

TECHNOLOGICAL DEVELOPMENT IN AFRICA: IMPEDIMENTS AND RECOMMENDATIONS FOR CHANGE

Constantine Bartel and Teisha Oberg, ATDF

Abstract

Indications are that the gap between African exports and that in non-African developing world is widening. Africa maintains its tradition of exporting unprocessed materials, and sub-Saharan Africa's exports consist mainly of primary products, while other developing countries have diversified. The main structural problem contributing to this appears to be Africa's weak technological and managerial capabilities. Africa pursued IMF and World Bank structural adjustment policy with the expectation that that liberalization would lead to the success of export-oriented countries of East and South-East Asia. However, it has now become clear that other measures are needed.

Introduction

It seems that the manufacturing sector is the main catalyst of economic development and modernisation, hence countries use technology to improve production processes to achieve comparative advantage in manufacturing. In most manufacturing activities, competitiveness can be attributable to the continuous modernization of production processes, organizational methods, networks, firm-wide and region-wide integration of production systems, as well as technological change. The East Asian experience shows that coherent, well-designed technology policies can increase firm's competitiveness, and help businesses to develop and pursue technology development activities.

Unlike many countries which constantly upgrade their technological capabilities, to function in an increasingly liberalized and competitive world, African countries have not, even in the cases where governments have recognized the importance of technology policies, such as Ghana and Tanzania. While some problems with African industrial development are attributable to political and ethnic conflicts; natural disasters; external market shocks in the form of declining terms of trade; debt or falling aid inflows; poor macroeconomic management; and inadequate infrastructure, others are due to inappropriate industrial policy. Africa countries must, like others, industrialize efficiently in order to grow, compete and advance.

1 Technology gap; a summary of five indicators.

The fact that technological gap could be the source of Africa's increasing economic deterioration was confirmed in a case study of four sub-Saharan countries -

Kenya, Ghana, Uganda and Tanzania. The study-cited weaknesses in the conditions and policies governing technology transfer, as well as its absorption and use in the manufacturing industry. The study assessed the technological capabilities in these four countries using five indicators:

1. Technological structure of manufactured exports;
2. Industrial performance;
3. Human capita base;
4. Structure of manufactured exports sector;
5. Foreign technology inflows, particularly through foreign direct investment (FDI).

1.1 Technological structure of manufactured exports

Manufacturing in African has many weaknesses: few supply linkages between large and small enterprises, poor productivity growth, low technological efficiency with little dynamism or innovation (Lall and Wangwe, 1998). In addition, African firms are below international "best-practice" technical levels, and below the levels of other developing countries (Biggs, Shah and Srivasatava, 1995). Consequently, manufacturing has slowed down regional economic growth.

Africa lags behind because it is still dominated by a low-level of processing natural resources and the manufacture of simple consumer goods for domestic markets. It is characterized by small and weak indigenous base of industrial entrepreneurship. African manufacturing does not show many signs of upgrading, yet efficient competition requires better technological capability in every country, regardless of resource base and location – even those that are not at the frontiers of innovation.

1.2 Structure of manufactured exports sector

The amount of manufactured exports is an indicator of technological strength and specialization of the industrial sector (particularly when countries are assessed comparatively). It shows trends for trade activities and provides an overview of underlying technological activity. In general, technology-intensive activities are expected to be more beneficial because:

- ⇒ There is demand for activities with rapid innovation as opposed to technologically stagnant activities; Newly invented products substitute for other products (final or intermediate) and stimulate demands for other technology-based products; thereby quickening the pace of production, employment and

exports;

- ⇒ Technology-intensive activities are less vulnerable to entry by competitors compared to low-technology activities;
- ⇒ Technology-intensive activities offer higher learning and productivity potential and greater spill over benefits for other activities. Thus, they lead to faster growth in skills, greater diffusion of knowledge and offer greater systemic benefits for learning and innovation;
- ⇒ They are more attuned to technological and market trends, giving the ability to respond more flexibly to changing conditions. In the emerging global environment, therefore, they provide more valuable competitive skills.

Among developing countries, Asia had a two-thirds increase of manufactured exporters compared to 1980, Latin American maintained its 20 % share, but Sub-Saharan African lost ground in its world market shares of manufactured exports in every category, including resource-based exports.

