Plenary Session: Importance of Science and Technology

THE PAN AFRICAN IMPERATIVE FOR INCREASED EMPHASIS ON SCIENCE AND TECHNOLOGY

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INTRODUCTION

The address that follows was prepared by the Committee on Science and Technology for the Sixth Pan African Congress. I am indeed humbled by being accorded the privilege to stand before you today in delivery of this address on so historic an occasion.

The title of this address is "The Pan-African Imperative for Increased Emphasis on Science and Technology". We would like to subtitle it, "Development of Human and Natural Resources for Self-Reliance." This rather exhaustive title was so chosen because of the criticality with which we view the importance of the role of science and technology in the struggle for self-reliance and self-determination, through the development of our own human and natural resources.

The organisation of this address is as follows. We will first offer the committee's definitions of science and technology; secondly, we will posit our views of the political implications of science and technology; thirdly, we will present a capsulized view of what we see as the overall scientific and technological needs; fourthly, we will present a brief analysis of the human and natural resources of the Pan African world; and lastly, we will propose a plan for the long run development of a scientific and technological infrastructure that is requisite for the eventual total indegenization of our development processes.

DEFINITION OF SCIENCE AND TECHNOLOGY

Science

We choose to define science simply as the study of the fundamental forces and phenomena of the universe, through the well-disciplined use of common sense and observation. Note that this is an inclusive -- as opposed to an exclusive --- definition, which eliminates the traditional artificial boundaries between what is, or is not, bonafide science. This is a recognition of the fact that scientific pursuits may be carried on by anyone, at anytime, at any location. We might coin a phrase here --- "To be alive is to be a scientist." We are all scientists, comsciously or uncosciously.

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Technology

We define technology as the displined application of scientific concepts to human living, i.e., the politically determined materials needs of people. Specifically, we refer here to adequacy of food, clothing and shelter in the broadest sense, so as to release the creative and spiritual potential of the people.

One is thus engaging in technology when one is "product oriented", while one is engaging in science when seeking only basic understanding of fundamental phenomena.

Illustrations

Let us illustrate the above with a few examples. The technology of radio communication is rooted in the science of electro-magnetic wave theory; the technology of vehicular locomotion is based on the science of thermodynamics; the technology of mineral extraction from the earth calls upon the sciences of metallurgy, geology and geophysics; the technology of medicine draws upon the zoological and botanical sciences and chemistry; the technology of nuclear destruction is based on the sciences of particles and quantum physics; the technology of food production utilizes the science of soil chemistry, fluid mechanics and botany; the technology of building construction calls upon the science of soil and structural mechanics. We do not suggest that everyone who participates in the above technologies is in fact consciously aware of or must fully comprehend the associated scientific principles. We do suggest, however, that the more one understands the underlying scientific principles, the better a technologist he is likely to become.

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POLITICAL IMPLICATIONS OF SCIENCE AND TECHNOLOGY

We support the position that science and technology, in whatever form they manifest themselves, are only means to an end --- not ends in themselves --- and as such must be subordinated to the material, creative and spiritual needs of a people, a nation. We support the position that science and technology must serve, not dominate people. We support the assumption that goals for human living must be dictated by political imperatives, and that scientific and technological endeavours must also be evaluated for their political implications.

In the wake of the successful post World War II Pan-African Freedom marches, we have all come to appreciate the fact that true political independence and political self-determination are impossible without economic independence and economic self-dtermination. It is equally clear, we believe that the level of economic independence and economic self-determination that can be achieved, is in direct proportion to the extent to which a people, a nation, can effectively mobilize its scientific and technological resources, both human and natural, for its own benefit.

