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FEDERAL MINISTRY OF SCIENCE AND TECHNOLOGY

MINISTERIAL PRESS BRIEFING

BY

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HONOURABLE MINISTER OF SCIENCE AND TECHNOLOGY

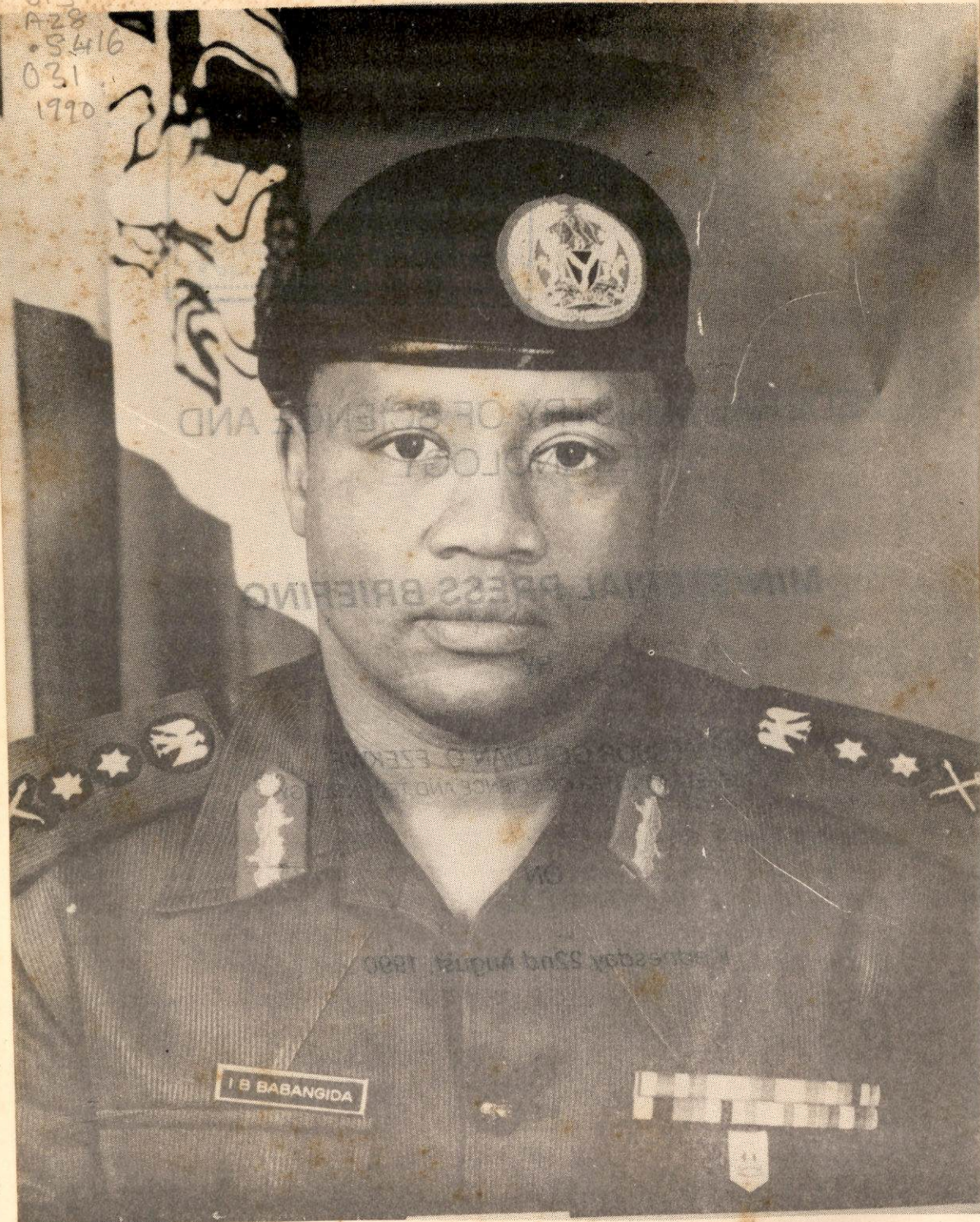
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GENERAL IBRAHIM BADAMASI BABANGIDA C.F.R, fss, mni
PRESIDENT, COMMANDER-IN-CHIEF OF THE ARMED FORCES

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PROFESSOR GORDIAN O. EZEKWE
HONOURABLE MINISTER OF SCIENCE AND TECHNOLOGY

**PRESS BRIEFING BY THE HON. MINISTER OF
SCIENCE AND TECHNOLOGY
PROFESSOR GORDIAN O. EZEKWE
ON
22ND AUGUST, 1990**

Your Excellencies, Members of the Diplomatic Corps,
Ladies and Gentlemen of the Press and Electronic media,
Invited Guests,
Ladies and Gentlemen.

I welcome you to this Ministerial Press Briefing, the fifth in the series by this Ministry, but my first since my assumption of office as the Minister of Science and Technology on 29th December, 1989. I am delighted to meet with you, the press and media at this forum, and I am sure that we shall have the usual mutually beneficial interactions and exchanges which characterised your meetings with my predecessor in office during the past five years. For a start, I would like to review briefly the highlights of our previous briefing in November 1989, and then link them with recent developments, progress, and the achievements of my Ministry since then. During the last press briefing you were informed of the following:

- (i) staff development and motivation in the Ministry, subsequent to the implementation of the new Civil Service reforms, aimed at an enhanced efficiency and professionalism;
- (ii) the achievements of the National Science and Technology Fund (NSTF), in sponsoring and funding six projects for multiplication of cassava planting materials; fabrication and popularisation of cassava processing machines; development of instant *Fura da nono*; design and construction of portable rice and wheat harvesters; development of a shear box for the prediction of wall pressures in grain storage structures; and the preparation of a weaning food;
- (iii) the reports on encouragement of indigenous inventions and innovations - including the awards of the Minister's Prizes for Excellence in Science and Technology, and provision of technical and financial assistance to inventors/innovators;
- (iv) the activities of the National Committee on Earthquake Phenomena - including efforts made to procure and instal seismic equipment; studies of Lake Nyos, investigation of earth-phenomena incidents as well as the formulation of standards and design criteria for withstanding earthquakes;

