

**MINING AND INDUSTRIALIZATION IN AFRICAN
ECONOMIES: IMPLICATION OF PUBLIC POLICY AND
ENTREPRENEURSHIP**

Paul Msoma Africa's industrial
transformation

by

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INTRODUCTION (*definitions & stylized facts*)

MINING is the key that converts dormant mineral wealth into schools, homes, ports, and other forms of capital that directly contribute to economic development (Davis & Tilton, 2015).

- provides employment, revenues, and demand for local services and goods transfers skills to workers and can also be an important source of social services to remote communities.
- major foreign exchange earner in economies,
- attraction for **Resource-Seeking FDI** (UNCTAD, 2008)
- *Aprori expectation* is that countries possess rich mineral deposits are fortunate. Like an individual or family, the more capital and wealth a nation possesses, the richer and better off it is -
- The US Geological society ranks Africa **as the largest or second-largest** reserve of bauxite, cobalt, industrial diamonds, manganese, phosphate rock, etc (KPMG, 2013).
- **ADB (2012)** affirms that natural resource endowment offer great opportunities for achieving high levels of growth and development (industrialization), if properly managed!.

INTRODUCTION (*definitions & stylized facts*)

mining by its nature is financially expensive, environmentally invasive & socially intrusive

the Mining sector most in African countries is faced with :

- (1) **Political risk** (spate of accidents, intense social conflicts and political debate) as we as,
- (2) **Financing risk** (problems for financiers, investors, lenders and insurers
(costs of mitigating the environmental and social damage can be enormous)

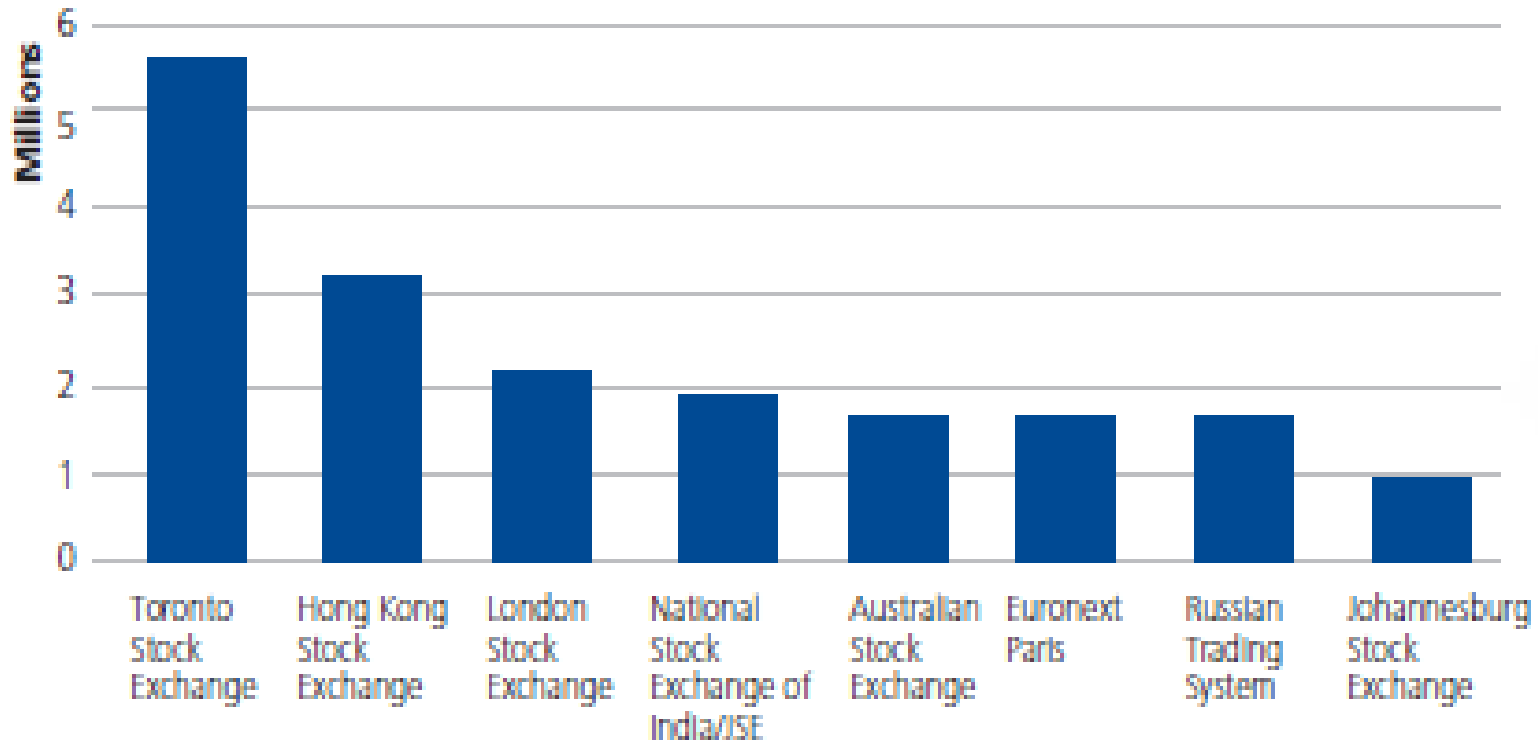
To this end, the Multilateral Investment Guarantee Agency (MIGA) -World Bank group that promotes foreign investment into developing countries. They help by supporting economic growth (industrialization), improve standard of living as well as poverty reduction in host countries. MIGA is present in Africa (Table below).