Export growth and technological upgrading seem to be bypassing Africa. Countries are still exporting unprocessed materials, which is the slowest-growing segment of world trade and the least stimulating for structural, entrepreneurial, skill and technology growth. Apart from the Middle East and North Africa and its huge oil-exporting base, Africa is the region with the highest reliance on primary products.

1.3 Industrial Performance

Sub-Saharan Africa lags in terms of volume and technological content of its manufacturing activity. In the past twenty years manufactured exports have not grown significantly (Helleiner, 1999); growth has been very low or even negative. The only African enterprises growing are those with a local cost advantage, or those with niche markets that do not face direct import competition. And while it is possible to remain competitive with unskilled cheap labour and by processing natural resources in some largely traditional activities, this base is eroding steadily.

The revival of growth and competitiveness in Africa must be based on greater technology inflows into Africa and on improvement in enterprises' ability to absorb, adapt and improve on imported technologies.

1.4 Human Capital

Technological activity levels are closely linked to the skills level and skills need to be continuously upgraded. Traditional methods of education and training such as primary schooling, basic technical activities and ad hoc on the job training are not sufficient for technological advancement today. Industrial development now requires high-level specialised training with close interaction between education and industry, including cognitive

Facts:

Between 1972 and 2002 income per capita in Sub-Saharan Africa fell by 8 percent, from USD 625 to USD 575 in constant 1995 values.

Between 1972 and 2002 manufacturing value-added per capita in Sub-Saharan Africa fell by 13 percent, from USD 98 to USD 85 in constant 1995 values.

In 2001/2002 the share of Sub-Saharan African in world income was 1.1 percent, the share in world manufacturing value-added was 0.8 percent, and the share in world manufacturing exports was 0.7 percent.

Source: World Development Indicators¹

skills relevant to information technology (Breshnam, Brynjolfsson and Hitt, 1999).

A 2002 assessment of the impact of skills on productivity in Ghana, Kenya and Zimbabwe shows that most firms are relatively isolated from world markets both as importers and exporters, and that they import little technology. African countries also lags in research and development (R&D) as a share of national income, and the number of scientist and engineers engaged in R&D. Similarly, they are behind in the number of international standards organization 9000 certificates. These certificates are a good indicator of export levels. Up until 1998 Tanzania and Uganda had not received any certificates.

Comparison of enrolment data across primary, secondary and tertiary levels of formal education show that Sub-Saharan African lags behind the mean for developing countries, Asia and Latin America. Tertiary enrolment in technical subjects such as science, mathematics, and engineering which affects the capability to absorb technology is lower. Moreover, while Sub-Saharan Africa has 12% of the population it accounts for only 4.4% of enrolment in tertiary institutions and 3.1 % of technical tertiary enrolments and 1.7% of engineering enrolments.

To promote national technological growth, African countries must introduce corrective policies and change the traditional mindsets to form interactions and linkages with other firms or institutions, and to build technical know-how, as well as to overcome the problem of brain drain.

1.5 Foreign technology inflows, particularly through FDI

Foreign technology may be introduced in a country through many channels, principally through capital goods imports, royalties and inward FDI. Most developing countries acquire technology via capital goods imports. However, Kenya, Ghana, Uganda and Tanzania import very little new capital goods. In Uganda, capital goods can be brought duty free, however, the tax deductibility (50-70%)

for plant and machinery have not stimulated growth. Poor infrastructure, and costly communication and transportation also raise the cost of importing capital goods.

Developing countries as a whole paid \$5.8 billion in licensing fees in 1997 for imported technology. Of this, Sub Saharan Africa, excluding South Africa, paid \$84 million and Kenya and Swaziland \$39 million each. Ghana's payments for royalties and license fees show that only a trickle of new technology in terms of royalties and licenses enter the country (how much is a trickle).

Technology imports seems very low in Africa and technological efforts to adopt, import or adapt foreign technology are limited at the firm level. Even where there are foreign affiliates, such as in Ghana, they do not make much impact on domestic technology development and they operate in the primary and the services sectors as opposed to the manufacturing sector. Moreover, inflows are not by themselves necessary nor sufficient to ensure industrial development or technology upgrading.