- (v) the development of low cost 4-wheeled vehicle by PRODA was reported as well as the display of the vehicle;
- (vi) in road and building technology - the production of engineering soil maps, the recording of solar radiation data in 30 centres of the country, and the production of lime from Nigerian limestone at small-scale industrial level;
- (vii) in the area of food processing technology - the design and production of a flash dryer for *Soyogi* etc; and the formulation of *soy-gari* - a protein fortified *gari*;
- (viii) progress of the four Energy Research Centres at Sokoto, Zaria, Ife and Nsukka, including the popularising of efficient woodstoves, the application of neutron activation analysis in agriculture and the progress in the installation of a nuclear accelerator for high energy physics research;
- (ix) activities and achievements of the Raw materials Research and Development Council (RMRDC), including techno-economic survey; establishment of its computer centre and library, the Technical Advisory and Development Centre (TEDAC); raw material display centre; development of new processes, technologies and products using local raw materials, and compilation of specifications for industrial raw material;
- (x) research in human and medical care, including cholera vaccine research and development; development of meningitis vaccine and antisera, and collaborative work with the Federal Ministry of Health in the guinea-worm eradication programme; anti-snake venom vaccine and control of schistosomiasis.
- (xi) activities in support of environmental and natural resources management, including ecological disasters and waterhyacinth control;
- (xii) promotion of support for activities of the scientific community, including the provision of grants to scientists for research and for conferences; and the development of the Technology Business Incubation Project (TBIP), aimed at facilitating the growth and success rate of small to medium scale industries which employ new technologies;
- (xiii) the promotion of agricultural development and food production in arable crops - through the development, release and multiplication of improved varieties of cereals, legumes and oil seeds, fibre crops; root crops (cassava, yam, sweet and irish potato, ginger) tree and horticultural crops (palms, citrus; oranges, grapefruits, pineapples) livestock

- and fish fingerlings, and the production of new vaccines for animal health; and
- (xiv) activities aimed at promoting and popularising science and technology through the National Science and Technology Week, science fairs, exhibitions, and publications in science and technology.

2. HIGHLIGHTS OF RECENT DEVELOPMENTS

2.1. *Action towards the Establishment of an Engineering Infrastructure in Nigeria*

Among the well-known problems militating against a rapid and effective technological development in our country are inadequate allocation of funds for Research and Development (R&D) activities; low-level of commercialisation of R&D results; a lack of well developed industrial entrepreneurial community; and above all the lack of an engineering infrastructure; the absence of an Engineering Infrastructure has been mainly responsible for our failures which have to do with industries, utilities, transportation, materials processing, agriculture, science education, commercialisation of research results, equipment maintenance etc. The possession of this capability is the foundation for self-reliance and socio-economic independence in the present world.

I am therefore happy to inform you that the Federal Military Government has approved that work be started towards the establishment of an engineering infrastructure in Nigeria. The first step in this important project was taken on 18th July 1990, with the inauguration by Mr. President of the National Committee on Engineering Infrastructure. The National Committee comprises of 150 members drawn from State and Federal Ministries, the organised private sector, professional organisations, higher institutions, research institutes and individual professionals. It is divided into 7 sectoral sub-committees:-

- Engineering materials;
- Chemical materials,
- Scientific Equipment and Electronics;
- Power Equipment;
- Engineering Accessories;
- Mechanical Engineering Tools; and
- Management and Finance.

The task before the National Committee is to produce, after detailed studies, a comprehensive, yet concise strategic plan for the establishment of an Engineering Infrastructure. The Committee shall identify

the essential engineering materials, scientific and power equipment, engineering accessories, workshop and other tools etc. which must be made readily available in the Nigerian market, in order to provide the required inputs for machine design, equipment fabrication and copy-engineering. The putting in place of the master plan for an Engineering Infrastructure will ensure an orderly and logical development of the physical pre-requisites for the growth of indigenous technology.

2.2 *The Ministry and its Research Institutes*

Prominent in the mandate of the Ministry of Science and Technology, aside from Policy Formulation and monitoring, are the promotion and co-ordination of scientific and technological research and development; - promotion and co-ordination of scientific and technological innovation, development, adaptation and production; and - the maintenance of a good working relations with its 26 national Research Institutes and Parastatals and with other S.&T. Agencies in the country and abroad.

I will highlight our progress so far in achieving this mandate. On my assumption of office, I was desirous of addressing aspects of this mandate, and especially the issue of the public criticism that the Research Institutes have made negligible impact on the nation's development process. I believe that the Research Institutes have, inspite of inadequate funding, made considerable impact in national development, especially in the areas of crop agriculture, forestry, livestock and fishery developments; but the impact in the industrial sector has not been up to our expectation. But even where impact has been demonstrated, the public has not been fully acquainted with the contributions of the Research Institutes to national productivity.

The indispensable role of research and development work in national economic development has been brought to a sharper focus during this era of the Structural Adjustment Programme. In the case of the Industrial Research Institutes, a lot has actually been achieved inspite of the prevailing adverse engineering infrastructural conditons and poor funding under which they operate.

Many relevant and appropriate equipment and processes have been prototyped in FIIRO, PRODA, Nigerian Stored Products Research Institute (NISPRI), the Nigerian Building and Road Research Institute (NBRRI) and the Institute of Agricultural Research (IAR) Samaru. If these equipment are realistically commercialised, their impact on production activities would become patent to everybody.

2.3 *Encouragement of Pilot Production of Research Results*

To redress the shortcomings high-lighted above, I have this year given instructions that Institutes should undertake a limited production of some of their research and development results. Under this policy, known as "Research and Production" (RAP), the Institutes are expected, as a matter of deliberate policy, to develop selected engineering projects, from their prototype stages, to pilot plant stages and run them as profitable ventures, either solely or in collaboration with private sector companies. Similarly, agricultural and related projects, such as the development and commercial multiplication of new and improved varieties of crops, forestry, livestock and fishery, should be translated into practical commercialisable projects.

It is our expectation that the successful implementation of this policy will stimulate private entrepreneurship development among Nigerians whereby they can acquire these commercial projects at reasonable fees. While some Institutes have before now started a limited production of some of their research results, it has been done as a minor peripheral activity, while others have not been doing so. However, the translation of viable research results to pilot production plants will demand a much higher level of funding than has been the case up to now. I am optimistic that if these projects are adequately funded in the 1991 budget, this strategy will offer more entrepreneurs new opportunities for the establishment of commercial industries which originate from indigenous research.

3.0 DEVELOPMENTS IN INDUSTRIAL AND CHEMICAL TECHNOLOGY

3.1 *Nigerian Indigenous Vehicles*

PRODA, an Institute under my Ministry, produced a prototype of a Nigerian indigenous car in 1989, under the sponsorship of the Federal Ministry of Commerce and Industry. The technical model of that car, which was exhibited during the second National Science and Technology Week in October 1989, is however not the production prototype. Further work has to be done to develop the production model on which mass-production will be based. This stage of the work involves extensive tooling-up, the identification and strengthening of existing workshops which will participate in the mass production of parts, and the exploration of technical partnerships. In the meantime, as soon as

the funding for the second stage of work is secured, work on the production model will commence, at the completion of which the probable market price of the indigenous vehicle will be determined. It is hoped that the price of this vehicle will be within the purchasing power of many Nigerians.

3.2 Feed Pelleting Machines

PRODA has designed and fabricated mechanical equipment for the production of pelleted fish meal, which is needed by rural farmers for large scale production of fish feed. These machines can also be used for pelleting animal feeds and edibles for local consumption and for export trade. Two production prototype versions have been fabricated and successfully tested:

- the Archimedian screw extruder type, and
- the 3-roller press type.

Large and medium sized versions of the Archimedian type have been motorised. These and the manual versions are already being utilised in some DFRRI-assisted projects, and by the National Institute for Freshwater Fisheries Research, New Bussa, for the production of fish meal pellets used in fish culture. Existing workshops in the country can now adopt these machines for mass-production.