It is also clear, however, that scientific and technological achievements may harm, as well as benefit people. These disbenefits may either be the result of conscious diabolical political policies, or of improper pre-assessment of the impacts on the material, creative and spiritual [illegible] conditions of people. History is loaded with examples of "good" and "bad" scientific applications. The invention of the cotton gin by a Balck man in America so increased the demand for cotton to keep the gin operating economically, that the slave trade was reintensified at the very time that it had begun to decline. With the benefit of the hindsight, one might argue that this Black inventor was politically naive /-inventor not to have anticipated the results. The splitting of the atom has eventually brought the entire world to the brink of a nuclear holocaust; it has also made possible the development for energy potential that far exceeds all the known non-replaceable fossil fuel sources.

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The technology of pyretechnics and explosives may be utilized for construction or destruction. The Tanzam railroad, judged by some to be economically infeasible in light of existing lines of communications to the seas via Mozambique and Angola, might well turn out to be one of the most astute decisions of the twentieth century, not only politically, but for its implications for stimulating economic development, self-sufficiency and self-determination. The Earth Resources Technology Satelite (ERTS) circling the globe, yields information about crops, water, minerals, locust breeding grounds, drought conditions, etc. Such information is unquestionably invaluable to nations, farmers, natural developers. It is equally unquestionable that such information can be used with devastating consequences to some, depending upon the political imperatives of he who controls the processing flow and implementation of that information. It is a fact worth reiterating, that whether it's the development of sophisticated weaponry, or the increased knowledge of keeping healthy and physically fit, or the advance in agricultural science to improve the quantity and quality of food, science and technology may be used for you or against you.

But we contend that this is precisely what makes science and technology imperative. Not that science and technology automatically guarantee economic independence and political independence. We do assert however, that without them there would be little chance of achieving economic and political independence in today's world, and certainly not in tomorrow's world. The need for shelter, in its broadest sense, alone demands that a people be able comsolidate and protect whatever incremental gains are made along the path of human development. There is not one of us here, who is unaware that historically, people who have not developed technologically have been forced to relinguish their traditions, their cultures, and their land to other people, with whom they have come into contact, and who are technologically superior.

So the issue, if there was one, is clear. Science and technology are not inherently evil. It is the way in which they are used that determines whether or not the masses of people will benefit or suffer.

SCIENCE AND TECHNOLOGICAL NEEDS

The extent to which national goals will be articulated into programs of action is largely the responsibility of scientists and technologists. Numerous tasks must be carried out in the process of goal realization, but they may be grouped into three broad categories: program planning, project implementation, and system operation and monitoring.

Program Planning

Defined simply, program planning is the totality of activities that determine, prioritorize and schedule the multiplicity of individual projects that must be undertaken in order to achieve a specified goal. It must of necessity, include the assessment of manpower and material needs and availability. For without a careful, dispassionate, realistic analysis of both the requirements for, and availability of the resources necessary to realize any goal, we might quite easily find ourselves setting objectives, and scheduling events, that are totally unrealistic within the concept of self-reliance and self-determination.

And this is where the scientists and technologists can play a key role. Scientists and technologists are equipped to evaluate the feasibility of alternative strategies. Scientists and technologists are equipped to determine the necessity and nature of the parallel and long range research that must be conducted in order to support the goal realization. Scientists and technologists are equiped to develop the "bill of materials", that are requisite for the successful completion of the projects defined.

Project Implementation

Project implementation is the concretization of program planning. It is the "building phase". The spectrum of scientific and technological involvement almost needs no articulation. There may be roads to be built, hospitals, schools, dams, refineries, railroads, food processing plants, water pumps, ports and harbours, vehicles; there may be fields to be ploughed, crops to be grown, animals to be bred and reared, minerals to be extracted. There may even be weapons plants to be built, and weapons to be manufactured. The scientific and technological skills to be employed run the gamut from so-called artisans to so called professionals: carpenters, brick layers, demolition experts, heavy equipment operators, engineers, laborers, farmers, truck drivers, steel and iron workers, pipefitters, electricians, plumbers, painters, project managers, carpet layers, tilemen. And what about the effective coordination of all these people working on myriads of tasks? We submit to you that this too is the function of the technologists, the so-called "systems engineers."