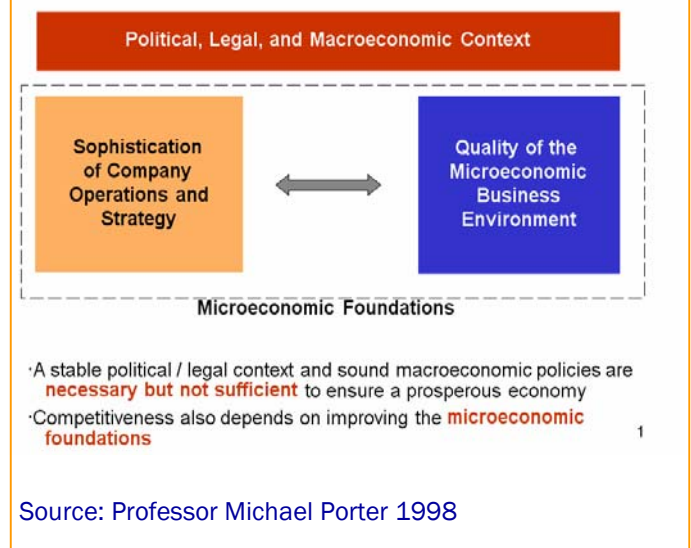
2 Role of Government

Although productivity has become an important issue globally, some aspects of productivity are not well understood. First, it is generally known that in thinking about productivity one must think as much about the value of the products as the efficiency with which the products are produced. Even though productivity indexes are indexes of unit volume productivity - yet that is not directly what matters. What matters is the value you can create with a day of work, or a dollar or pound of capital invested, and increasingly we need to think about value productivity. Secondly, ownership of the company and where the company is owned is less and less important to prosperity. What matters to the prosperity of a nation is what companies choose to do in their location, not whether those companies are American, Japanese or UK owned.

What will eventually drive the productivity of (African) countries is what the companies choose to do in Africa. If they choose to do very productive things and use very advanced technology to produce a lot of value per unit of work, then African countries will be prosperous as the wages will be high. So increasing ownership of the company matters much less than the environment provided by a country that allows the company to operate in a productive way. As long as African policy makers see their countries as low cost production sites rather than a high value production site, the trend will never be broken (Michael Porter).

Government policies have a major role to play in facilitating technological development by implementing policies that, promote in-firm learning and skill development; improve the supply of information and skills from markets and institutions, and coordinate collective learning

Moving to an Advanced Economy



ning within and across industries. As illustrated by the example of East Asia, strong government intervention can be an engine of technological development if it takes place as part of an export-oriented strategy and is reinforced by policies that boost learning and help one to acquire new skills and access information.

In the past, many African Governments offered high and indiscriminate protection to industry. They encouraged state-owned enterprises with limited managerial and technological capabilities and this fostered rent-seeking and political interference, which exacerbated inefficiency. Some Governments also nationalized enterprises run by foreign firms or entrepreneurs of non-African origin and created environments that were riddled with high transaction costs and often inhospitable even to local entrepreneurs.

Poor economic conditions, disillusionment with past strategies and intense pressure from other countries caused many African governments to liberalize economic policies with the hope of reviving growth in manufacturing output, exports and employment. They introduced liberalization as part of the IMF and the World Bank structural adjustment programme—regardless of their level of industrial development. Adjustment was touted as having the ability to improve productive sectors by removing inefficient interventions and expose activities to international competition and governments believed that this would lead to efficiency and technological dynamism. Liberalization was considered to be sufficient for better performance and most of the burden of policy reform was based on price adjustment.

Efficient use of technology requires the ability to master new technology; to adapt it to local factors and conditions; and to upgrade as technologies improve and new products emerge. It is more than importing machinery. It entails building capabilities, technical understanding and an informational base; acquiring new technical skills and

managerial practices; and forging linkages with other firms and institutions. The main factors affecting technology development are the rules governing competition and trade policies, other important matters are regulations, physical infrastructure, skills, financing, and technology and supply clusters.

3 Intellectual Property

The intellectual property regime in a country is central to technological activity as it covers trademark, patents, copyrights, trade names etc. Patents tend to spur innovation and also facilitate the transfer of technology. Intellectual property protection can raise the cost to developing countries of buying technology and stifle local copying, one way of building technological capability. Generally there is a low level of patents granted to individuals in Kenya, Ghana, Uganda and Tanzania.

