

12865

**United Nations
Economic Commission for Africa**

Food Security and Sustainable Development Division



**NATURAL RESOURCES AND TECHNOLOGY:
COMPETITIVENESS AND SUSTAINABLE DEVELOPMENT
IN AFRICA**

This paper has been prepared for the Food Security and Sustainable Development Division by a visiting scholar, Mr. Banji Oyelaran-Oyeyinka. The views expressed are those of its author and do not necessarily reflect those of the United Nations Economic Commission for Africa.

Table of Contents

1. Introduction	1
2. Africa's Natural Resources	2
3. Importance of Natural Resources	4
4. Between Natural Capital and Human Capital	5
5. Natural Capital in Development Perspective	10
6. The Competitive Assets of African Industry	12
7. Factors inhabiting Competitiveness	16
8. Natural Resources and Competitiveness	17
9. Conclusions	19
References	20

1. Introduction

Natural resources, including agricultural and minerals remain inert until they are brought out of their natural state and processed into usable forms. For instance, crude petroleum remains a dark and mysterious substance until it is brought out from underground and refined into various fractions. Iron ore remains a part of the earth until it is transformed through high temperature iron-making processes into iron, and subsequently steel and steel alloys. The primary mediating force in this transformation process is technology.

It is technology that gives the lie to pessimistic predictions, such as contained in such reports as the famous MIT study [year?], “The Limits to Growth”, which in the 1970s predicted that mankind will eventually run out of natural resources, due to the unrelenting and sometime wasteful use of them. David Ricardo, the English economist had made his prognosis in the same vein. His premise was simple: the geometric rise in human population will eventually lead to scarcity of natural resources. Combined with the Malthusian gloomy view, the future of resources, as was perceived in the 17th century, was very bleak indeed.

But then very little was known about the role that technological innovations will subsequently play in mankind’s search for raw materials. Constraints to the use of natural resources have been gradually removed through technological innovations. Empirical evidences abound to illustrate the ways in which technical innovation liberated natural resources – from being a neutral matter – to becoming a potent force in economic development.

The United States of America once faced the prospects of iron ore shortage to feed its iron and steel industry. Meanwhile vast deposits of iron ores (taconite ores) lay buried – because it could not be utilised directly in its natural form. Taconite ore became usable in steelmaking only when it was “palletised” – a technique hitherto unavailable to the steelmaker. Again in the mid-1800 America, the major source of lighting was whale oil. The demand for this fuel made it very scarce. By the 1860s, a gallon of whale oil was costing US\$2.55. In 1858, Drake made his famous expedition to Western Pennsylvania in search of “Pennsylvania Rock Oil”. By 1859, Drake and his group had struck oil. Initially crude petroleum sold for \$20 a barrel – dropping to a mere 10 cents a barrel within three years. Within ten years, kerosene had almost completely displaced whale oil as home fuel. These are a few examples in a very long list.

Resource-rich countries and regions were therefore the earliest zones of prosperity. Paradoxically, the regions and countries that have exhibited the most dynamic growth in the last fifty years or so are resource-poor. Africa with its huge natural resources remains among the poorest regions exhibiting all the symptoms of chronic underdevelopment; high infant mortality, low per capita income, and so on.

The paper examines the issue of “resource-curse” paradox in the context of Africa’s persistent underdevelopment. We examine the state of Africa’s natural resources and the importance of natural capital in relation to other forms of capital - human, physical, and

created capitals. We outline the constraints to competitiveness of Africa's industry and conclude with a number of propositions.

2. Africa's Natural Resources

Africa has huge natural resources and has for decades depended solely on the export of commodities for foreign exchange. Although the region is not a monolith and the extent of dependence varies widely, the region shares the common characteristics of being well endowed with agricultural, aquatic and mineral resources.

Much of the minerals and energy resources remain untapped, and yet close to half of the national incomes of African countries come from natural resources and between 90 and 100 percent of export income for a majority of the countries. In addition, much of the labour force, which is located largely in the rural areas gains its livelihood from agricultural production and trade, including fishery and forestry.

Again, countries in the region differ in the level of dependence on primary products, and they are as diverse in their geographic size, population, as in their access to port facilities. However, dependence on natural resource is a common feature. For instance, some 11 countries or areas depend on export income for more than 75 percent of total earnings. These are:

- Botswana (diamonds)
- Burundi, Ethiopia, Rwanda and Uganda (coffee)
- Cape Verde (fish)
- Guinea (bauxite)
- Liberia (iron ore)
- Reunion (sugar)
- Somalia (livestock), and
- Zambia (copper)

In spite of Africa's considerable resource abundance, the region's per capita income remains the lowest, even while global demand for Africa's resources remains high. Some of the reasons for the poor returns on resource production are fluctuating terms of trade for non-fuel commodities, with respect to manufactured good and poor prices for exports.