3.3 Industrial Alcohol Plants

This is a project that started with the purpose of developing equipment for purifying and rectifying, to 95%, crude alcohols popularly called "Ogogoro." Following the success of this initial project, PRODA has now successfully developed multiple tower units for the recovery of pure ethanol at 95% v/v from any fermented sugar solution. This Alcohol Distillery, complete with a centralised control panel, has production capacities of up to 1000 litres per day of refined ethanol. This project is also ready for commercialisation by private-sector workshops.

3.4 Traffic Control Equipment Project

This project involves the design and manufacture of electrical/electronic control systems for various categories of traffic controllers, and the fabrication of the mechanical components of the system using locally acquired materials. Targeted at the Nigerian road system, the project took cognisance of the weaknesses of imported traffic controllers. The objective stated above has been successfully accomplished at PRODA. In addition, the Institute has developed a new

system incorporating facilities to cater for pedestrians wishing to cross the road to request permission to do so. The entire system can also be operated manually by a traffic warden should the need arise. This traffic control system has been installed at Enugu and Ikom. The design is now available for mass-production by private-sector workshops.

3.5. *Safe Portable Household Water Works*

PRODA has successfully produced two working models of the device which is christened "*Household Waterworks*". This device has been approved by my Ministry for the production of safe potable water on a household scale. The unit was originally designed by Dr. George Mann of Vanderbilt University, USA, and my Ministry commissioned PRODA to reproduce the device using local materials. With this device, all the process operations of a modern municipal water works is undertaken in a single package, and it is efficient enough to handle any type of surface water, rendering it clinically safe for drinking and for preparation of baby foods. The Institute has been commissioned to produce 12 copies of one of these models for more field trials and acceptability tests, and these copies will be completed by the end of September this year. The wide application of this device will alleviate the scourge of guinea-worm and other water borne diseases. It is hoped that the project will become available for adoption by private-sector workshops in the near future.

3.6 *Ceramic Water Filters Project*

In another project, PRODA has successfully produced ceramic water filters from 100% local materials, which meets the stringent health-safety standards. Plaster moulds for mass-producing the filter candles are being developed, while an 8-litre capacity filter casing and the stand have been designed and fabricated ready for use in tests.

3.7 *Refractories for Furnace Construction*

This project aims to produce different types of refractories with wide applications in such industries as iron and steel, cement, petrochemicals, glass, ceramics, paper etc. PRODA is concentrating on the aluminosilicate type (clay based) because of the local abundance of the raw materials. The Institute has designed and built gas kilns with these locally-produced refractories and it has also developed its own atmospheric and forced-air gas burners to be used in the kilns. Industries that require fire-bricks are already purchasing them from

PRODA. The Institute now also supplies gas-heated kilns to small-scale ceramic industries.

3.8 *Electrical Porcelain Insulators*

PRODA has successfully developed, from entirely local raw materials, porcelain electrical insulators for small to medium electrical voltages. These have been tested at the high voltage laboratory of the University of Lagos and found to measure up to required international specifications. The full application of this technology could lead to a saving of most of the N60 million which is spent in foreign exchange now for the importation of such insulators. For this remarkable achievement, PRODA was awarded the Manufacturers Association of Nigeria's 1988 National Science prize for excellence, on 14th July this year.

3.9 *PRODA Coal Utilization Project*

The project aims to develop a safe solid-fuel alternative to firewood, which, when complemented by an efficient and cheap locally-produced oven, will assist in combating the problem of deforestation and therefore indirectly alleviate the problems of soil erosion and desertification. The low temperature carbonization characteristics of Onyeama, Okaba, and Ogbete coals have been studied. The chemical by-products of carbonization have been collected and analysed. Good smokeless solid fuel has been produced in the laboratory, and a one-tonne pilot plant for the production of the solid fuel is being fabricated.

3.10 *PRODA Electric Motors and Generators Development*

This project aims to design, construct and produce locally sourced, small-capacity electric motors (capacities 0.375Hp to 12.0Hp), as well as comparable generators. The local production of these will boost the rural industrialisation schemes of the Federal and State governments. The first phase started with winding, assembly and testing of the motors from imported components. The second phase will involve the design and machining of components from castings and stampings and will commence on the provision of funds. The electric motors produced in the first phase have been sold in order to generate funds for the continuation of the development work.

3.11 FIIRO Malting Plant for Local Grains

This malting plant, which was designed and fabricated by FIIRO, will have a tremendous impact on the national economy. The plant was designed for an output of 5-tons of malted sorghum per day and it can meet the needs of small and medium scale industrialists wishing to supply to breweries and food industries, local substitutes for barley malt, whose importation has been banned. The main components of the plant are:-

- (a) Steeping unit
- (b) Germination unit
- (c) Dryer
- (d) De-rooting machine.

Commercial firms can now place orders with FIIRO for the supply of this plant. Similarly, potential manufacturers can now adopt the project for commercialisation.

3.12 FIIRO Oil Expeller

This oil expeller is a prototype that can extract up to 90% of the oil in beniseed. This is rated up to be of very high commercial potential because beniseed is very rich in oil, but has so far defied the extraction of this oil to up to 90% recovery. The equipment can also process other oil seeds. The Institute can supply the expeller on order, and will deal with local workshop which can mass-produce it.

3.13 Other FIIRO's Machines and Products

Many other processing machines and equipment, developed in FIIRO, are already house-hold words and are available for adoption by small-scale and medium-scale industrialists.

3.14 Developments in Roads & Building Technology

(i) Small-scale Brick Production in Nigeria

This is a collaborative project between the International Development Research Centre (IDRC) of Canada and the Nigerian Building and Road Research Institute (NBRRI), aimed at increasing the accessibility of Nigerians to adequate housing, by reducing the cost of walling materials for buildings. The project aims to establish small-scale brick production units. The project has evaluated clay deposits in some parts of the country, and designed and constructed low cost brick making machines. An important component of the project is the design and construction of low cost, energy efficient, down draught

kilns suitable for using available coal in brick-making. This project will ultimately lead to the establishment of many small-scale brick plants.

(ii) ***Collaborative Project between Federal Housing Authority (F.H.A) and NBRRI***

The FHA has now embarked on using the local building materials developed in the NBRRI in the construction of low-cost housing prototypes. These materials are building blocks, roofing materials and ceiling boards. Already completed by the FHA are 7 (No.) bungalows at FESTAC town consisting of 14 flats. By using the locally produced materials, the FHA reduced the cost per flat from N80,000 to N35,000. Currently, more bungalows are being put up by FHA in Kano, while arrangements for two-storey buildings in Kano have reached an advanced stage. The Institute is ready to deal with interested cooperatives and individuals on the transfer to them of the simple technologies for the manufacture of these building materials.

