SCIENCE AND TECHNOLOGY POLICIES IN AFRICA

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Summary

The forces which govern today the construction of S&T policies in Africa cannot be understood without taking a look at the past, which explains the transformation of colonial sciences to a national science model, which still moulds present attitudes and institutions. The article examines the research capabilities that have been built up, draw attention to the sharp contrasts between different regions (North Africa, South Africa and "intermediate" regions). This unequal landscape has been subject to a profound shock due to the deep changes in the world scene: economic liberalisation, globalization and the instauration of a worldwide scientific agenda.

The trend that Africa experiences today is toward a more radical shift towards a "mode 2" science; science becomes highly fragmented, internationally-oriented and demand-driven. The demand in question is often that of powerful NGOs, international organizations and of bilateral cooperation schemes, which act under the promise that local capacities will be enhanced by their field programmes. Different countries react with a whole new range of practices and policies, depending on their political regimes and the alternatives left by previous strategies. A quick typology of policy regimes are discussed in the article, from *laissez-faire* to policies recommended by international or

foreign bodies (the "donors", especially the World Bank). Some room seems left for emerging policies, as demonstrated by South Africa, or some North-African countries, either with a national range or a regional range.

1. Introduction

Is there still room for national science policies in Africa? This question is raised at a time where several sub-Saharan countries have seen their scientific organizations bereft of budget and deprived of any hold over those charged with implementation. Public establishments are left with neither programmes nor reliable and loyal research staff. The research profession is exercised more on a temporary, short-term basis than in the context of a career.

The forces which govern the construction of policies today cannot be understood without taking a brief look at the past, at the colonial model and its transformation to a national science model which has moulded attitudes and institutions. A sharp contrast can be seen between different regions (North Africa, South Africa and "intermediate" regions). In this already highly unequal landscape Africa has had to face the shock created by the deep changes experienced worldwide: economic liberalism, globalization and the set-up of a worldwide scientific agenda. The trend is an anarchic and radical move towards a "mode 2" science, which is highly fragmented, internationally-oriented and demand-driven. This is a paradox in countries where farms and enterprises are hardly geared to research and development. However, the demand in question might well be that of the powerful NGOs, international organizations and of bilateral cooperation schemes, which all function under the promise of the enhancement of local research capacities under their field programme objectives.

The article investigates how different countries react to these changes with a whole new range of practices and policies, depending on their political regimes and the alternatives left by previous strategies.

2. Historical Background

2.1 From Colonial Science to National Science

Colonization generated research centres, but not universities. Formed by circumstance rather than explicit policy, these research centers have left a specific type of knowledge types and, above all, models that still today serve as reference for public action. This model is a choice of research fields (mainly in agriculture and health), a choice of institutions (mainly full-time researchers, employed by specialist institutes), a choice of organizational set-up (subordination to technical departments, favouring technical innovation diffusion). The research centers were maintained by the former colonial countries, which assured financial support and cooperation which substituted to local authorities. However, a dual network then took shape. At the time of independence, the elite in Africa was limited. The strong expansion of the universities was to increase the local elite. In the space of one decade, nearly all the countries had set up their higher education system. Standards were high and research was a normal part of the teaching staff's duties. Their research work, monitored by the academic authority, supported by

cooperation schemes, concerned basic sciences, whereas the technically-based ministries valued the applied nature of technical work conducted by specialized agencies (particularly in agriculture). The 1970s saw the start of Africanization of all these establishments. The new researchers moved in with a different approach. Their institutional culture did not now amount just to being part of a learned community; rather it embodied the concepts of a "national" endeavour and promoted "autocentred" communities. In this way a new model of "national science" appeared, whose main characteristics were as follows:

- Science is a public good.
- The state bears most of its funding.
- Science is geared toward the needs of the country.
- Researchers are civil servants and have a right to forge their careers.
- They defend national as well as scientific values.
- Apart from scientists, scientific products are destined to governmental bodies. The direct users of the research are hardly involved, and certainly not by way of any commercial links or marketable values, considered "impure" in the eyes of these researchers.

The governments expected a great deal from research and education in terms of usable results. Budgets allocated increased tenfold in ten years. So did the numbers of researchers. From 1975 national steering bodies began to spring up. In English-speaking Africa, scientific "Councils", specialized according to field (Health, Agriculture, Industry, Energy) were given the task of defining priorities, managing incentive budgets and assessing results. A national "Council" for research was heading the specialized councils in order to make their objectives consistent with the national Plan and forge links with universities. In French-speaking Africa, a direction of research was set up in each ministry which was in charge of the research establishments; an inter-ministerial department (sometimes a ministry or specialized governmental office) coordinated the system as a whole. It is true that the interministerial agencies were often unheeded with since they had no control over budgets (which were assigned to the operating ministries). However, with or without centralized planning, good results ensued: in 1985, scientific publications were quite visible on the international scene, eminent figures emerged; certain leading-edge establishments gained a good reputation and notable innovations stemmed out from research done.

2.2 North Africa, South Africa

South Africa and North Africa each have their specific characteristics. The former is an old colony of settlers. Its "modern" scientific history goes back more than two centuries. Its first universities date from 1870 (but in 1950, there were only 2,000 "coloured" students out of the 30,000 in the country as a whole). When in 1945, South Africa gained autonomy from the British Empire, research became a priority. The brand new Council for Industrial Sciences drew up a national policy, founded laboratories in strategic subject areas, formed links with companies and administered the incentive fund which was to bring with it academic research. The apartheid regime went on to reinforce the system by favouring a concentration on military and security-related fields, the basic sciences and advanced technology. The post-apartheid regime is taking care not to weaken this complex, whose capacities extend from aeronautics to nuclear

systems, from chemistry to metallurgy, from food processing to highly advanced medical specialties. It is trying to redirect it, to serve basic needs and the competitiveness of civilian industry, and to encourage appropriation by black Africans, long kept out of any such enterprise.