While resource endowment has been the starting point for the industrialisation of a number of developed countries such as Australia and the United States, the basis of economic progress as demonstrated by East Asia is now very different. Recent studies have found negative relationship between per capita growth rates and the ratio of natural resource exports to GDP for a number of developing countries (Sachs and Warner, 1995).

suffered most from the phenomenon of “resource curse”. The resource curse hypothesis holds that resource-abundant countries tend to record lower sustainable economic growth than resource-poor countries. This hypothesis tends to hold even at periods of high export earnings.

Accordingly, mineral exporting countries tend to suffer more from the resource curse. This is evident in table 1, which shows that for a group of twenty-three mineral exporters in the 1980-1992 period, the average capita growth rate was a negative 0.5%. Only five countries: Indonesia, Colombia, Chile, Oman and Botswana recorded positive per capita growth rates. For all the countries, the average rate of GNP growth was 0.9%. Apart from growth bias, mineral exporters fare badly in terms of social welfare, and income inequality (see Mikesell, 1997; Aunty, 1998). According to Aunty (1998), “heightened income inequality is associated with the resource-rich regions at both mid-income and low-income levels”.

What is more significant about this finding is that inequitable distribution of income is negatively related to skill acquisition and also to sustainable economic growth. As Birdsall (1997) notes, higher average educational attainment tend to mitigate income differentials, and when this happens the propensity of lower-income families investing in superior goods like schooling and health care is enhanced. This leads to greater health of the populace and improvement in the productivity of the workforce.

Table 1: Exports of Fuels, Minerals and Metals as a Percentage of Total Exports, Per Capita GNP (1992 dollars), and Average Annual GNP Growth Rates (1980-1992)

Country	Share of exports (%)	GNP (1992 \$)	Average annual growth (%)
Sierra Leone	34	160	-1.4
Niger	86	280	-4.3
Nigeria	96	320	-0.4
Togo	45	390	-1.8
Mauritania	84	530	-0.8
Indonesia	38	670	4.0
Bolivia	66	680	-1.5
Papua New Guinea	52	950	0.0
Peru	49	950	-2.8
Congo	92	1030	-0.8
Ecuador	45	1070	-0.3
Jordan	34	1120	-5.4
Colombia	29	1330	1.4
Algeria	97	1840	-0.5
Iran	90	2200	-1.4
Chile	47	2730	3.7

Venezuela	86	2910	-0.8
Mexico	34	3470	0.2
Trinidad/Tobago	64	3940	-2.6
Gabon	89	4450	-3.7
Oman	94	6480	4.1
Saudi Arabia	99	7510	-3.3
Botswana	NA	2790	6.1
All low- and middle-income countries	-	-	0.9

Source: World Bank (1994), *World Development Report*, Washington, DC.

Note: To the above list we may add Zaire and Zambia, which have a high proportion of mineral exports, but negative per capita GNP growth rates.

3. The Importance of Natural Resources

A good measure of the relative importance of natural resources or natural capital in long-term development is arrived at by the valuation of natural capital as a stock of wealth. The World Bank (1998) examined the share of natural capital in per capita wealth with that of produced capital and human capital. [In doing this, the asset value of natural capital is taken to be cropland and minerals measured as the stream of commodity output generated from natural resources valued at world prices and discounted at 4 percent over the lifetime of the work force. --- Meaning unclear!] The study shows that the relative importance of natural capital taken against other forms of capital is negatively correlated with per capita income. This is evident in table 2 where natural capital constitutes just about 2% of total capital in Western Europe and Pacific Ocean, and only 5% in resource-rich North America. In contrast, most Africa and the Middle East have 20% and 39% respectively. While the broad pattern would seem to be supported by empirical evidence, the figure for the least developed countries (LDCs), particularly for Africa would seem to be too low.

Other studies provide further evidence of the negative correlation between natural capital and national wealth. Sachs and Warner (1995) found a negative relationship between per capita growth rates and the rate of natural resource exports to CDP [What does this stand for?] for eighteen countries over an eighteen year period (1971-1989).

Resource-rich developing countries exhibit relatively poor per capita growth performance, while slower per capita growth is more pronounced in mineral exporting countries (see table 2). In the period of 1980-1992, average per capita GNP growth rate in the twenty-three mineral exporting countries was a negative 0.5% with the exception of five countries, namely, Indonesia, Colombia, Chile, Oman and Botswana. The evidence is corroborated by Nankani (1979), where he observed that "mineral economies have been less than successful in economic performance: lower rates of growth, lower levels of social welfare and more highly skewed income

distributions than non-mineral LDCs”.

Hirschman (1958) has also made the point about the relatively lower contribution of natural capital. He concluded that resource industries exhibit much lower linkage effects than manufacturing and are therefore less effective in propelling growth to the rest of the economy.

Table 2: Per Capita Wealth, By Major Global Region (1994)

Region	Total wealth (\$ per capita) %	Human resources %	Produced assets %	Natural capital
North America	326,000	76	19	52
Pacific OECD	302,000	68	30	239
Western Europe	237,000	74	23	9
Middle East	150,000	43	18	5
South America	95,000	74	17	6
North Africa	55,000	69	26	11
Central America	52,000	79	15	8
Caribbean	48,000	69	21	10
East Asia	47,000	77	15	21
East + Southern Africa	30,000	66	25	16
West Africa	22,000	60	18	
South Asia	22,000	65	19	

Source: World Bank (1998), *Estimating national wealth: methodology and results*, Environment Department Paper No. 57, Washington, DC.