(iii) ***Study of Engineering Properties of Subgrade Soils in Nigeria***

This project involves the investigation and collation of data on the engineering properties of subgrade soils in the varied geological and climatic zones of the country. The results are of immense importance to highway engineers, consultants and other practitioners of the road construction industry - not only for road route location and resource evaluation, but also as an initial ready data bank for detailed soil investigation for engineering works. Also, from the data obtained, maps of engineering subgrades of different areas of the country have been produced. These maps, which are of immense value in road route location, are now available for Bendel, Cross River, Akwa Ibom, Rivers and Borno States.

(iv) ***Study of Road Traffic Accidents in Nigeria***

The Nigerian Building and Road Research Institute has undertaken an investigation of factors which contribute to the occurrence of road traffic accidents in Nigeria, with a view to minimising such accidents. A pilot study has been completed in Lagos State with the co-operation of the Lagos State Police Command, by using a new format for recording road accidents. The following are examples of results obtained so far for accidents in Lagos state. There were 2,570 accidents between March and December 1989. 16.7 percent of these were fatal, 36.9 percent serious, and 46.4 percent were minor. 97.6 percent of the total number of 986 killed or injured were pedestrians. This

high casualty highlights the need for pedestrian crossings and road users education on the importance of overhead bridges. The results of the project are of particular interest to the Road Safety Corps and the State Government, in the location of overhead pedestrian crossings.

3.15 Industrial Chemicals Research and Development

(i) Processing of Chemical materials

Progress has been achieved by the National Research Institute for Chemical Technology (NARICT), Zaria, in the processing of local limestone into various intermediate chemicals and salts, such as 99.7% pure calcium carbonate; iron free calcium chloride; whiting, hydrated lime and quicklime.

Techniques for the purification of local potash to obtain a purer and more soluble salt has been developed, as well as an enrichment procedure to obtain sodium carbonate or sodium sulphate from local potash. The production of caustic soda from local potash and limestone has been developed. Fatty acids for use in cosmetics, candles, soap and oleochemicals have been produced from palm oil, palm kernel oil and from castor oil. It is hoped that funds will be sufficiently released in the 1991 budget for these results to proceed to pilot production stages.

(ii) Research in Biochemicals

NARICT has also developed a process for the extraction of crude papain enzyme from the latex of pawpaw fruits. Papain is used in food processing industries as a tenderiser.

(iii) Research in Petro and Other Chemicals

NARICT has also developed two dye stuffs - Orange II and Orange III, which are ready for commercialisation. And from corn-cobs, it has developed furfuraldehyde - a dearomatizer which is used in lubricating oil production.

3.16 Technology Acquisition Agreements, evaluation, monitoring and advisory services

(i) Technology Agreements

The National Office of Industrial Property (NOIP), a parastatal of my Ministry, has continued to provide services to Nigerians on problems associated with the acquisition of foreign technologies. This

has been achieved through the evaluation and monitoring of technology agreements. This service has enabled the removal of obnoxious clauses, and prevention of exorbitant charges. Since the last press briefing, NOIP examined 79 Technology Transfer/Acquisition Agreements, of which 36 were approved and 43 referred for renegotiation. A savings of N23.5 million was made in the 36 Agreements which were evaluated and registered by NOIP.

Over the same period, the National Office of Industrial Property visited 17 companies during its monitoring activities, and also provided technology advisory services to many entrepreneurs.

(ii) **Technology Advisory Services**

The Office has also concluded arrangements with the United Nations Industrial Development Organisation (UNIDO), the United Nations Centre on Transnational Corporations (UNCTC), and the World Intellectual Property Organisation (WIPO); to provide experts for Technology Advisory Services (TAS). TAS will provide information on sources of foreign technology; identify alternative sources of local raw materials, and priority areas of investments.

3.17 Raw Materials Research and Development

Significant progress has been achieved by the Raw Materials Research and Development Council (RMRDC) in the implementation of its mandate. Prominent among the achievements are the successes which I report below.

(i) **Up-grading of Industrial Materials Projects**

The programme aims at upgrading proven viable materials Research and Development projects from laboratory to pilot scale in order to establish all requisite parameters for industrial scale production. 16 priority areas have been selected, including;

soft drinks concentrates; food additives; forest and forest residue utilization; long fibre pulp; synthetic dyes and pigments, bates; natural rubber and latex products, industrial solvents from refinery cuts; epoxidised oils and alkyl resins from local oils; alloy steel materials from local manganese; glazing raw materials; foundry raw materials; engine blocks and pistons; as well as production-boosting research on industrial crops.

(ii) *Establishment of small/medium scale model factories in the states*

Catalytic model factories for local raw materials production are being established in five states in order to demonstrate the viability of investment, ensure process dissemination and entrepreneurial confidence. The states and projects being executed in them are as follows:

Borno	-	Soda Ash production
Niger	-	Talc processing plant
Ondo	-	Cocoa processing plant
Sokoto	-	Phosphate beneficiation plant
Imo	-	Galena smelting plant.

(iii) *Raw Materials Display Centres and Liaison Offices in the States and Abuja*

The RMRDC has already established liaison offices and raw materials display centres in Lagos, Ondo and Sokoto, while those for Ogun, Oyo, Niger, Akwa Ibom, Borno and Imo will be opened before the end of the year. These offices will help in the dissemination of information on agricultural and mineral raw materials resources and relevant processes and technologies for their commercial exploitation.

(iv) *National and ECOWAS Directory of Raw Materials Producers*

In order to bridge the communication gap between raw materials producers and end users, and in fulfilment of the recommendations of the ECOWAS Action Committee on Raw Materials, the RMRDC is currently producing a national directory of raw materials producers, as well as an ECOWAS Directory of Raw Materials producers. When completed, the data will be of great benefit not only to industrialists in Nigeria, but also to others in the ECOWAS subregion.

(v) *Study on Raw Materials whose export is detrimental*

The council has completed a study of "Raw Materials whose exportation is detrimental to local industries". The report is primarily for the consideration of Government, but is also available to members of the public.

(vi) *Audit of Indigenous Equipment Manufacturers*

An audit of indigenous equipment manufacturers was conducted recently and revealed that:

- Nigerian equipment manufacturers have the capability not only for

local manufacture of some machines and equipment but also to replicate some imported ones;

there are about 60 established cottage level and 400 road-side equipment manufacturers, and 40 R&D institutions associated with equipment manufacturing.

The study showed that there is need to tap the talent and potentials of these indigenous manufacturers for national development.

(vii) *Establishment of a Risk Guarantee Fund for Commercialisation of selected process technologies*

A proposal for establishing a N500 million Risk Fund Scheme with greater equity participation by the private sector, such as banks, financial houses and industrialists, has been considered by the RMRDC. The blue print recommends the structure and management of the fund, operational and funding modalities, criteria for project selection, fund accessing, choice of investment instruments, incentives and legal framework for operating the fund. A workshop was organised early in August this year at Abuja, to create a greater awareness among Nigerian entrepreneurs of venture capital potentials in Nigeria.

4. ENERGY RESEARCH AND DEVELOPMENT

(i) *National Energy Commission*

The National Energy Commission, of which the President is the Chairman, has now taken off. Presently, it is establishing its Lagos Office and recruiting the staff needed to commence work in earnest.