System Operation and Monitoring

So we have planned, programmed and built. But the beautiful hospital out there will be nothing more than a monument to artisanship unless it is actually a functioning part of a total comprehensive health care delivery system. The Well-located and constructed railroad might as well not be there if the trains do not run with reliability due to lack of proper maintenance and availability of spare parts. The refinery must be operated efficiently. The produce from the fields must get to the food processing plants so that the produce will not rot where it is reaped, nor the food processing plant operate at such low capacity as to be uneconomical. The performance of the systems in operation must be monitored

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in order to ensure that the overall goals are being met, and to facilitate management by exception, and modification through feedback. And who are the scientists and technologists involved here? Doctors, nurses, paramedics, nutritionists, engineers, mechanics, equipment operators, chemists, physicists, food technologists, scientists --- you name them.

An Example

A national goal in transportation might be articulated as follows: "every community, or village, or region, must be linked by a system of routes so as to facilitate the transportation of people and goods from any one community, or village, or region, to another, safely, cheaply, quickly, and comfortably. This to be accomplished within ten years so as to facilitate other objectives of development such as, mining, forestry, national unity, security, self-reliance, agriculture, education, and internal and external trade". The translation of such a noble goal into a physical reality constitutes a complicated process involving thousands of people over many years. It is the articulation of such a goal that sets into motion the myriad activities that constitute program planning, project implementation and system operation and monitoring.

Technology Adaptation

One cannot speak of the scientific and technological needs of the Pan-African world, without dealing with the question of technology adaptation. In its broadest sense we speak not merely of technology transplantation, but of the need to copy, adapt and improve upon any given item of technology, be it a piece of equipment or a procedure. The impact of this kind of endeavor will be felt in a reduction in costs of numerous commodities and services --- hence an effective increase in personal income --- a stimulation of light industry, and the use of indigenous materials as substitutes.

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HUMAN AND NATURAL RESOURCES

Natural Resources

The natural wealth of Africa is stupendous, almost beyond comprehension. The contradiction of the existence of poverty and wretchedness in the midst of such wealth is embarrassing. Africa leads the world in the production, or known reserves, of gold, diamonds, bauxite, copper, chrome, uranium and phosphates. IT has huge oil and gas reserves off the northern and western coasts as well as on the mainland. Africa's hydro-electric power potential is the greatest in the world, an indication of its industrial potential. There are vast unexploited forest lands to provide lumber. Agricultural studies indicate that Africa can be self-sufficient in food with present day scientific and technological methods. Likewise, the oceans that surround the African world provide an abundant source of much needed food.

Mining produces forty-nine percent of Africa's export revenue. It is a fast growing sector and one of the most important. At present Africa's mining production is 15% of total world production and when the continent's resources are fully developed they will be as important as any on the face of the earth. Africa produces almost the whole of the world's supply of gems and industrial diamonds, a quarter of the world's copper, seventy percent of the world's cobalt and sixty-seven percent of the world's production of gold. North Africa has half the world's reserves of phosphates. Africa also produces a quarter of the growing world demand for manganese and a third of the world's chrome. The most accesible bauxite is in West Africa. One of the world's richest bauxite deposits is in Guinea and already with Jamaica the world's largest producer of bauxite and alumina, and Guyana the fifth largest, account for over twenty-five percent of the world'S needs. The recently announced oil finds off the coast of Cabinda and Angola promise reserves equal to the estimated reserves in Kuwait. Even the Sahara Desert is the object of search for oil and minerals; it is not a wasteland, it is a resource. We need only to know how to use it.