4. Between Natural Capital and Human Capital

Manufactures export is commonly regarded as a proxy measure of competitiveness. The rapid growth of East Asia's economy has been intimately associated with export of manufactured goods (Wood and Berge, 1997). In contrast, primary product exporters, especially African exporters have fared less well.

Why is it that Africa with abundant natural resources has recorded significantly lower economic growth rates and social welfare than East Asia that is resource-scarce? In a series of empirical studies (see Mayer, 1997; Wood and Berge, 1997; Aunty, 1998), there is an emerging consensus that the key to greater industrial dynamism is superior human capital.

According to Berge [Reference? – Wood and Berge? Also, year – missing!], “Countries with high skill/land ratios have a comparative advantage in manufacturing; those with low skill/land ratios have a comparative advantage in primary production . . . the share of manufactures in exports depend on the availability not only of skill but also of land”.

From econometric studies, the authors [who are these authors?] demonstrate that the considerable inter-regional differences in the manufactured/primary export ratios are strongly correlated with inter-regional differences in skill/land ratio. The study divided the world into developed countries and the four main developing regions, namely, Africa, Latin America, South Asia and East Asia. East Asia has sub-components of seven high performing countries including Japan. The sixth group in their analysis is all other countries including those in Eastern Europe and the Middle East.

The proxy measure of skills is the average years of schooling, while natural resource endowment is taken to mean the land area per worker. The latter measure is questionable, as the authors noted, but it suffices as an unbiased measure. On average, both Africa and South Asia have low level schooling, Latin America and East Asia both have medium levels of schooling. The Asian regions are resource-poor, while Latin America and Africa are resource-rich. The contrast between high performing East Asia and Africa is very significant (see Tables 3 and 4).

Table 3: Variation among Country Groups

	Number of countries	Group mean (Standard deviation)		Coefficient on dummy variable (Standard error)
		Average years of schooling	Square km of land per 100 workers	
Developed countries	19	8.9 (1.7)	11.2 (21.8)	1.18 (.040)
Developing regions	11	5.1 (2.0)	4.9 (9.7)	0.02 (0.49)
East Asia (total)				
East Africa (high performing)	7	5.9 (1.5)	1.6 (1.8)	0.66 (0.58)
Latin America and Caribbean	21	4.7 (1.4)	10.8 (10.4)	-0.17 (0.37)

South Asia	6	2.4 (1.5)	3.0 (3.9)	0.94 (0.58)
Sub-Saharan Africa	84	1.8 (1.2)	24.8 (30.6)	-0.53 (0.35)

Source: Wood and Berge (1997), Exporting Manufactures: Human resources, natural resources and trade policy, in: *Journal of Development Studies*, Vol. 34, pp. 35-39.

Notes: 1. Group means and standard deviations are unweighted.

2. This grouping of the 114 countries [in regression (ii) --- Where is this? And need to double-check the figures in match with countries!] in Table 3 is based on the World Development Report 1993 (pp.326-7). Developed countries are high-income OECD, with non-OECD high-income countries transferred to the relevant other groups. High-performing East Asia economies are Hong Kong, Indonesia, Republic of Korea, Malaysia, Singapore, Taiwan and Thailand. The residual group (not shown) contains 23 countries.

Table 4: Human Capital and Natural Resource Endowment of Selected Country Groups

		Developing HPAEs			Sub-Saharan Africa		Developing America
		All	Republic of Korea Singapore	Indonesia Malaysia Thailand	All	Ghana Kenya Zaire Zambia Zimbabwe	
1960	Human capital	2.11	2.61	2.01	0.80	1.46	3.20
	Natural resources	3.96	0.68	3.86	13.73	22.90	18.24
1987	Human capital	5.34	7.70	4.84	2.60	4.21	5.48
	Natural resources	1.66	0.33	1.94	7.01	9.57	8.64

Source: Mayer (1997), [title?]; Based on skill and population data from Nehru et al. (1995), and land data from the World Bank. [Both references, otherwise which one is the correct ref.??]

Notes: Developing HPAEs = Developing high-performing Asian economies (Indonesia, Republic of Korea, Malaysia, Singapore and Thailand) The data used for this table is not available for Taiwan Province of China and Hong Kong).

See annex table A1, for the composition of the group of countries from sub-Saharan Africa and developing America.

Human capital are population-weighted regional average person-years of schooling of the population between age 15 and 64, as reported by Nehru et al. (1995). Natural resources are population-weighted regional averages of hectare per person of the population between age of 15 and 64. This measure implies that the decline in natural resources between 1960-1987 is due to population growth.