(ii) *Energy Research Centres*

The Energy Research Centres at Usman-Dan Fodio University (UDFU), Sokoto; Obafemi Awolowo University (OAU), Ile-Ife; Ahmadu Bello University (ABU), Zaria and University of Nigeria, Nsukka, (UNN), have continued to pursue their mandates. The Centre at UDFU, Sokoto, has developed a 0.75 kw wind-electricity generator, a 1.5 kw photo-voltaic power generator and a vertical axis water-pumping wind turbine. The centre is now experimenting on the local production of solar cells in order to reduce the cost of solar panels.

The Energy Centre at UNN has built efficient and cheap solar dryers for drying food products such as yam chips, cassava, fish, and maize and other cereals. The centre has also designed and fabricated solar

power units for refrigeration, water purifiers, and water heaters for rural application.

The Energy Centre at OAU, Ile-Ife, has made notable achievements in adaptive research in food irradiation technology and plant genetic improvement through radiation-induced mutations.

The Energy Centre at ABU, Zaria, has successfully developed an efficient methodology for uranium ore dressing and processing and is in this regard providing valuable technical assistance to the Nigerian Uranium Mining Company. It has also developed powerful gamma spectrophotometric procedure for monitoring radioactivity in foods, wastes and the environment.

5. RESEARCH IN SUPPORT OF HUMAN MEDICAL CARE

(i) *Research into traditional and alternative medicine*

Since the last Ministerial press briefing, efforts have been geared to exploring and highlighting priority areas of research and validation of traditional and alternative medicine practices in this country. A proposal has been presented by the National Committee on Research and Development into Traditional and Alternative medicine. The sub-committee on model clinics visited some states of the Federation to evaluate traditional medicine, and their report will be made available to the public.

The staff of my Ministry, and those of the National Institute for Pharmaceutical Research and Development, undertook a fact finding study visit on traditional medicine in China. The trip, which was funded by the Nigerian philanthropist Bashorun M.K.O. Abiola, will be of immense benefit to our pharmaceutical research institute.

(ii) *Fagara - Anti-sickling and anti-inflammatory research development and production studies*

Sickle Cell Anaemia is a common chronic disease in Nigeria, with its attendant social, economic and psychological hardships on the affected families. It is estimated that one quarter of all Nigerians carry the sickle cell gene and about 2% of all Nigerian babies will have the disease. To date, there is no known cure for sickle cell anaemia. Ministry has intensified its efforts in the research and development of crude extracts of the local chewing stick - "Orin Ata" or *Fagara*. The crude extracts have been produced in tablet form and preliminary reports of laboratory and clinical studies show that *Fagara* does ameliorate Sickle Cell crises. Most recently, some Nigerian scientists,

in collaboration with a German laboratory have been able to synthesize the active ingredient in Fagara. This active ingredient, in addition to its anti-sickling property, also has an anti-inflammatory potential with a potency many times that of aspirin. Efforts are currently being made to patent this product and procedure with the Federal Ministry of Trade. More extensive clinical trials will be done before this drug can be made available to the generality of our sickle cell patients.

(iii) ***Local production of antisera and vaccine against Cerebrospinal meningitis***

The National Institute for Medical Research has so far successfully produced 50 vials of the freeze-dried antisera against *Neisseria Meningitidis*, the causative agent of *Cerebrospinal meningitis*, which is a serious disease that annually ravages parts of the country. The Institute hopes to achieve a target of 200 vials by the end of 1990. This development could lead to a considerable saving in foreign exchange, by the eventual elimination of the importation of both the antisera and vaccine.

(iv) ***Kargasok Tea (Tea of Life)***

Following investigations conducted by the National Institute for Pharmaceutical Research and Development (NIPRD), into the Kargasok Tea, also known as the "Tea of Life", a preliminary report was presented to the National Council of Science and Technology at its meeting in Lagos in May 1990. While acknowledging the need for further work on the tea, the results so far recommended caution on the part of the consuming public.

(v) ***Inter-Ministerial Collaboration on Health Projects***

(a) ***Guinea worm***

The Ministry has continued its active membership of the National Guinea Worm Eradication Programme Task Force, and provides research support towards government efforts to eradicate guinea-worm by 1995.

(b) ***Local Production of Drugs***

In addition to its representation at the National Council on Health, my Ministry provides research funds, and collaborates with the Federal Ministry of Health in government's efforts to encourage local production of drugs. The same collaboration has been extended by

my Ministry to the Obafemi Awolowo University's Drug Research and Production Centre of the Faculty of Pharmacy.

(c) ***Studies on the relationship between Tuberculosis (TB) and Human Immuno Deficiency Virus (AIDS Virus)***

Studies recently conducted at the National Institute for Medical Research (NIMR) show a significant increase in the incidence of tuberculosis among patients with chronic lung disorders in the Lagos metropolis. 35% of such patients examined in 1990 were found to be positive for tuberculosis, compared with 21% and 23% in 1969 and 1981 respectively. These infected patients are, through constant coughing, spreading the disease to healthy individuals in the society. It was also discovered that a positive correlation exists between tuberculosis and the dreaded AIDS disease. These findings make it imperative for an increased national attention and further research on the eradication of tuberculosis, which is essentially a disease of poverty, urban congestion and poor sanitation.

6. **PROMOTION OF AGRICULTURE AND FOOD PRODUCTION**

6.1 ***Arable Crops***

Research activities on food and fibre crops continued in all Agricultural Research Institutes with emphasis on the production of improved, high yielding, disease resistant, and acceptable quality crops, coupled with a package of agronomic and crop protection practices.

(i) ***Cereals***

Wheat and Triticale

Research on wheat, conducted at the Lake Chad Research Institute (LCRI) and the Institute for Agricultural Research, Samaru, have continued to yield encouragingly good results. At LCRI, evaluation of 11 germ plasm materials from the International Centre for Maize and Wheat Improvement, Mexico (CIMMYT) revealed 8 lines yielding over 2.5 tons/ha; and that a great potential for rain-fed wheat production exists on the high lands of Gembu in Mambilla Plateau, Gongola State. The mean average yield in 3 years trial was over 2 tonnes/ha. without irrigation. The trials will now be extended to Jos and Biu Plateaus. *Triticale*, an artificial crop derived from crossing wheat and rye, has also been found to do very well under rain fed production. Its flour is very close to wheat's and is also a good composite bread-making material.

6.2 Horticultural Crops

6.2.1 Horticultural Crops Diseases

(i) *Black Sigatoka Disease of Plantain*

This disease, which remains a major threat to plantain and banana production, is being contained by my Ministry, through integrated control measures involving trials of fungicides and other cultural practices. Breeding programme for the development of Black Sigatoka resistant plantain types has also been initiated at the National Horticultural Research Institute (NIHORT), Ibadan.

(ii) *Mango Mealybug*

My Ministry, through NIHORT, co-ordinates the research activities of a group of Nigerian scientists drawn from research Institutes, the University of Ibadan, and the Plant Quarantine Services, to map out strategies for appropriate control measures for the Mango mealybug, an insect pest infesting mangos in the country. Biological control measures, employing a mealybug parasitoid, as well as chemical methods, are being tried with promising results.