Selected MIGA guaranteed mining projects in Africa

Host country	Projects	Guarantee holder (s)	Investor country	Guarantee amount (US\$ million)
Mozambique	Kenmare Moma Mining Limited: Kenmare Moma Processing Ltd	KfW-Kreditanstalt fur Wiederaufbau	Germany	12.4
DRC	Anvil Mining Congo. Ltd.	Anvil Mining Ltd., RMB International (Dublin) Limited	Canada, Ireland	13.6
Tanzania	Kahama Mining Corp. Ltd	Barrick Gold Corp. of Canada	Canada	56.3
Tanzania	Kahama Mining Corporation Ltd	Societe Generale. S.A.	France	115.8
Zambia	Chambishi Metals Plc	Anglovaal Mining Limited	South Africa	30.0

INTRODUCTION *(definitions & stylized facts)*

Funding of mining projects across Africa



Source: State of mining in Africa

INTRODUCTION (*the problem*)

From empirical studies, there is widespread agreement that rich mineral deposits provide developing countries with opportunities. In some instances it has been used wisely to promote development, and in other instances have been misused.

However, a new view of mining has emerged over the past two decades that questions the positive relationship between mineral extraction and economic development (industrialization inclusive).

- countries with abundant primary resources are likely to grow slowly (Sachs & Warner (1995))
- capital-intensive resource industries tend to induce more corruption, hampering economic development -Leite & Weidmann (1999)
- negative effects of policies, such as trade openness and educational investment, outweigh the direct, positive resource effects -Papyrakis and Gerlagh (2004)
- resource-rich economies tend to fail in accelerating growth because of various adverse effects of abundant natural resources -Iimi (2007)
- Some mineral-dependent nations are the poorest & worst performing economies -Roderick, (2014)

The cause of this has been linked to the **Dutch disease syndrome** which has negative effect on growth due to large increases in income commonly caused by resource endowment.

The contention between the two schools of thoughts remains unresolved, hence, this creates a problem which informs the core objective of this paper.

LITERATURE REVIEW *(Concept of industrialization)*



structural changes caused by:

- * globalisation,
- * technological changes
- * new institutional economics (NIE)
- * public policies

Consequently, two dimensions of industrialization (Hedley, 1992)

- ✓ economic activity
- ✓ economic output

LITERATURE REVIEW (*Concept of industrialization*)

Taking a cue from the British industrialization , the concept has been viewed as:

- transformation from a primarily agricultural society into a manufacturing economy
- panacea to growth and development (Hasse, 2008, Szirmai, 2009)
- socio-economic process that includes a rise in manufacturing activity O'Brien (2001) and Szirmai (2012)
- a complicated process of change such as using per capita GDP which indicates standard of living.
- economic transformation through industrialisation is an important driver for growth and poverty reduction (UNCTAD, 2011).
- technology driven mechanized process used to boost productivity and thus increase income.
- hallmark for modern economic growth & development (Tamuno & Edoumiekumo, 2012).
- A drive to improve systems, technologies and processes in order to utilise natural resources more effectively, thereby promote economic development and growth (Fu, Pietrobelli & Soete, 2010).