Other studies support the evidence provided by the authors. For instance, Table 4 shows that the skill endowment of sub-Saharan African countries as a group in 1987 is similar to that of the Republic of Korea and Singapore in 1960, an almost three decades' gap. The findings of the different authors can be codified in the following stylized facts:

- Resource-rich Sub-Saharan African with the poorest per capita income has the lowest ratio of manufactured exports to primary exports as well as the lowest density of schooling per unit area of land.
- Resource-poor East Asian countries, with relatively higher per capita income have the highest ratios of manufactured exports as well as the highest ratios of schooling per unit of land.
- South Asia, Latin America and South East Asia are in between.
- High rates of economic growth were stimulated among exporters of manufactures largely due to the development of a strong manufacturing sector. This sector makes greater demand on skills, a variable that is positively correlated with the economic growth.
- Manufacturing has stronger externalities being underpinned by higher level of technological capacity and technological capabilities acquired through "technological learning" (the ways by which enterprises accumulate competencies). Natural resources and service sectors require considerably less technological capabilities, but also contribute much less to economic growth.
- Resource-based industry has higher land-intensity and higher skill-intensity (and lower employment-intensity) than manufacturing. However, comparative advantage is possible, only if resource-rich countries complement this with higher skills and technical competencies.
- The structure of production has much to do with demand for education. In the case of East Asia, a combination of intensive agricultural system and the initially less capital-intensive manufacturing sectors demands greater skills and technological competence than does primary exports and import substitution adopted by much of African countries. This early investment in manufacturing led to equally early investments in primary education.

- Resource-abundance with poor human resources is not likely to promote export diversification from unprocessed primary products. Post-school skill acquisition should therefore be taken seriously in addition to schooling. For this reason, countries with poor human but rich natural resources, may adopt a strategy of producing and exporting processed forms of primary products. As shown in table 5, Africa's human capital is largely engaged in rural-based subsistence agriculture. Not surprisingly, the proportion of manufactures in exports is uniformly low for African countries with the exception of Mauritius (see table 6).
- Crop-driven economies seem to have an inherently slower growth rate than manufacturing-driven resource-scarce economies. The agricultural sector, if properly managed, may expand at 4%-6% annually at most, while manufacturing has the potential to grow at twice this rate or more. Consequently, an economy with a small manufacturing sector is likely to record slower economic growth rate and a smaller share of manufacturing in GDP, which varies systematically with per capita income.

Table 5: Industrial Structure of Labour for Selected Countries and Sub-Saharan Africa (1990)

Regions/Countries	Agriculture	Industry	Services
Sub-Saharan	67	9	14
Africa	63	11	16
All Africa	0	36	64
Singapore	18	35	47
Republic of Korea	12	32	55
Argentina	23	23	54
Brazil	[figure??]	[figure??]	[figure??]

Source: UNDP (1998), *Human Development Report*, New York.

Table 6: Industrial Performance of Selected African Countries (1995)

Region/Country	Real GDP	Manufactured Goods Export	Manufactured Goods Export as % of GDP	Value Added in Industry	Value Added as % of GDP
Sub-Saharan Africa	282,608	3,127	1.10	79,015	28.00
Botswana	2,693	45	1.67	1,188	44.00
Cameroon	9,555	137	1.40	2,177	22.80
Cote d'Ivoire	11,309	57	5.10	2,428	21.50
Kenya	10,005	182	1.82	1,626	16.30
Lesotho	651	43	6.60	286	44.00
Mauritius	2,855	852	29.50	850	29.80
Nigeria	34,196	22	0.06	10,421	30.40
Zimbabwe	6,375	829	13.00	1,660	26.00

Source: Calculated from World Bank (1997), *African Development Indicators*, Washington, DC.

5. Natural Capital in Development Perspective

The resource curse hypothesis is certainly a recent phenomenon, because natural resource endowment played a crucial role in the industrialisation of resource-rich western industrial nations. Among other things, natural capital accounted for:

- the initial source of inputs and provided impetus for practically all developments;
- provided a ready source of foreign exchange;
- provided the basis for inflow of foreign capital, technology and technological capabilities;
- provided the raw materials as inputs into the factory system and markets for manufactures.

In the period before the Great War (1870-1914), resource-rich countries prospered a result of strong demand for primary products. However, with the decline in bulk transportation costs and subsequent growth in manufacturing productivity, the trend was terminated (Sachs, 1996).

Resource-rich temperate lands of North America, Oceania and Southern South America achieved faster economic growth than resource-scarce Europe. However, post 1950s, per capita incomes in resource-scarce Europe grew at a much faster rate (3.8%) per annum (1950-73) compared with 2.4% growth recorded by the resource-rich countries. This pattern was replicated among resource-deficient East Asian economies than both Latin America and sub-Saharan Africa (see table 7).

The rise of East Asia puts to question the thesis that the poor economic growth rates in Latin America and sub-Saharan Africa was as a result of deterioration of the exports of commodities from these areas. The dynamism of resource-poor East Asia suggests that economic progress is possible in the absence of natural resources. In the absence of natural endowment, resource-poor areas progressed on the basis of imported technology acquired through deliberate technological learning and undergirded by massive investment in education, particularly in technical and science education.