On the southern shores of the Mediterranean, the beginnings of science can be traced back even further. The first universities date back 1000 years. The "Reform" in the Ottoman countries gave rise to the creation of high-level Schools of Engineering and Medicine: their graduates performed outstandingly throughout the 19th Century. European domination closed the doors of higher education on local people and at the same time precluded any jobs in the public sector or qualified employment. However, members of the elite continued to set their hearts on superior studies for their children and subsequent independence unlocked an enormous desire for education. In Egypt free education was extended to higher education in 1962. In 1990, there were 1 million working graduates and the student population made up 15% of the 20-24 year age group. In the Maghreb, comprising Morocco, Algeria and Tunisia, the explosion of education came about after 1975. With some delay, independence brought the opportunity to create a national system of research. This was to be divided between the national centres (in Egypt powerful, in nuclear research and experimental sciences; and in Tunisia, active in agriculture) and the university system (which was especially successful in experimental and engineering sciences, without a great deal of government support).

2.3 Capacities Established

The major bibliographic databases reveal the difference in capacities between countries. They also indicate the unexpected downturns that have occurred between 1985 (the peak time for national sciences) and the present. Scientific output is only a small part of world production (1.5% considering all disciplines), but is substantial in the disciplines that are crucial for that region (agriculture and tropical health: 10 -15%). There is a strong hierarchy between countries. Only 7 or 8 countries have a significant capacity in experimental and engineering sciences (and South Africa and Egypt share three-quarters of the potential). In 1985, the leaders were South Africa (which alone represented 33% of the production of the African continent), Egypt (22%) and Nigeria (13%). Quite far behind came Kenya and the Maghreb countries (around 4% each). If we add three French-speaking countries (Senegal, Côte d'Ivoire, Cameroon) and four English-speaking ones (Tanzania, Zimbabwe, Ethiopia, Ghana, all around 1.5%), that accounts for 90% of Africa's production. The other countries are tiny in terms of scientific production (which does not exclude the existence of small circles of specialists, around an eminent figure or in a breeding ground that a prominent establishment shelters, which create some unexpected centres of strength: embryology in Ghana, pharmacology in Madagascar, for instance). For a decade, the scene has been undergoing profound changes. The most spectacular breaks in the curve concern the abrupt decline of Nigeria (but also, in agriculture, that of Kenya or the Côte d'Ivoire). Conversely, the Maghreb countries show a spectacular rise (a growth of 9% per year). Although South Africa remains far ahead, North Africa as a whole from now on carries more weight (35% against 30%). Morocco has become the third scientific producer in Africa, ahead of Kenya, Tunisia and Nigeria, all at about the same level. Other variations reflect the

reduction of fruitful international cooperation actions (frequent, like in Niger, Gabon, Mozambique), or their resumption (Uganda or Ghana); but also the erosion, disintegration or resurgence of scientific communities confronted by dramatic changes.

2.4 Recent Change, and the Factors Behind

The upheavals of a profound change, destabilizing the national sciences, began to make their effect from about 1985. These were in no way confined to Africa. Increasing emphasis on the market economy brought states to reduce the degree of their intervention. Expectations for progress hinged no longer on the discoveries of science but on the innovations of industry. And the well-being of all was perceived not as the anticipated result of planning but of the free rein of the market. In the scientific world the preoccupation became, both in the industrialized countries and in the South, to associate clients to funding, guidance and, if possible, performance of research.

Gibbons and his colleagues describe this shift in the professional practice of research and the reorganization of institutions and policy changes as the spread of a new mode of knowledge production ("Mode 2" as opposed to the older, "Mode 1"). It can be summed up in five points:

- it is firms and not the academic establishment that become the centre of research activities
- research is performed in worldwide networks
- the search for profit (rather than knowledge) becomes the guiding principle
- the market rather than evaluation by scientific peers is the regulator of research
- the profession is exercised according to short-term contracts (and not in the context of a life-long career).

While we are examining the signs of the emergence of this new mode of knowledge production in the industrialized countries of the North, the paradox is that the cultural and professional revolution on which the wave of change is supposed to be based is more intense in the South. The tendency is at its strongest in the poorest countries, notably in Africa, affected now by 15 years of far-reaching economic crisis. The devaluation of scientific careers has caused researchers either to emigrate or change profession. Those who stay in their countries look for all sorts of contracts on an individual basis in order to survive professionally. There is not really much demand from producers; but there are many calls from international organizations, NGOs and multi-lateral co-operation schemes seeking to further their own programmes.

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Biographical Sketch

Roland Waast is a senior researcher at IRD (Institut de Recherches pour le Développement, France). He holds an engineering diploma from the Ecole Polytechnique, Paris, and graduated in sociology from La Sorbonne University, Paris. As a sociologist, he spent numerous years in developing countries (particularly Madagascar and Algeria). He has been head of the Department of "Development Strategies" at IRD, and is a member of several scientific Commissions on S&T policies as well as a former member of the French High Council for Science and Technology. He is currently a member of the French Commission for UNESCO.

He has set up a research team specializing in the Sociology of the Sciences at IRD fifteen years ago, and an international network (ALFONSO) dealing with the same topics in developing countries (main nodes in India, Venezuela, Brazil, Argentina, Algeria and South Africa). He is the founder and co-director of the Journal *Science, Technology and Society*. He has authored numerous papers in French and International Journals, collaborates to the *World Science Report* (Unesco), and completed various research projects for the European Commission. He is the Series Editor of *Les sciences hors d'Occident au 20° siècle/Science beyond the Metropolis*" (IRD-UNESCO: 7 volumes). He recently published (in collaboration): *Scientific*

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