It cannot be disputed that industrialization is a pre-requisite for economic growth and development (Murphy et al., 2000, de Ferranti et al., 2001).

However, there cannot be growth without entrepreneurship and enterprises strive better in an industrialized economy (Ibbih and Gaiya, 2013).

This makes a case for an entrepreneurship led industrialization growth.

LITERATURE REVIEW (*linking industrialization to entrepreneurship*)

The search for the relationship between entrepreneurship and economic growth is not new. Countless theorists, scholars, economist have made significant contributions to the understanding of entrepreneurship and its relations to economic growth.

To mention a few, Cantillon, Schumpeter, Kirzner, Knight, Casson, Pinchott, Shane and Venkataraman recognized entrepreneurship as a principal agent of production and industrial progress.

Audretsch and Thurik (2001) assert that entrepreneurship has been increasingly recognized as a major driving force for innovation and economic growth in all economies.

For instance, Schumpeter (1984) argued that entrepreneurship is very significant to the growth and development of economies

Coincidentally, the term 'industrialization' refers to a society's increasing use of machinery, technology and automated processes, with this increase usually comes economic growth.

Entrepreneurship contributes in immeasurable ways towards creating new jobs, wealth creation, poverty reduction and income generating for both government and individuals. (Dickson, Solomon and Weaver, 2008; Ossai and Nwalado, 2012; Arewa, 2004; Akpomi, 2008; Ojeifo; Baba, 2013)

GEM (2002), shows that the national level of entrepreneurial activity has statistical significant association with subsequent levels of economic growth.

Entrepreneurship is driven by the presence of certain factors such as infrastructure and a sound macroeconomic environment which acts as opportunities for growth. So also is industrialization

We coclude that entrepreneurship enables the industrialization process to continue to evolve

This is why we link the measure of industrialization to the indicators adapted from the measures and drivers of knowledge economy, the global entrepreneurship monitor (GEM)

Literature review *(linking industrialization to entrepreneurship)*

Measures of Industrialization

Manufacturing value added
Wages
Population
Undervaluation index
Democracy index
Education
GDP per capita
Terms of trade
inflation
Research & Development
Source: Fagerberg & Srholec (2008); Guadagno (on going research); Cornwall (1977), Veblen (1915); Gerschenkron (1962); Abramovitz (1986); Cohen & Levinthal (1990); Kim (1980); Lall (1992)

Measures of Entrepreneurship

Globalization measure	FDI intensity
	Total export
	High- tech export
	Per capita GDP
Technology Innovation Capacity	Science and technology jobs
	R & D investments
	Venture capital investments
Economic Dynamism	Patents and copy rights
	Knowledge jobs
	Researchers
	Employed in Science & Technology
Digital Economy	E-government availability
	ICT and broadband penetration
	Household internet access
Source: Murdock (2009), Atkinson & Correa (2007) Allen (2001), Murdock (2009), Saisana & Munda (2008) GEM Data	

These measure informs the variables used for statistical analysis in this paper. To this end, we measure industrialization using the full indicators of entrepreneurship activities as measured by the Global Entrepreneurship Monitor (GEM) and the knowledge economy indicators. However, we adopt specific total entrepreneurship activities (TEA) for the study using OECD indicators in Ahmad and Hoffman (2007).