Kim (1999) argues: "Regardless of one's theoretical explanation of what has happened, the evidence of acquisition of new technological capabilities is dramatic in NICs. In the period since the early 1960s, countries such as Republic of Korea, Taiwan and Singapore have transformed themselves from technologically backward and poor to relative modern and affluent economies. Each now has a significant collection of industrial firms producing technologically complex products . . . Beginning in 1962, the Korean economy grew at an annual rate of almost 9 per cent through the mid-1990s . . .".

In effect, modern industrial economies are built less on the production of primary products, but more on manufacture of high value-added goods. Dynamic economies are in turn built on the foundation of modern technology, and an array of technological competencies. We suggest that growth ceased in sub-Saharan Africa partly as result of the region's over-reliance on commodity export and the failure of African countries to effectively manage imported technology.

Another reason is related to the above. Most of the relatively rich African countries like Nigeria had taken the path of development through resource-based industry (RBI). However, RBI demands higher land-intensity. But then again, as Aunty (1998) observes: "comparative advantage in RBI is more likely in those resource rich countries with high skills, than those with low skills. RBI has been important route to industrialization for Latin America, but not for Sub-Saharan Africa."

Table 7: Real Per Capita GDP Growth 1820-1992, by Region Sample Countries (%)

	1820-1870	1870-1913	1913-1950	1950-1973	1973-92
W. Europe	0.9	1.3	1.2	3.8	1.8
W.[?]	1.4	1.5	1.3	2.4	1.2
Offshoots	0.1	0.8	0.1	5.6	5.3

E. Asia	N/A	N/A	-0.1	2.5	3.6
SE. Asia	0.1	0.4	0.6	0.9	2.4
S. Asia	N/A	1.5	1.9	2.4	0.4
Latin America	N/A	N/A	1.5	1.9	-1.2
SS. Africa	[figure?]	[figure?]	[figure?]	[figure?]	[figure?]

[source -- missing!]

In explaining, why development performance of resource-abundant countries has been relatively poor, Wood and Berge (1997) concluded that: "one of the suggested reasons is that manufacturing has inherently greater growth potential than primary production, because of faster technical progress and more scope for learning-by-doing".

In order to prosper through manufacturing, a country needs high skill/land ratios that confer comparative advantage in manufacturing as in East Asia. Open trade policy is likely to lead to manufacturing contraction in low skill/land ratios as in Africa. In the next section we will examine the competitive assets of Africa's manufacturing industry. We take it that the manufacturing enterprise is the strategic locus for innovation and production.

6. The Competitive Assets of African Industry

In historic terms, resources endowment, availability of cheap and plentiful low-level skills were factors that gave competitive edge to countries and regions. Traditionally, LDCs' and particularly Africa's export strength had been in commodity. LDCs had developed industries in which they have comparative advantage such as food processing, beverages and tobacco, clothing and textiles, and leather and leather products (including footwear). However, intense competition and aggressive export of low cost products from Asia have not only eroded LDCs' share of global production, most enterprises have not been able to compete even in the domestic market. The players in this market are largely small and medium-sized enterprises (SMEs) and are characterised by the following:

- African SMEs are largely labour-intensive establishments operating with technologies that are often low-level and somewhat outdated. This is in sharp contrast with East Asian SMEs operating in skill- and technology-intensive industries.
- African SMEs have relied on low cost raw materials, low energy costs in addition to low labour cost; all of which are becoming less significant in the competitive equation.
- African SMEs operate within industrial environments, in which physical and engineering infrastructure costs are extremely high and as such transport and telecommunications are

not only primitive but also inadequate and often unavailable.

- The dynamic "missing middle" within the SME category is rare in most LDCs and the countries are highly populated by microenterprises and small enterprises that are decades behind the "ideal" export-oriented skill-intensive types found for instance in Japan.
- For these reasons, African SMEs tend to operate well below world competitive "benchmark" (best practices) and innovate at levels far behind the industrial leaders.

National comparative advantage may be gained, when an economy is able to move from "resource-driven" to "investment-driven" stage of economic development, according to Porter (1990). But then competitiveness is essentially enterprise-driven. It is at the level of the enterprise that competitiveness is built and lost, and this happens when enterprises explicitly build up technological capabilities. The development of industrial competitiveness necessarily involves a process of building technological capabilities, as Lall (1995) argues.

The accent on "process" necessarily connotes timeliness and dynamism, a point more pointedly made by Mytelka (1998), who in addition emphasised the systemic importance of the innovating context, as follows: "Innovation policy. . . is part of a larger set of sometimes complementary, sometimes contradictory policies. . . Industries are characterised by a multiplicity of competitive, organisational and institutional practices, by social regularities, rules, and expectations".

In other words, the above elements, particularly the environment, in which the enterprise is embedded, will for good or ill shape the competitive edge of the African firm.

Liberalisation, Learning and Supply Response Capacity of Industry

As enterprises face global competition, it becomes clear that traditional notion and traditional enterprise-level concept of assets had to change. No single event in the recent past has brought this home as poignantly as economic liberalisation and the wave of innovations of the last decade. Dynamic capabilities acquired through technological learning now characterise firms that succeed in today's market environment. This is because the "new competition" is accompanied by rapidly shifting market environment, fast changing pace of innovation in processes and products, high level of uncertainty and hard-to-determine response of competitors.