6.2.2 Vegetables and Fruits

(i) *Improved varieties recommended*

Five promising cultivars of "okra", combining high yields (3-4 t/ha.) with consumer acceptable qualities, and three varieties of "Ewedu" (*C. olerius*) with high leaf yield (20-25 t/ha) have been identified and recommended to farmers. Improved citrus varieties with high fruit yield (40-50 t/ha.) and good nutritional qualities; and sweet guava with large fruits (70-80g.) have been identified and recommended to farmers. Pawpaw varieties combining high fruit yield with low bearing height (1m.) have also been produced and distributed to farmers. In Zaria, IAR has also identified vine grapes which are suitable for commercial production for table use, for raisins, wines and juices.

(ii) *Mass Production of improved planting materials*

To achieve the aim of providing adequate quantities of improved good quality planting materials to growers throughout the country, the Ministry's Horticultural Research Institute distributed to farmers 40,000 citrus seedlings and a total of 63,178 seedlings comprising of fruits such as mango, pawpaw, guava and pineapple.

It also produced and distributed 500kg of assorted improved vegetable seeds of tomato, okra, pepper, onions, ewedu, Amaranthus and Celosia.

(iii) *Processing of Fruits and Vegetables*

To reduce losses through the spoilage of fresh fruits and vegetables, the processing of fresh fruits and vegetables into different preserved products is imperative. In this regard, my Ministry, through NIHORT, has developed various confectionneries such as biscuits, cakes, as well as a baby food "soyamusa" from plantain, maize, "amaranth" and soya bean. The Institute has also been producing single strength pasteurised fruit juices from local sweet oranges, tangelo, pineapple, grapefruit, using its own prototype plant produced by the Rural Agricultural and Industrial Development Agency at Ibadan. This process is available for adoption by entrepreneurs.

6.3. *Agro Processing and Agricultural Machinery*

(i) *Sunflower seed decorticator*

The IAR, Samaru, has successfully designed and produced a machine that decorticates the high oil bearing seeds of sunflower. It is a bar mill machine with decorticating action taking place between a rotating drum and a stationary quadrant. Manually operated, it has a capacity of 20 kg./hr. and has 85% decortication efficiency. The Institute can supply this machine on order.

(ii) *Okra and Ewedu threshing machines*

NIHORT has designed and fabricated a machine for threshing "Okra" and "ewedu" (*Corchorus*) pods, thus reducing many-fold the cost and time of processing the seeds of these valuable vegetables. The machines have extraction rates nine times higher than the traditional hand threshing, and the seeds produced are of higher quality. The institute can supply this machine on order.

6.4 *Food and Crop Preservation and Storage:*

(i) *Local Crop Pesticides and Storage Materials:*

My Ministry has intensified its efforts in food and crop preservation and storage through the activities of the Stored Products Research Institute. Local plant materials are being screened to find substitutes for pesticides, especially insecticides for protecting foods crops from

storage pests. Work is also in progress to evaluate local earths, particularly limestone, as protectants for grains during storage. Improvements are being made on evaporative coolant structures for low cost storage of perishable crops, especially for the storage of fruits and vegetables.

(ii) **Presidential Project on "On-Farm Storage of Produce"**

Following the release of funds for this Presidential Project late in 1989, NISPRI commenced the construction of storage structures in different centres of six states.

As at the end of June, 1990, the six storage Centres had been commissioned at Benin (Bendel State), Port Harcourt (Rivers State), Ilorin (Kwara State), Minna (Niger State) and Kano (Kano State). A week's training of extension workers followed each commissioning. The implementation of this Project has led to vast improvements in the reduction of losses from storage of food crops in the states. Ministries of Agriculture in the state are supposed to encourage farmers to establish their own storage system based on the demonstrated NISPRI systems.

6.5. **Tree Crops**

(i) **Palms**

The second cycle of oil palm breeding programme has been expanded by my Ministry through the research work of NIFOR, Benin City. This cycle will result in about 20% increase over the 15-18 tonnes Fresh Fruit Bunches (FFB) per hectare achieved in the first cycle. Palm oil processing has been identified as the most serious problem of the small-scale farmer. NIFOR has now developed other ancillary gadgets e.g. Palm kernel oil extractor, nut fibre extractor, in order to make the small-scale oil mill processing equipment developed by the Institute into a full palm oil processing mill. Enquiries for palm-oil mill will be attended to by NIFOR.

(ii) **Cocoa**

In order to arrest the decline of Nigeria from her second position as the world's foremost cocoa producer (308,000 tons in 1970) to the fourth position (185,000 tons in 1989), my Ministry, through its Cocoa Research Institute (CRIN), has carried out a lot of research on improving the existing Cocoa genotypes that combine many desirable economic attributes. The breeding programme, now in its third

pnase, has led to the release of 15 genotypes known as CRIN ELITES for planting in areas considered marginal for cocoa production. 3 selected clones showing tolerance to cocoa swallow shoot virus disease, and 6 selected clones showing apparent tolerance to the *Phytophthora* pod rot. To enhance the expansion of commercial production of improved cocoa cultivars, the Institute has established seed gardens for producing these and distributing to farmers. Also, methods for assessing good cocoa soils have been articulated and the most effective fertiliser regimes recommended to farmers.

(iii) **Kola**

Improved planting materials of Kola (*Cola nitida*), with yield of over 3,000 nuts per tree per annum, have been developed and distributed to farmers.

CRIN has perfected the vegetative propagation of Kola and as a result of this achievement, the area of land as well as the number of farmers engaged in Kola farming has increased greatly over the last five years.

(iv) **Rubber**

Emphasis during the recent past in Rubber research has been in the area of development of new products for domestic and export markets and for industrial raw materials for indigenous industries. In this regard, the Rubber Research Institute, Benin City, an organ of my Ministry, has designed and fabricated a proto-type rubber seed oil extraction screw press which has been test-run satisfactorily. The machine was found to sufficiently press oil from uncracked seeds, which eliminates the need to de-shell the nuts before extraction. The resultant rubber seed oil is purified and used for the production of alkyd resin, adhesive, leather far-liquor, plasticisers, soap, skin cream and hair shampoo, which are in high demand locally and overseas.

6.6. **Forestry**

(i) **Large Scale Tree Planting Scheme:**

In furtherance of my directive to the Research Institutes to emphasise the use of research findings for production activities, the Forestry Research Institute (FRIN) has used its mass propagation and viable seed storage techniques to enhance planting stock production. The Institute has assisted in the establishment of industrial forest plantations for the production of match splints for the Safa Splint Company.

Since last year, a further 100 ha of plantations have been established, and 146,666 planting stock of "cedar" wood (*Cedrela odorata*) and "obeche" (*Triplochiton scleroxylon*) were produced for the company.

In addition to the Safa Splint Company, other Companies have approached the Institute for feasibility reports on establishing forest plantations.