Methodology

There are two main objectives:

- (1) to determine whether non mining countries are more industrialized than non mining countries in Africa
- (2) to determine the effects of mining on industrialization in Africa

Method (1): a mixed qualitative approach (Hierarchical Agglomerative cluster (HAC) analysis

to classify a sample of African countries comprising of a group of mining countries and another group of non mining of precious metals using a mixed qualitative approach. The selected countries were derived from a list of mining economies in Africa as seen in Figure 1. The two groups used in the cluster analysis were simultaneously derived from four parts of Africa, namely Northern, Southern, Western and eastern part of the continent. Using the measures of entrepreneurship and indicators of knowledge economies as a proxy for industrialization, we determine which group is industrialization enhancing and which is industrialization inhibiting squared Euclidean distance (k mean) to classify 8 countries into two cluster solution based on data for 2013.

Method (2) cross country analysis (using panel data for the period 2000 -2015 in 4 purposely selected African countries)

Our baseline model will be as follows:

$$K = f(G)$$

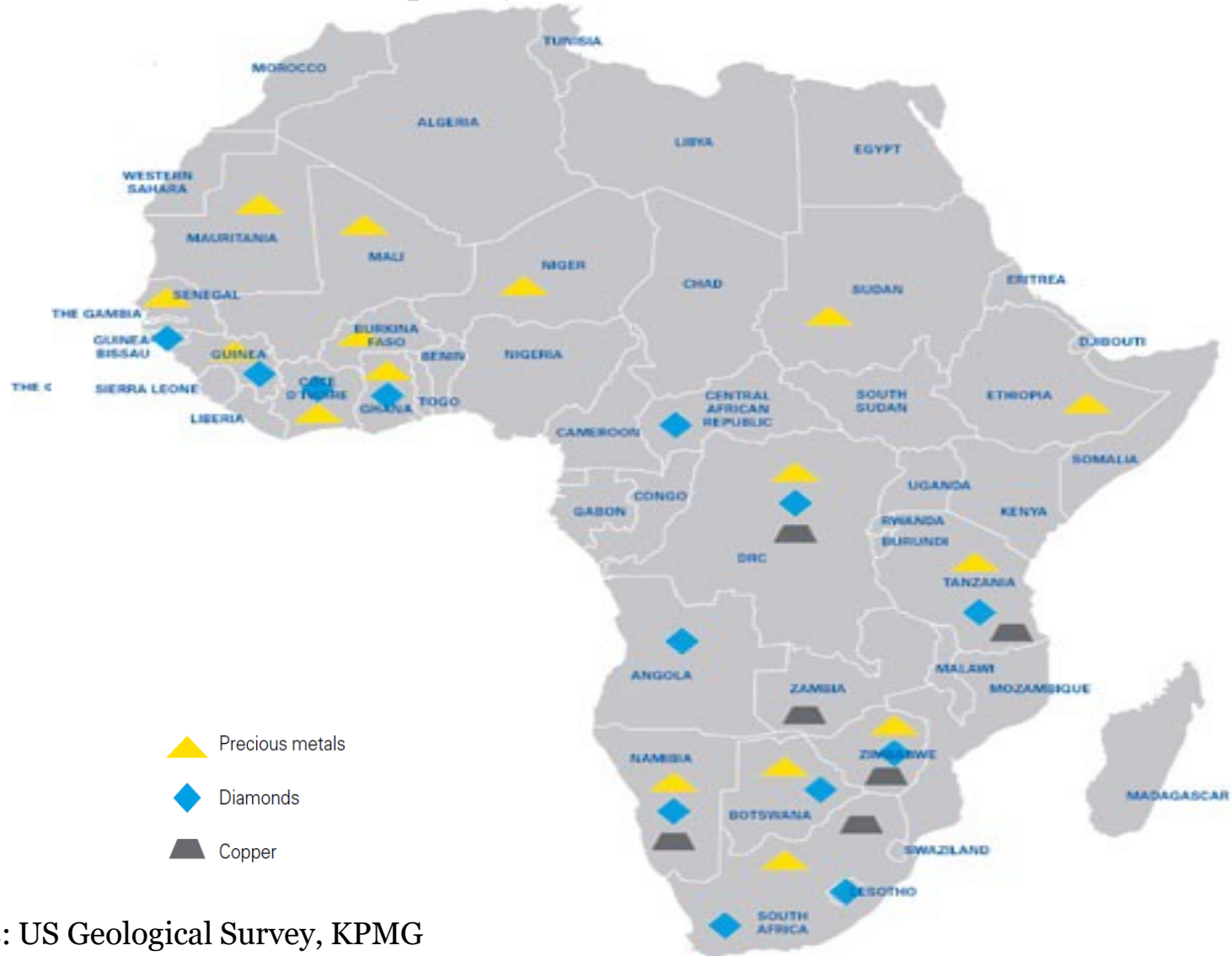
- where: K = Total Entrepreneurship Activities (TEA) as a proxy for industrialization measure
- TEA = Summation of Venture capital + High tech export + per capita GDP
- TEA = Level of industrialization
- G = Vector of explainable variables reflecting industrialization