But what capability does an average African enterprise possess, upon which it must build new competencies?

The concept of path-dependency has been employed by the evolutionary school to emphasise the fact that 'history matters' (Teece, 1994). Learning is heuristic - characterised by trial-and-error, and involving feedback and evaluations. This means that the process of capability building takes time and is highly dependent on the enterprise's previous history (or initial conditions). In other words, a firm's core competence will greatly determine its response to present and future events.

This has also to do with the fact that learning is localised, highly tacit and idiosyncratic. Firms

learn and stay on certain paths as a result of the transactional environment and production challenges that they face. When the rules are changed too quickly, and the environment shifts in too many directions, the capacity to respond coherently and competently is jeopardised. This is particularly true, if new competencies are not developed to cope with new rules and changed environment.

From our earlier characterisation of African enterprises, a vast majority are ill prepared for the kind of competitive pressures that they have been made to deal with in the face of current sweeping liberalisation. This is because it is difficult to transform organisations overnight. Industrialisation itself is about continuous acquisition of technological capabilities by firms.

This means a process, in which enterprises are themselves progressively transformed from traditional units employing outdated techniques to modern establishments employing complex technologies. In other words, industrialisation of an economy is synonymous with the modernisation of the enterprises in that economy. For Africa, SMEs are an important agent of the industrialisation process. Effort to modernise them is therefore an effort to industrialise.

Technology and Resources-based Industry: What has changed in the Global Context?

In broad terms, rapid technological changes and worldwide neo-liberal reforms have given rise to different and new forms of competition and manifest for enterprises in the following ways:

- 1) Technology transfer cycle has shrunk considerably, and available catch-up time has reduced significantly. The implication of this is that firms that do not have the absorptive capacity to quickly master production and design will be increasingly marginalised.
- 2) Competitive advantage is no longer based on low labour cost, low energy cost and abundant natural resources; but on enterprise-level competencies that are readily deployed to master complex technologies as well as on competencies to respond to markets that are in perpetual flux.
- 3) The new rules-based competitive regime makes very little effort at discriminating between the more advanced NICs and LDCs; even though some LDCs are industrially more than three decades behind the NICs.

For instance:

- WTO strips local markets and firms of protection from foreign products, services and investment and investment, and in the process pits local firms in competition with often better prepared foreign firms.
- Enforcement of intellectual property rights strips local enterprises of an important source of non-formal technology transfer mechanism, namely, reverse engineering. This means local firms must develop own designs or pay royalties for technologies that were hitherto free.
- Anti-dumping rulings foreclose or at least makes difficult, cut in export price presumably so African firms will compete on level terms.

Again, the abolition or reduction of local context provision and state preferential procurement for guaranteeing market for infant enterprises tend to put extreme pressures on enterprises and are bound to impact negatively on enterprises in the region.

In specific terms, Box 1 captures the paradigmatic shifts at the level of technology policy (macro) and at the level of technology strategy (enterprise competitiveness).

Box 1: Paradigm Shift in Technology and Policy Strategy in LDCs

Corporate Strategy	
From	To
Conventional production engineering	Total quality management, just-in-time, ISO 9000 systems, constant improvement
Traditional forms of autonomous R&D in isolated research institutes	Networking, international integration of R&D, collaboration with suppliers
Cost competition	Competition based on flexibility, new materials and products, delivery and training
Adversarial relations with suppliers	Closet and continuous linkages, exchange of information and technology

Technology Policy	
From	To
Mission-oriented policies led by public institutions	Market-driven R&D, led by private sector with public research support, technology
Passive technology import	Indigenous capabilities to conduct R&D, adapt and diffuse new technologies
Regulation of technology transactions and FDI	Active support of technology import, alliances with TNC support for R&D
Institution-led training and formal education	Industry-led training, continuous education and skills upgrading

Source: Adapted from Lall (1995), [Is this S. Lall, 1990 or D. Lall 1995??? Pls. compare your reference]
Why growth rates differ in social capability and long term economic growth. etc [?], pp. 288-309.

7. Factors Inhibiting Competitiveness

In the previous sections, the point was made that the manufacturing capacity of African economies is weak and that it is the sector that is capable of generating greater productivity far more than agriculture and services. According to the first African Competitive Report published by the World Economic Forum, the most problematic factors that inhibit business in the continent are:

- (a) Tax regulation regimes
- (b) Difficulties in raising local financing
- (c) Weak infrastructure, and
- (d) Corruption.

For the countries surveyed, the major competitive constraints are summarised in Table 8. From Table 8, most of the factors inhibiting competitiveness are supply side rigidities. While macroeconomic stability is important, it is naïve to assume that a uniform set of rules will apply to all African countries. The structural adjustment programmes, as they were applied, could not possibly enhance productivity growth, particularly in manufacturing, and especially given the low skills/land ratio prevailing in Africa. Wood and Berge (1997) argue, as follows: "our results call into question the universal applicability of the now-conventional policy advice that openness to trade promotes development: this advice may be right for countries with high skill/land factors and hence a comparable advantage in manufacturing, as in East Asia but not for countries with low skill/land ratios, where more open trade policies would tend to cause manufacturing to contract".