Production work has also been geared towards the use of clonal stocks of 30% improved and superior genotypes to enhance the value of plantations. These have been established in various sites to encourage the transfer of genetic qualities to industrial plantations such as for pulp and paper. Results obtained from work on the tropical pine (*Pinus caribaea*), a long fibre pulp species, has been so promising that it will soon be possible to stop the importation of pine seeds and thus conserve foreign exchange on this product.

(ii) *Afforestation of Semi-arid Areas*

Research work done by the FRIN jointly under the Japanese International Co-operation Agency (JICA) Project at Afaka, Kaduna State, has yielded useful data on the selection of appropriate tree species, and afforestation technology in the savanna zone of Nigeria. Two million seedlings of indigeneous and exotic tree species have been produced towards the establishment of over 450 ha of planting projects in the semi-arid areas of the country. These efforts will help to mitigate the impact of desertification in the affected areas.

6.7 *Fisheries*

(i) *Fish farming*

My Ministry through its two Fishery Research Institutes (NIOMR and NIFFR) has actively promoted the practice of fish farming as a means of increasing fish production throughout the country. The successful artificial propagation of economically culturable fish species such as the mud fish (*Clarias*), silver cat fish "Obokun" (*Chrysichthys*) tilapia and *Heterobranchus*, has led to hundreds of thousands of fingerlings of these fishes being provided to fish farmers. The extension of fish farming techniques to the grassroots has been facilitated through the participatory management approach method, whereby farmers are taught on-the-job in homestead fish ponds constructed by the National Institute for Freshwater Fisheries Research, on the farmers land. More than 25 fish farmers have benefited from this scheme and over 50 ponds of different sizes have been constructed. Training programmes have also been arranged for fish

farmers.

(ii) ***Fish parasites of cultured tilapia***

Six new species of *Myxospora*, a protozoan parasite affecting tilapia, have been reported for the first time from Kainji. One of these, *M.kainjiae*, is named after Kainji Lake. The emergence of these parasites poses a challenge to our research institutes for an urgent remedial action.

(iii) ***Fish processing: Shark liver oil refinement***

NIOMR has now, after sixteen years of research work, succeeded in producing refined Shark liver oil that is stable, free of rancidity, and that remains fluid for over one month after preparation.

This was achieved through a process of filtration, neutralization, bleaching and deodorization. The percentage of extractible oil in Shark liver is 30% compared with 18% for soyabeans. Shark liver oil is an effective import substitute for codliver oil, but has a higher vitamin A content than codliver oil, and it can be used as a lubricant for fine machinery.

(iv) ***Deep Sea fish resources***

As the nation's territorial inshore fish resources continue to suffer from depletion of fish stocks, as a result of over capitalisation and poaching by foreign vessels, NIOMR has emphasised its search for fish resources in deeper unexploited waters down to 300 metres. In a survey conducted by the Institute during 1989-90, abundant commercial quantities of Drift fish (*Arioma bondi* and *A. melanum*) were located. Catches ranging from 112 kg/hr. to 160 kg/hr were recorded off Forcados and Sombreiro Rivers at depths of 141-250m. The fish which is excellent for canning is already being canned and sold by NIOMR. This is an area for entrepreneurs to look into for possible investment.

6.8 Livestock

(i) ***Demand for, and Cost of Livestock***

Rising demand for animal protein, particularly livestock, coupled with increasing prices of imported inputs for production, have conspired to raise the price of livestock beyond the reach of many farmers and consumer. The research and production activities of the National Animal Production Research Institute (NAPRI) and other Institutes dealing with livestock and animal health such as NVRI, Vom, and

NITR, Kaduna, are geared to solving the problems associated with the production of livestock and their diseases, in order to increase production.

(ii) *Poultry*

Unavailability of cheap but nutritious poultry feed, and the cost of day-old chicks, are presently the biggest constraints in the commercial production of poultry in Nigeria. NAPRI has successfully used maize offal to replace 50% of dietary maize in broiler diets and 100% maize in chick grower and layer ration, with no adverse effects on the birds, thus reducing considerably the cost of poultry feed.

In the area of day old chicks production, while NAPRI has been developing and improving a national foundation stock the National Veterinary Research Institute (NVRI), Vom, has developed a kerosene incubator capable of hatching 160 to 200 eggs every three weeks. There has been such a high public demand for this incubator that the Institute is now taking action to transfer this technology to the private sector for full-scale commercial production. These developments will significantly boost chick production in the country.

(iii) *Small Ruminants*

The NAPRI's Research work has shown that lambing/kidding can be regularly achieved twice a year with potential doubling of meat output of small ruminants. 200 selected improved rams/bucks are being sold to states yearly for use in multiplier flocks. The technology for the milking of indigenous goats as a means of obtaining additional protein for the populace has also been developed by NARRI and is available for commercialisation by interested farmers.

(iv) *Vaccines*

In the fight against livestock disease, the National Veterinary Research Institute, Vom, produced 70 million doses of bacterial and viral vaccines during the past year, realising about N5.0 million from vaccine sales. A new vaccine has been developed against pulpy kidney disease of goats and sheep and its production in commercial quantity has commenced. This development will enhance animal protein availability in the country.

7. SUPPORT FOR ACTIVITIES OF THE SCIENTIFIC COMMUNITY

7.1. *Workshop on Science and Technology Management In Africa*

My Ministry has a mandate for the promotion of Science and Technology Management capability in Nigeria, and in this regard, in collaboration with UNESCO, we hosted the international workshop on the Management of Science and Technology in Africa, in February 1990. Participants were drawn from 19 African countries, as well as from the Caribbean, Latin America and Europe. The Workshop recommended the establishment of an African network of Training Institutions in Science and Technology Management. Nigeria, through my Ministry, is vying for hosting the headquarters of this continental network.

7.2. *Development of Informatics in Nigeria*

My Ministry is giving considerable attention to the development of informatics in Nigeria, as a means of facilitating the acquisition, processing, storage and retrieval of scientific and technological information for national planning and development. To this end, the Ministry serves as the national focal point for the Inter-governmental Informatics Programme (IIP) and also for the African network of Science and Technology Information. (AFSTINET).

My Ministry, in collaboration with the Federal Ministry of Education, has embarked on a 2-year project to develop appropriate computer softwares for teaching computer technology in secondary schools in the country. The project has received a grant of USA \$110,000 from the IIP to execute it.

7.3. *Research Grants and Travel Fellowships to Nigerian Scientists*

In support of scientific and technological research and development efforts outside the Ministry's Research Institutes, my Ministry offers to Nigerian scientists, engineers, technologists and other academic and scientific associations, research grants and travel fellowships to enable them pursue research in areas of National interest and to attend conferences overseas. To date, my Ministry has spent N4.5 million in such research grants to over 150 research projects in Nigerian Universities, and Polytechnics countrywide. In addition, my Ministry assists Nigerian scientists to obtain research grants and fellowship from friendly countries and international organisations, such as the International Foundation for Science (IFS).