Using a regression equation as stated:
$$\Delta IDZ_{it} = \alpha \Delta ID_{it-1} + \sum_{j=1}^2 \beta_{1j} \Delta MVZ_{t-j} + \sum_{j=1}^2 \beta_{2j} \Delta TOP + \sum_{j=1}^2 \beta_{3j} \Delta ST + \mu_i + \Delta \varepsilon_{it}$$

Where ΔMVZ_t is manufacturing added value, ΔTOP_t is trade openness, ΔST is science and technical research. Due to the peculiarity of insufficient data in African countries over the years

METHODOLOGY

Sample key mineral resources in Africa



Sources: US Geological Survey, KPMG

Methodology

Homogeneity of mining and non mining precious metals countries in Africa

	Africa regions	Country	Mining of Precious metals	*GDP as per 2016 estimate	Year of independence	Colonial master
1	Southern	South Africa	Yes	\$742.4 billion	1910 (1931)	UK
		Mozambique	No	\$36.92 billion	1975	Portugal
2	Northern	Sudan	Yes	\$179.5 billion	1956	UK & Egypt
		Egypt	No	\$1.047 trillion	1922	UK
3	Eastern	Tanzania	Yes	\$149.8 billion	1961	UK
		Kenya	No	\$143.1 billion	1963	UK
4	Western	Ivory Coast	Yes	\$85.3 billion	1960	France
		Nigeria	No	\$1.2 trillion	1960	Britain

Precious metal are rare metals of high economic value such as gold, silver, and platinum

Variables

We were limited to venture capital, high tech export; per capita GDP and science and technology researchers as the measure of industrialization based on the categories, while manufacturing value added; trade openness; and science and technology researchers were used as the explainable variable of industrialization. Data was sourced from the World Bank and IMF, over a period of 15 years i.e. from 2000 to 2014.

Results and Interpretations (HAC analysis)

Hierarchical cluster analysis with Ward's method of clustering algorithm separated the sample countries based on the variable described earlier, and specifying two cluster solutions. The aim of using the cluster analysis is to combine variables to form groups in which the characteristics of the variable are as homogeneous as possible while ensuring that the characteristics of variable between groups are as dissimilar as possible. The clustered are as follows: South Africa, Sudan, Tanzania and Ivory Coast are classified into the group of countries involved in mining of special metals (group 1). Mozambique, Egypt, Kenya and Nigeria are classified into another group depicting non-mining of precious metals countries (group 2).

	Group 1	Group 2	Mining Group 1 F
	Mean	Mean	
Trade Openness	12052560963050312000.000	8289812082819517400.000	*1.454
Science Technical research	9480137.161	18144959.599	.522
Manufacturing value added	278803155764954140000.000	507144927470420560000.000	.550
Venture capital investment	969592275163037200000000.000	2744402930011724600000.000	*353.298
High tech Export	94158109482046976.000	665451107155886340.000	.141
GDP per capita	1005109.568	4723809.453	.213

Results and Interpretations (HAC analysis)