The land area of Africa is 11.5 million square miles or a quarter of the world's land mass. There are approximately only 330 million inhabitants, or 10% of the world population with an average density of 28.5 to the square mile, while it is 65 per square mile in the rest of the world. Between 1960 and 1966, the annual rate of growth of the world population was between 1.9% and 1.2% in the metropolitan countries, while the rate was 2.3% in Africa. But this rate of growth is lower than that of Asia at 2.7% or Latin America at 2.8%. According to UN forecasts, the toal African population will increase to 728 million in the year 2000, for an average density of 63.3 per square mile, still less than the current average density of the rest of the world. Thus, Africa has the land area to be self-sufficiant in agriculture and livestock raising. The only problem is the technology. The fact that one million acres of"desert" land in Mali are being converted into an oasis by Frenchmen raising sheep, or that in Senegal some nine thousand acres of land being developed as an agribusiness ± are by Euro-Americans to raise fruits and vegetables for the European winter market, should be a lesson to all of us, should demonstrate that self-sufficiency in food is not a pie-in-the-sky dream.

There is no doubt that we as African possess the material needs for our own development.

Human Resources

It is the manpower pool that is inadequate. It is of utmost importance that we establish priorities of skills and learning based on our needs. We desperately need scientists and technologists who can heal, grow, mine, farm, manufature, design, build and teach. In Africa today on the average there are four hundred and eighty students in higher education per one million inhabitants in the UNESCO African member states, excluding Egypt. This represents 1/5 of the ratio for Asia, excluding Japan and China, 1/10 of that in Latin America, and only 1/20 of that in Europe, excluding USSR. Seventy per cent of the students studying at national institutions of higher education are enrolled in the faculties of humanities, education, fine arts, law and social science.

Engineering and agriculture are the smallest groups of study in most African countries (on the average, 5.3% and 4.8% respectively.) This fact, of course, has dire repercussions for the building up, within the African countries, of an adequate potential for industrilization, for the mechanization of agriculture, and for economic growth and national development as a whole. Similarly, the low percentage of students in the agricultural science is blatantly low for countries very largely dependent on national utilization of land resources for the production of food and of cash as well as exploitation of forests.

A further aggravating factor for scientific development, of a general nature, is that the number of graduates from national institutions of higher learning is very low if related to population. For every 100,000 inhabitants, 5, to 10 students graduate annually in twelve countries, and in only five countries does the ratio reach 20. Since no noticeable change has taken place in the composition of the student enrollment in recent years, the distribution by field of study is likewise fairly stable and no immediate relief is in sight for the shortage of scientists, engineers and medical doctors of African origin.

It is only in recent years, and generally not before their accession to independence, that the subject of science policy has received serious attention in the African countries. Not surprisingly, therefore, the institutions and mechanisms for the planning of science policy and the management of research and development are found to be mostly in an evolutionary stage, often of a tentative nature, or even in some cases totaly lacking.

However, even those African countries where the science policy structure appears weakest have expressed keen appreciation of the potential significance of science and technology for their economic development as well as the great value of a purposeful science policy for coordinating their national research activities and for guiding them into those projects most likely to accelerate socio-economic development. The scarcity of resources --- human, financial, institutional and informational --- devoted to scientific and technological activities, which is common to most of these countries, and explicitly deplored by them, is a factor which intensifies the necessity of using efficiently all the available resources, thereby avoiding undue overlap or serious gaps in their national research and development efforts.

The condition of the African on the continent reflects to a certain degree the status of African people all over the world. Of 36,000,000 plus Black people in the United States of America, there are only 5,000 Black physicians, less than 2,500 dentists, less than 2,000 pharmacists, less than 1,000 architects and less than 4,000 engineers.i Of the estimated 1.2 million engineers and technologists in the Americas and the Caribbean, the estimates of Blacks range from 8 - 14,000--- of the order if 1%. Yet it is the largest source of trained Black scientific and technological manpower.