4 Science and technology training and policy-making structure

In Kenya, the jurisdiction for science and technology is disbursed across 3 ministries and these overlap tend to lead to conflict. There is also little interdepartmental communication and coherence and coordination in decision-making. The relations between the different bodies in the ministries are also weak. There is no institutional mechanism in Kenya for comprehensively evaluating and setting science and technology priorities. There is no well-developed science and technology plan, and responsibilities are spread over many ministries and institutions. While in Ghana science and technology coordination face difficulties from excessive fragmentation and suffers from sectoral policies and objectives. The educational and training institutions do not produce enough graduates to satisfy the quantity and quality of industrial development. In addition, in most Sub-Saharan countries it is public institutions which undertake research. This is in contrast to other industrializing countries where private enterprise finance and undertake R & D.

5 Summary

The wide technological gap between Africa and the rest of world can be bridged. For this to happen, Africa needs unabated commitment by governments in furthering science and technology. And a strategy and focus that everyone including the public and private sectors can implement. Africa needs to have a vision, a policy. It needs to have something to aim at, a goal to which it is committed, something to budget for. Unless goals are set and clearly defined, there would be nothing to work for. For example India crafted its three-page policy framework on science and technology in 1958 and it is still valid day.

Sub Saharan Africa does poorly in industrial competitiveness. It mostly exports primary products that offer few beneficial learning or spill over effects for technological development. African enterprises have failed to

build up comparable levels of technological capability with many developing countries, and few have reached a level where they could compete directly in international markets as a result manufacturing rudimentary dominated by simple activities.

The region lacks technological dynamism and the basic pre requisites for technological development. The skills base is weak and the education system is not attuned to the needs of industrial competitiveness. Low wages in Africa has not led to increases in the global production of low technology consumer product. The region hardly exports any sophisticated products.

Inflows of technology, as measured by contractual transfers, FDI and equipment imports are very low. As a result there is little mastery of simple technologies and technological learning and diffusion are limited. The ability to absorb sophisticated technologies, the cutting edge of industrial dynamism and competitiveness is absent.

Trade liberalization in Africa has not been linked to technological policies. Instead of functioning as the engine of growth and structural transformation, the industrial base is eroding in part due to liberalization and adjustment.

Recommendations

Policy

- ⇒ Undertake a technology foresight exercise involving industry, government, technology institutions, and universities. Have all sectors assess local technological competence by global standards and work out strategies to overcome weakness and to upgrade. In doing this assessment, evaluate the role of technology as distinct from science.
- ⇒ Review and improve technology strategy formulation and entrust one body to analyze technological needs, and to design and implement strategies at the national level.
- ⇒ Improve budgeting and allocate more resources.
- ⇒ Improve the R&D climate. Promote industrial R&D through attractive fiscal incentives, service support systems and have a campaign targeting the industrial and business sectors.
- ⇒ Strengthen the technology infrastructure and institutions such as the bureau of standards, institutions and promote SMEs in high value added industrial activities.
- ⇒ Stimulate and improve technology imports, and base technology upgrading on current technological levels and the needs of the manufacturing and industrial sectors.
- ⇒ Attract FDI in manufacturing offer fast services for investors that are modern and competitive, one-stop shops for permits and licenses.
- ⇒ Consider establishing a benchmarking unit trained to develop, implement and analyse benchmarking in

industry involving the private sector and association. Technology upgrading requires an understanding of technological status and needs of upgrading enterprise. Countries gain such understanding by conducting and promoting benchmarking enterprise.

Education and Training

- ⇒ Have a skills strategy to create competitive skills for industry.
- ⇒ Improve human skills will create qualified technical and managerial personnel who will respond to rapid economic and technology development and help the move into more advance technology.

Intellectual Property

- ⇒ Strengthen IP rights in terms of formulation of competition policy and price regulation.
- ⇒ Implement targeted subsidies and other transfer mechanism to mitigate the potential negative effects of strong ownership rights on IP on the cost of technology transfer.
- ⇒ Train patent lawyers.

Support for SMEs

- ⇒ Make information provision to enterprise the focus of technological transfer. Provide information to export - oriented SME's on the sources, cost and appropriateness of foreign technologies, as non export oriented firms find it difficult and costly to obtain information on the sources of technology. This can be done through online databases in industrial activities.
- ⇒ Provide technical extension services to help SMES absorb new technology. In East Asia and Hong Kong, not only was information provided but it was backed by advice, finance, consultation, and market support and subsidized assistance.

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