The discriminant function was statistically reliable at $p < .05$ and accounted for more than 90% of the variability between the groups. The discriminant function separates the two groupings of economies presumably based on the comparison of the group centroids. All 100% of the original grouped cases were correctly classified except **Venture capital investment** and **trade openness** which showed significant univariate F s for group difference. High-tech export (.720), GDP per capita (.661), science and technical research (.497) and manufacturing value added (.486) were the most discriminating variables for distinguishing between the two groupings of countries. Table 3 below shows that group 1 being the countries involved in the mining of precious metals has higher mean values of trade openness and venture capital investment corresponding lower F values than the second group. **This signifies that the mining countries have performed better than the non mining countries only in the two measures capable of enhancing industrialization, while the other measures of industrialization have not shown significant F s in mining countries.**

Results and interpretations (Panel data analysis)

The data of the four countries on all the variables are pooled together and the panel analysis was carried out. Both static panel models i.e **fixed** and **random effects** are used in the study. This is to enable the analysis come up with estimates that are consistent. Notwithstanding, a number of diagnostic test were also run.

Firstly, the **hausman test** is performed to know which of the fixed or random effects estimates is appropriate for the study. Secondly, **cross sectional dependency test (pool-ability test)** is also run to identify the existence or otherwise of cross sectional specific factors in the panel models.

The analysis begins with the estimation and interpretation of the **Static panel models** which comprise of both the fixed and random effects. Tables 4 and 5 contain the estimated fixed effect within regression and random effects regression results respectively. The first thing we observed there is no much difference between the results of the fixed effects and the random effect but notwithstanding, we go ahead to conduct the hausman test to enable us determine which of the two result we should stick to.

Table 4: Fixed Effects (within variation regression) Estimation Results for the four countries

Variables	Coefficient	Standard error
TOP	2.317989	14.08972
S&T	-9573934	3.01e+07
MVA	5.829377	6.478817
CONSTANT	1.66e+11**	5.34e+10

Note: Standard errors in parentheses

$R^2 = 0.0226$ (within) $R^2 = 0.0472$ (overall) $F(3,53) = 0.41$ $Prob > F = 0.7475$

* statistical significance at 10%** statistical significance at 5%.***statistical significance at 1%

Source: Authors Computation

Table 5: Random Effects Estimation Results for the four countries

Variables	Coefficient	Standard error
TOP	-50.07436	31.92286
S&T	-2.96e+07	7.00e+07
MVA	5.135994	11.77532
CONSTANT	3.06e+11	6.49e+10

$R^2 = 0.0019$ (within) $R^2 = 0.0989$ (overall) $Wald\ chi2(3) = 6.15$ $Prob > \chi^2 = 0.1047$

* statistical significance at 10%** statistical significance at 5%.***statistical significance at 1%

Source: Authors Computation

Results and interpretations (Panel data analysis)

Hausman test for panel models:

Despite the similarities in the estimated results from the two panel models, yet there are slight differences.

Table 6: Results of the Hausman test for the panel models

Variables	Coefficient fixed B	Coefficient Random B	Difference (b-B)	Standard error
TOP	2.317989	-50.07436	52.39235	9.030235
S&T	-9573934	-2.96e+07	2.01e+07	1.17e+07
MVA	5.829377	5.135994	.6933836	9.698217

Test: Ho: difference in coefficients not systematic

$$\chi^2(10) = (b-B)'[(V_b - V_B)^{-1}](b-B) = 2.94, \text{Prob} > \chi^2 = 0.0863$$

The results from the hausman test suggest **we accept the null hypothesis and reject the alternative hypothesis**. The implication of this is that we accept the results from the random effect and reject fixed effects results. Therefore **random effect result is more suitable for our analysis**. Hence, the few places where we noticed slight differences in the results of the model means we stick with the outcomes of the random effect.

Results and interpretations (Panel data analysis)

none of the independent variables has individual significant impact on industrialization in the four countries. The implication is that mining is not strong enough to exert significant impact on industrialization in the four countries.

This implies the dominance of the specific characteristics of each of the country. As earlier posited this might have accounted for the significance of the constant in the panel estimation.

Furthermore the result shows that each of the country **South Africa, Ivory Coast, Sudan** and **Tanzania** possess salient feature that distinguish them from one another in terms of the impacts of mining on industrialization.

