dismissed as a “worthless hill of mullock.”

He pegged the first block on the rocky outcrop which he thought was a mountain of tin. On the advice of his employer – Mount Gipps station manager George McCulloch – a syndicate of seven was formed and a further six blocks were pegged to include the whole ridge. Initial reports from Adelaide-based analysts produced disappointing results as they only tested for tin, they then tested for silver… and it turns out that Hieronymous aka Charles Rasp had found “a fairly good thing” to quote him. The name of his first block was Broken Hill – which correspond to the first two initials of the company he became – BHP which was floated as a public company on August 13, 1885. And it started with an artisanal miner.