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It is virtually impossible for any Black scientist in America to make a living in his field without being employed by the very system that limits, inhibits and suppresses the development of Black people. The contributions of the Black man to the advancement of the human race become the property of the multinational corporations. Patented inventions are suppressed or stolen; discoveries are utilized and rewarded with a token and very little recognition is given to the Black discoverer. America is a potential resource of Balck scientists and technologists whose skills are never fully utilized or developed because of racist policies, job competition, relatively low salaries, and just plain lack of opportunity to be of service or be involved in development processes.

STRATEGY FOR PAN-AFRICAN DEVELOPMENT

We must deal with a strategy for arresting the prevailing conditions and moving ahead to brighter tomorrows. Given that the desire for economic and political independence in the Pan-African world is axiomatic, and given that we have natural resources in abundance juxtaposed with a dearth of human capability, then it follows that the imperative must be for (1) development of the human and natural resources in the shortest time possible, and (2) development of an infrastructure for directing science and technology towards the goal of self-reliance.

Based upon an assessment of the need to develop a scientific and technical infrasturucture over the long run, the Committee on Science and Technology proposes to this Congress the establishment of a Pan-African Center of Science and Technology (PACST). This center will serve as an effective tool in bringing about self-reliance and self-sufficiency in the Pan African community as regards material needs. It will be effective because it will facilitate the sharing of the full spectrum of scientific and technological talents in the Pan-African community on both an applied and research basis; it will utilize the skills and knowledge of brothers and sisters on a learning partner basis, whether these skills and knowledge come from practical living, formal education, or a combination thereof. Specifically, the Pan-African Center of Science and Technology will have the main purpose of providing:

1. The development of an ever increasing pool of skilled Africans in the area of science and technology.

2. Research leading to sensible applied technology for rapidly meeting the material needs of the Pan-African Community.

3. A pool of skilled talent and pertinent scientific information for use by Pan-African nation states.

4. An area where Africans can share both their knowledge and skills related to science and technology.

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5. The dissemination of this shared information to the Pan African community.

6. A central depository for science and technological information.

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To achieve the above stated purposes the program of PACST will be defined by the following four functional areas:

1. Learning

2. Aplied Research and Implementation

3. Applied Analysis

4. Information Dessemination

PACST should be a Pan-African supported, directed and staffed institution, headquartered in Africa, and dedicated primarily to the solutions of client initiated problems.

In the long run, perhaps even in the short run, PACST amounts to a mamoth undertaking that would require a world-wide organization of skilled manpower upon which to draw for expertise in carrying out various projects. Accordingly, the Committee on Science and Technology further proposes the establishment of an Association of Scientists and Technologists for Pan-African Development (ASTPAD), international in scope and headquartered in Africa, as an international element of the Pan-African Center of Science and Technology. The overall goals of ASTPAD will be as follows:

1. Promotion of communication and cooperation among African scientists and technologists.

2. Demystification of science and technology and the fostering of the concept that science and technology are tools which can be used for the total liberation of African people.

3. Education and training of African people at all levels in science and technology.

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4. Focusing of scientific and technological expertise in the African world on those problems which are relevant to African peoples.

5. Devising of criteria for certification and credentialization of African scientists and technologists.

6. Establishment of a forum for recognizing and honoring those Africans who have demonstrated outstanding excellence of self-reliance and self-determination for African people.

7. Encouragement of youth to study, understand, and practice science, and the creation of educational tools which hasten this development.

8. Guardianship against the alienation of labor which so often accompanies technological development.

National and local chapters would incorporate according to the laws of each country, and membership would be open to organisations --- business, professional or fraternal --- as well as to individuals.

Perhaps by this time the question is already being asked by some, "Why should we even consider these proposals when there are numerous other organisations, Pan-African and otherwise engaged in scientific and technological pursuits relative to Africa?"" A 1970 Survey on the Scientific and Technical Potential of the Countries of Africa by the United Nations Educational Scientific and Cultural Organisation (UNESCO) lists some 652 institutions conducting research in fundamental sciences, earth and space sciences, medical sciences, food and agricultural sciences, fuel and power research, industrial research, economics, and social and human sciences. There are other similar research institutes in the Caribbean. Of no small consequence is a recently established special agency of the Organisation of African Unity (OAU) namely, the scientific, Training and Research Center, headquarterd in Lagos, with branches in Yaounde, Nairobi, Bangui and Niamey.