The key to sustained productivity growth, which is required for competitiveness is high level managerial and technical manpower.

Table 8: Factors Constraining Competitiveness in Africa (1998)

Botswana	Labour, inflation, financing, infrastructure
Burkina Faso	Financing, infrastructure, tax, regulations, coups
Cameroon	Corruption financing, tax infrastructure
Côte d'Ivoire	Tax, policy, finance, education, infrastructure
Ethiopia	Infrastructure, Tax, finance, corruption
Ghana	Inflation, finance, tax, infrastructure, corruption
Kenya	Corruption, infrastructure, crime, finance, policy, instability

Malawi	Infrastructure, finance, crime, corruption, education
Mauritius	Labour, education, policy instability, inflation
Mozambique	Infrastructure, tax, crime, education corruption
Namibia	Education, work ethic, labour crime
Nigeria	Infrastructure, corruption, political and policy instability, inflation, crime
South Africa	Crime, tax, labour, work ethic, education
Tanzania	Tax, finance, infrastructure inflation, regulation
Uganda	Finance, infrastructure, tax, corruption, political instability
Zambia	Finance, tax, inflation crime, education, infrastructure
Zimbabwe	Tax, inflation, infrastructure corruption, policy instability

Source: UNIDO (1998), *Domestic Capacity-Building for Enhancing Productivity and competitiveness in Africa*, Vienna.

8. Natural Resources and Competitiveness

While external factors are becoming increasingly important, there is evidence that many of the factors that determine national competitiveness are to be found within the domestic economy. An important factor of competitiveness is sustained productivity growth, which is what enhances the competitiveness of firms. In fact, growth in per capita income in advanced industrial countries is often tied to domestic productivity. In other words, African countries will do well to pay close attention to those determinants of productivity.

While input factors such as labour and capital are important, they are not the principal sources of productivity. There is considerable evidence that the nature of industrial organisation such as clustering and networking, domestic technological capabilities, human and physical capital formation and the nature of the incentive system exert far greater influence on the competitive performance of domestic economies. In effect, natural resource endowment is only an evidence of potential that has to be transformed through the instrumentality of human capital and technological capacity.

For African countries, comparative advantage has always been in agricultural industries due to the considerable agricultural resources of the region. However, gaining competitive advantage in this sector is not automatic. From empirical evidence, natural resources processing require significant human and technological capital, even if this is not as demanding as that required for manufactures. However, what has been the productivity growth profile for Africa?

According to UNIDO (1998), total factor productivity grew at a yearly rate of 0.2 percent in Africa during the 1971–1993 period, compared with 1.4 percent for all developing countries. Two main reasons are advanced. The first reason is the rapid decline in the share of industry and manufacturing in African GDP during the 1980–1996 period. Secondly, productivity growth was depressed by scarcity of technological competencies, deteriorating physical and institutional infrastructure and diminished markets.

De-industrialisation has a direct relationship with decelerating productivity growth, according to Pack (1994) and Lall (1990). De-industrialisation manifests in the reduction of Africa's share of world manufacturing value added, which was 0.3 percent in 1980 and down to 0.2 per cent in the late 1990s. Again output per head manufacturing fell from \$7,924 in 1990 to \$6,762 in 1996, according to UNIDO (1998).

Is Comparative Advantage in Resource-based Sectors Automatic?

The pertinent question now is, whether comparative advantage is automatic as a result of resource abundance. If we examine table 9 closely, we will find that the only industrial branch, in which Africa recorded a positive value of revealed comparative advantage index was food manufacturing in 1976. Leather products and wearing apparel improved considerably in 1986 and 1995, while food-manufacturing declined. While the manufacturing sectors as a whole improved, a number of the “natural” branches such as textiles and beverages deteriorated.

Given Africa's resource abundance in the branches shown in table 9, the regional competitive performance is disappointing. For instance, only a handful of countries have gained competitiveness in a sector such as footwear, clothing and textiles. However, revealed comparative advantage has increased considerably in furniture and leather products, which are the most labour-intensive branches. So what does all these mean? We advance a number of propositions as our conclusions.

Table 9: Revealed Comparative Advantage (RCA) Indices, Africa except South Africa, 1975-1995 (percentage)

		1976	1986	1995
311-12	Food manufacturing	37.1	13.7	-0.9
313	Beverages	-22.7	-33.4	-501
314	Tobacco	-61.8	-64.9	-72.7
321	Textiles	-59.5	-55.3	-67.1

322	Wearing Apparel	-20.6	25.0	81.0
323	Leather Products	-8.4	6.1	23.1
334	Footwear	-26.4	-11.2	6.2
331	Wood Products	-26.8	-32.8	-24.1
332	Furniture	-36.7	-32.9	-12.2
352	Other Chemicals (Fertiliser Proxy)	-81.5	-100.9	.91.1
369	Other non metallic minerals	-167.5	-199.9	.99.0
	Total manufacturing	-57.7	-45.1	-41.1

Source: UNIDO (1997), *Progress and Prospects for Industrial Development in LDCs: Towards the 21st Century*, 19 November 1997, Vienna [document??, mimeo??]