Consequently, this is an area for further research, that is based on the findings from this research work, other researcher can now try to investigate the impact of mining on industrialization of the these four countries individually.

Policy recommendations

General Policy recommendation

- (1) project finance strategies should also be employed in African countries in order to manage mining activities i.e. through PPPs this will reduce the pressure on domestic funds and increase **venture capital investment** which has been found significant as an indication on the 4 mining countries.

The use of project finance as an investment tool for economic development is gaining popularity among many economies world-wide. Project finance is widely used in the investment of natural resources and infrastructure sectors such as power plants, toll roads, mines, pipelines, and telecommunications systems (Esty, 2002).

(2) Trade openness

there are various dynamics and mechanism for managing foreign investments in the natural resources sector. The benefits each offers, and the manner in which each interacts with the host economy differs. For instance the new trade theory classifies FDI specifically into two categories ([Helmberger \(1970\)](#) & [Vernon \(1966\)](#)) opine that such investment may induce increased export and manufacturing value added among other indicators of industrialization

(i) The vertical investments is factor intensity conscious; this helps to determine the stages of production in host countries, while

(2) the horizontal FDI operates as close final markets.

We recommended that the **vertical foreign investment** should be encouraged in mining countries in Africa.

Public policy implication -

Mining policies focus and industrialization: The suggested link

- Employment generation and growth -featuring local content issues (education & citizens empowerment)
- Supplementing domestic savings – this will increase venture capital investment (**s = I**)
- Transfer of modern technologies - (This will enhance high tech export)
- Raising skills of local manpower -(create employment, innovation, peace)
- Enhanced efficiency (this innovation, creativity and adding value)

Mining and industrialization: Necessary requirements

What brings about industrialization is a question best answered by the role of the host countries' strategies in promoting mining activities. The World Association for Investment Agency (WAIPA) criteriaon which was created to assist developing countries to overcome development challenges.

Stipulates ten (10) criteria favourable for investments, they are: (1) political stability; (2) domestic economic strength; (3) a welcoming attitude; (4) policies on foreign equity ownership; (5) liberal exchange controls; (6) stable labour force, (7) efficient banking; (8) efficient bureaucracy, (9) sound infrastructure; and (10) acceptable quality of life.

All these explains trade openness that has been find significant as a measure for industrialization, hence these should be the focus of public policies in African economies.

Conclusion

For mining to have effect on industrialization in African countries, public policies should employ ingenious strategies aimed at promoting entrepreneurship (creativity, innovation and adding value) in the mining process.

The inclusiveness of local content should also be taking into consideration. Public policies such as macroeconomic policies that affect fiscal and monetary issues; health/welfare that takes HDI measures into consideration such as literacy, PPP and life expectancy.

and very important, mining countries should embrace their colonial heritage. For instance in West Africa Franco phone countries (the bvrn). – this promote trade in the countries.

Personal remarks on Nigeria

A shadow question posed from the literatures and the theme of the conference which is natural resource endowment a curse to mining countries?

Contributions of economic sectors to GDP in Nigeria

YEAR	AGRICULTURE	INDUSTRY*	BUILDING & CONSTRUCTION	WHOLESALE & RETAIL TRADE	SERVICES	Total
1960	63.5	6.0	4.2	12.7	13.6	100
1965	54.4	11.5	5.7	13.1	15.3	100
1970	48.8	17.3	5.1	12.7	16.1	100
1975	27.3	27.2	8.5	20.2	16.8	100
1980	20.1	40.6	7.4	19.4	12.3	100
1985	39.2	26.8	2.3	13.5	18.2	100
1990	31.5	43.2	1.6	13.4	10.3	100
1995	32.1	45.2	0.7	14.2	7.8	100
2000	26.0	51.5	0.6	11.5	10.3	100
2005	32.8	41.8	1.5	12.8	11.1	100
2008	30.9	41.7	1.2	14.6	11.6	100

Lastly I wish to reiterate the key note speakers (Prof Wangwe) address that remarked that natural resources abundance on its own is not a curse, rather it is the management of this resources which is a function of policy makers.

End of presentation

Thank you for listening