7.4 *Commonwealth Consultative Group on Technology Management*

The formation of the Commonwealth Consultative Group on Technology Management (CCGTM) was recommended by the summit meeting of the Commonwealth Heads of Governments at their meeting in Kuala-Lumpur in 1989. My Ministry, which represents Nigeria in the Commonwealth Science Council, participated in the deliberations on the possible structure, mode of operation, and sources of funding of the CCGTM and also took part in its formal launching in July, 1990. A number of projects are being considered as Nigeria's task within the proposed work programme of the Commonwealth Consultative Group. Among these are the combating of post harvest losses in agriculture; agricultural mechanisation; integration of science and technology into National Development Plans; application of remote sensing to the assessing and managing of national resources; and mathematical modelling in scientific and engineering research.

7.5 *Bilateral relations with foreign countries in Science and Technology.*

Nigeria has, through the Ministry, entered into bilateral arrangements and proposals for Institutional Research and Development collaboration and for mutual exchanges of S&T information, scientists etc. with some foreign countries since my last briefing. These include Bulgaria, Zimbabwe, Ghana, Brazil and Sierra Leone.

7.6 *World Bank Assisted Agricultural Research Project in Nigeria*

In order to strengthen the Agricultural Research System in Nigeria, my Ministry in 1988/89 sought the assistance of the World Bank. The Project, which will be funded by a soft-loan from the World Bank, is titled "World Bank Assisted Project to strengthen Agricultural Research in Nigeria". The project will be implemented over a seven year period (1991-1997) at an estimated cost of N1,110.6 million (US \$104.10 million). The proposed loan amounts to US \$78.0 million, representing 75 percent of the total project cost and would be financed by the World Bank, while the Federal Government's contribution amounts to US\$26.1 million or 25 percent.

The project has two main thrusts. The first is to strengthen the national agricultural Research Institutes through the rehabilitation of their infrastructure and provision of new equipment, machinery etc; and to provide funds for priority research and extension programmes.

The second thrust is to develop the national research system through the establishment of a National Advisory Committee for Agricultural Research, as an independent advisory body; to strengthen the Agricultural Sciences Department of my Ministry; to establish a research grant scheme to fund priority research in the Universities and other Institutions outside the Research Institutes, and to establish a systematic human resources development programme in agricultural research.

8. SCIENCE AND TECHNOLOGY PROMOTION

8.1 *National Science and Technology Week (NASTECH)*

My Ministry organises monthly Technical Seminars at which topics of national interest in Science and Technology for national development are discussed and given media publicity. The proceedings of the Seminars are being published for wider circulation. These, and the yearly observance of the National Science and Technology Week (NASTECH), which takes place in the third week of October, are parts of our activities to popularise Science and Technology and inculcate a Science culture. This year's observance of the Week, known as NASTECH '90, will be held from 15th through 20th October, 1990. The highlights of the Week include:

- the NASTECH '90 Science and Technology Fair and Exhibition, to be held at the Tafawa Balewa Square, Lagos, from 15-20 October, 1990.
- a NASTECH '90 lecture on the theme of the week, i.e "Science and Technology in Nigeria: The Challenges of the '90's"
- a meeting of Investors and the Ministry's Research Institutes on Tuesday 16th October, 9 a.m., at the Senate Chambers, National Assemblies Building, Tafawa Balewa square, Lagos
- an Inventors/Innovators Day at the S&T Fair on 17th October.
- a seminar on "Managing Technology for Industrialisation in Nigeria", on 18th and 19th October
- The finals of the Junior Engineers Technicians and Scientists competition, in collaboration with the Federal Ministry of Education, to be held at Yola, Gongola State, on 20th October,
- The Award of the Ministers Prizes for Excellence in Science and Technology, and for popularisation of Science by the Media.

I will like to seize this opportunity to invite the general public to the events of NASTECH '90, and to appeal to the media to give adequate publicity to them in order to make the week a success. Various states

of the Federation have their own packages for observing the NAS-TECH '90 at the state capitals and local government headquarters, in order to reach the grassroots.

8.2 *Scientific Publications*

(i) *FMST-sponsored Nigerian Scientific Journals*

My Ministry has resumed the publication of four Nigerian Scientific Journals. These are the Nigerian Journal of Agricultural Sciences (NJAS); the Nigerian Journal of Natural Sciences (NJNS); the Nigerian Journal of Medical Sciences (NJMS) and the Nigerian Journal of Engineering and Technology (NJET). These Journals with the exception of the NJET, published from the University of Benin, are being published with the editorial support and supervision of the Nigerian Academy of Science, from whom copies of the Journals could be purchased.

(ii) *Fact Sheet on the Federal Ministry of Science and Technology (FMST)*

In the last press briefing, we announced the publication of the booklet, "Fact Sheet on the FMST and its Research Institutes - Volume I", which provided information on the mandates and activities of my Ministry and its parastatals. I am happy to announce the publication of "Fact Sheet" Volume 2 (Agricultural Research Institutes) and Volume 3 (Medical, Pharmaceutical, Animal Health and Industrial Research Institutes). These books deal with the history and achievements of all the 26 Research Institutes and Parastatals under my Ministry. Volume I has also been revised as a second edition in the light of recent developments in my Ministry. It is my honour and privilege to launch these three books today. I commend the books to you and the general reading public as a treasure store of basic information on the progress of Research and development in Nigeria's Research Institutes.

9. CONCLUSION

Your Excellencies, Ladies and Gentlemen of the Media, Distinguished Guests.

I have given you a run-down of the developments and some of the achievements of my Ministry during the past year. You will have observed that due to the nature of our mandate, our achievements are not easily measured in quantities such as kilometers or kilograms or volumes of goods

produced or even in the naira earned. The contributions of Science and Technology in the advancement of knowledge of our physical environment, and in the creation of wealth through the application of technology to economic development, are however, enormous and enduring.

The introduction of an improved high yielding crop or animal variety to farmers translates into higher production per hectare. The farmer sees this in increased income and the people in greater availability of cheaper food. The introduction of a new simple machine or tool, e.g. for threshing millet or "ewedu", or of a process for malting of Sorghum, transforms the economics of the production process. The beneficiaries of our work are the nation and the people.

Some of the work now going on in our Research Institutions take many years to reach maturity and yield dividends; but it is the understanding of the importance of Research and Development that will enable the continuous and adequate funding of these activities.

I wish to assure you that with our new orientation of combining Research and Production (RAP), the visibility and impact of the activities of the Research Institutes and parastatals in my Ministry will be more concretely felt. A note of caution is however pertinent in this regard; the level of commercial production is not expected to be large, in that the major function of the Research Institutes will continue to be Research and Development work. What is required is that entrepreneurs and investors would be attracted to take up the projects which have been proven to be viable by the Institutes, and commercialise them, thereby creating the desired multiplier effect in the production process.

All these will be facilitated by the establishment of the Engineering Infrastructure - a project that will run through successive administrations, but whose completion will transform the technological fortunes of the nation and launch the country into the industrial era.

I thank you for your attention.

Professor Gordian O. Ezekwe

Hon. Minister of Science & Technology

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