9. Conclusions

The main conclusions are as follows:

- 1) Resources endowment does not bestow automatic comparative advantage on a country or region.
- 2) Export-oriented strategy will not automatically induce faster productivity growth.
- 3) Rapid productivity growth and subsequent competitiveness can only be advanced by the accumulation of relevant technological capabilities. The accumulation of technical competence is achieved only through technological learning – a highly heuristic process – that takes time and calls for explicit investment in human capital formation.
- 4) While natural capital points the way to the nature of activities that a country or region may carry out, it is not a sufficient condition for development. The key to gaining competitiveness is the building up of capacities within domestic firms and benchmarking them with firms elsewhere in the world.
- 5) At the macroeconomic level, African countries need to begin to pay closer attention to the mix of disciplines that promote industrial growth.

This may be looked at two levels:

- a) Schooling: recent data show that growth in per capita GDP is positively correlated with enrolment in Mathematics, Science and Engineering;
- b) Human skills formation at shop floor which requires the building and where already available, strengthening of technological institutions for skills and managerial training. Box 2 shows the findings on schools enrolment and per capita income.

Box 2: Mathematics, Science and Engineering Studies May Spur Growth

A recent study investigated the relationship between the proportions of college students majoring in various disciplines in 1970 and subsequent real growth in GDP per capita. The study found a significant positive association between the proportion of engineering major and later growth, but none between the proportion of pre law students and growth. And for the 55 countries with college enrolments of at least 10,000 in 1970, the proportion of college students in engineering was [significantly and with primary schooling --- meaning unclear!]. Although these studies fall short of establishing a causal effect of science and engineering education on growth, they confirm that countries with a more technically skilled labour force do have faster growth. The emphasis by some countries on higher scientific and technical studies has enhanced their capacity to import sophisticated technologies from the richer industrial countries and helped maintain high rates of economic growth over a long period. When current tertiary enrolment is broken down by field, the East Asian economies show higher ratios in technical fields than the major industrial countries.

Source: World Bank, *World Development Report* (1998/99), Washington, DC. [which year, 98 or 99 is correct?]

References

Aunty, R. (1998), *Resource Abundance and Economic Development: Improving the Performance of Resource-Rich Countries*, UNU/WIDER: Helsinki.

Birdsall, N. and D. Ross and R. Sabot (1997), Education, growth and inequality, in: N. Birdsall and F. Jasperson (eds.), *Pathway to Growth: Comparing East Asia and Latin America*, Inter-American Development Bank: Washington DC, pp. 93-127.

Hirschman, A.O. (1958), *The Strategy of Economic Development*, Yale University Press: New Haven, CT.

Kim, L. (1999), *Management of Technology in Developing Countries: Lessons for Africa*. A paper presented in a conference at the ECA, Addis Ababa, June 21-26, 1999.

Lall, D. (1995), Why growth rates differ, in social capability and long term economic growth, etc [?] BH Koo and D.H. Perkins, Macmillan: New York, pp. 288-309. [incomplete/incorrect reference??]

Lall, S. (1990), *Building Industrial Competitiveness in Developing Countries*, OECD: Paris, 1990.

Mayer, [?] (1997) [reference missing!]

Mikesell, R.F. (1997), Explaining the resource curse, with special reference to mineral-exporting countries, in: *Resources Policy*, Vol. 23, No. 4, pp. 191-99.

Nankani, G.T. (1979), *Development Problems of Mineral-Exporting Countries*, World Bank Staff Working Paper No. 354. World Bank: Washington, DC.

Nehru, [?], et al. (1995), [missing reference]

Pack, H. (1994), Productivity and Industrial Development in sub-Saharan Africa, in: *World Development*, Vol. 23. 1994, pp.1-10.

Porter, M. (1990), *The competitive Advantage of Nations*. [missing location, publisher: incomplete reference!]

Sachs, J. and A. Warner (1995), *Economic Convergence and Economic Policy*, Working Paper No.5039, National Bureau of Economic Research: Cambridge, MA.

Sachs, J. (1996), *Resources Endowments and the Real Exchange Rate: A Comparison of Latin America and East Asia*, mimeo, Cambridge, MA:

Teece, D. (1994), [missing reference]

UNIDO (1997), *Progress and Prospects for Industrial Development in LDCs - Towards the 21st Century*, [mimeo??] 19 November 1997, Vienna.

UNIDO (1998), *Domestic Capacity-Building for Enhancing Productivity and competitiveness in Africa*, Vienna. [incomplete reference!]

Wood, A. and K. Berge (1997), Exporting Manufactures: Human Resources, Natural Resources and Trade Policy *Journal of Development Studies*, Vol. 34, pp. 35-39.

World Bank (1994), *World Development Report*, World Bank: Washington, DC.

World Bank (1997), *African Development Indicators*, Washington, DC.

World Bank (1998), *Estimating National Wealth Methodology and Results*, Environment Department Papers, No. 57, Washington DC.