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There have been exhaustive and thorough studies by experts from all over the world on the resources of Africa, development of Africa, science and research policies in Africa, etc. The results of these labors are voluminous and contain useful relevant data. Plans have been suggested for dealing with most of the problems we can anticipate. The Africa Regional Plan of the United Nations' World Plan of Action is one of the most recent compendia of suggested strategies. UNESCO recently sponsored (Jan 21-30, 1974) the Conference of Ministers of African Member States Responsible for the Application of Science and Technology to Development (CASTAFRICA) in Dakar, Senegal, one of a series of inter-governmental conferences, starting in 1961, that continued the complex and multifaceted planning for African development. It had been expressed by some attendees to these conferences that the information from these studies were of greater benefit to the developed countries and the multinational companies than to the Africans for whom the research was done. Be that as it may, CASTAFRICA did make it clear, that any steps beyond research and rearrangement of information, must be the initiative of the African countries themselves.

It is evident then that there is indeed a significant number of scientific research organisations already in existence. So, we are not suggesting another institution that would duplicate ongoing efforts, for it is obvious that African people can ill afford such an inefficient expenditure of limited manpower and capital. What we do suggest to this Congress is thecreation and development of an institution that would provide a consulting service to Pan-African governments and development programs, as well as contribute to the expansion of the scientific and technological infrastructure. The Pan-African Center of Science and Technology would utilize the results of other research institutions and, in fact, enhance the value of these very institutions by its problem solving orientation and emphasis on implementation. PACST would be unique because of its potential to be self-supporting, through eventual establishment of subscription or fee structure commensurate with services rendered. Finally, PACST would provide a framework for harnessing and utilizing those precious skills of African scientists and technologists in the Americas and Europe who seek an alternative to working for those very institutions that ultimately and inevitably act against the interests of African peoples.

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Big business in the United States of America today commited itself to vast expenditures to increase by ten-fold in ten years the output of minority engineers from institutions of higher learning. If this program is successful some 4000 Black engineers per year will be graduating from American universities by 1983. The time is now to build a structure that would tap this new fountain of expertise.

An intriguing special project that might be undertaken by PACST is the problem of the Sahel, because it constitutes a major crisis that has implications for all African people. The project can have two specific goals: (1) combat the effects of the drought, and (2) arrest the progression of the Sahara Desert. The achievement of these goals would necessitate, development of water resources and agriculture, meteorological and climatic studies, health and nutrition improvement, construction of transportation and communications networks, and a great deal of cooperation among Pan-African nation states, and African people from all over the world.

CONCLUSION

In this past hour, we have offered our definitions of science and technology, presented our views of the politics of science and technology, placed science and technology in the perspective of Pan-African needs, given a brief assessment of the human and natural resources of the Pan-African world, and proposed to this body the establishment of a Pan-African Center of Science and Technology, and the formation of an Association of Scientists and Technologists for Pan-African Development. We know that in the days that follow you would give serious thought to the importance of the role of science and technology in achieving self-reliance and meaningful political independence. We are confident that you will agree with us that the increased emphasis on science and technology is a Pan-African imperative. We invite you to participate in the committee discussions that follow, and to visit the rather modest, but we believe, meaningful science and technological exhibit we have prepared for the Congress. Copies of condensed versions of the proposals for PACST and ASTPAD are available for your perusal, as well as a few other pamphlets.

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We especially invite your comments, suggestions or constructive criticisms either through direct discussion and communication with the staff, or in writing.

A very grateful thank you from me, on behalf of the Committee on Science and Technology.