

The state of agricultural research and its commercialization in Nigeria

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Nigeria has an extensive agricultural research system with an impressive number of research results and technological innovations. However, these are inadequately applied in the private agricultural sector. The causes lie in insufficient publicity of the findings, bad presentation, lack of procedures for large-scale introduction to the agricultural practice, financial obstacles, risk factors, and cultural barriers. Hybrid maize and minisett yam and yam pounder are presented as case studies insufficient utilization of these technologies. The suggestions derived aim at improved infrastructure, enhanced cooperation of research and extension systems, and increased participation of the potential users (farmers) in determining research goals.

1 Introduction

Research findings and technological breakthroughs have been evident in the Nigerian research institutes, universities, and polytechnics since the turn of this century. Notable achievements are related to the fact that research activities have resulted in specific and practical technologies for direct application and use by farmers and other end-users (YAYOCK and KARIKARI 1989). However, the commercialization and/or dissemination for mass adoption of these results have been faulty. Where the research findings and technological breakthroughs have been adopted, the reality differs tremendously from the expectation, as the yields at farmers' level have remained low (Table 1). What are the problems in the commercialization of research findings and technological breakthroughs in Nigeria with emphasis on the agricultural sector? This issue needs to be addressed if Nigeria is to translate scientific research and technological innovations into

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practical realities through commercialization and mass adoption. This paper will focus on the historical perspective, existing commercialization framework, problems of commercialization, case studies of some findings, and conclusions.

2 Historical perspective

Research and hence research findings and technological breakthroughs have been an integral component of the Nigerian agricultural transformation process. Research activities were first formalized in the country in the 1920s by the colonialists, who established research stations at Moor plantation, Ibadan, Umudike, Samaru, and Vom, Jos.

Table 1: Yield from farmers' practice and research station improved technology

Crop	Farmers' practice (kg/ha)		Research station Improved technology
	Traditional technology	Improved technology (kg/ha)	
Sorghum	785	1,680	3,920
Millet	740	1,344	2,800
Maize	1,046	3,000	7,840
Rice	940	1,445	3,360
Wheat	1,000	2,300	4,500
Cassava	5,570	11,263	22,580
Yam	6,272	9,000	20,070
Groundnut	586	1,120	2,240

Source: YAYOCK and KARIKARI (1989)

In the 1940s the Cocoa Research Institute, Oil Palm Research Institute, and Trypanosomiasis Institute were established.

The colonialists' motivations in establishing research centres were founded on the desire to boost cash crop production which forms the major raw materials for European industries (KOLEOSO 1989). In spite of this selfish motive of the colonialists in encouraging research institutes, they succeeded in initiating research work in the country. Today there are 24 Nigerian research institutes in the country and 3 international research organisations (International Institute of Tropical Agriculture (IITA), Ibadan, International Crop Research Institute for Semi-Arid Tropics (ICRISAT), Kano, and International Livestock Centre for Africa (ILCA), Kaduna). In addition, 23 (including 2 agricultural universities) of the nation's, 30

universities (Federal and State), 28 polytechnics, and 27 other training institutes provide invaluable research and supporting services to the agricultural sector. In Nigeria, the responsibility for directing research and development (R & D), which constitute the backbone for any scientific and technological development, has been assumed by different government agencies. Since 1966 6 different agencies have been set up to direct the affairs of R & D (Table 2). These changes, may in part, have been responsible for Nigeria being considered as technologically low and thus classified along with the less industrialized countries. In industrialized countries, the agency responsible for R & D is always stable. Other reasons responsible for the low technological development of Nigeria, despite the numerous agricultural research centres, include the low percentage of GDP devoted to R & D and the inactive role of private and public industries in R & D. Nigeria, like other less developed countries (LDCs), still devotes a small proportion (0.01 to 0.1%) of her GDP to R & D (Koleoso 1989). All R & D activities (strategic and non-strategic) in LDCs are funded entirely by the government, whereas in the developed countries the private sector, commercial or industrial organisations or companies, fund non-strategic research. In Nigeria, the industries (the user group) contribute little to nothing to the R & D activities, and hence there is a problem in getting the results effectively utilized and commercialized. It is clear therefore, that a major barrier to the technological development of Nigeria is the failure to take up R & D results for commercial exploitation.

Table 2: Government agencies responsible for research and development 1966 - date

Name of agency	Year established	Remark
National Council for Scientific and Industrial Research	Degree 83, 1966	Never took off
National Council for Science and Technology	Degree 6, 1969	Operated 1970-76
National Science and Technology Development Agency	Degree 5, 1977	Operated 1977-79
Federal Ministry of Science and Technology	Act. 1, 1979	1979-83
Federal Ministry of Education, Science and Technology	1984	1984-85
Federal Ministry of Science and Technology	1985	Sept. 1985-date

3 Existing commercialization framework

Research and development in the agricultural sector is carried out in all agricultural institutes, some of the conventional universities, universities of technology, agricultural universities, polytechnics, and colleges of technology, established and funded by the Federal and State Governments. It is not surprising therefore, that the Nigerian Government, like in other LDCs, is overburdened with the task of generating research findings and technological breakthroughs.

3.1 Institutional arrangements

3.1.1 University research

Research activities in the conventional universities are fundamental or basic and are aimed at expanding the frontiers of knowledge. However, some of these universities have developed an interest in applied research aimed at solving practical problems. Notably amongst these are Faculty of Technology, University of Ibadan, and that of Obafemi Awolowo University, Ile-Ife. At Ibadan a process for the production of pounded yam (poundo yam) to replace the onerous, enervating and time-consuming cultural system of boiling and pounding yam has been developed. Also at Ile-Ife, the same objective was achieved by developing a fast blender (yam pounder) that churns the boiled yam into pounded yam. While other universities are making similar efforts, the specialized universities are still very young but promise to solve practical socio-cultural and economic problems.

3.1.2 Research institutes

The research institutes can be classified into agricultural research institutes (17) and industrial research institutes (5). The agricultural research institutes' mandate involves R & D into high-yielding, disease- and pest-resistant varieties, species, and breeds. In these aspects, the institutes have made substantial contributions to the development of improved varieties of crops and breeds, eradication of pests, development of labour-saving agricultural machines, fish and livestock feeds formulation, development of different vaccines for animal and poultry diseases, and improved storage techniques. The industrial research institutes focus on the industrial utilization of local raw materials, food and agro-allied processing techniques, development of industrial chemicals, and ceramic and fibre technology. These institutes have also made substantial technological breakthroughs in the areas of industrial utilization of local agricultural resources, improved processing technologies, development and fabrication of prototypes, and development of enriched foods to combat malnutrition.

3.1.3 Existing commercialization approach

Inadequate commercialization of research findings and technological breakthroughs have been a major barrier to R & D efforts since the user-agency (private sector) differs from the funding agency (public sector, government). In the area of agricultural research, the government has set up Agricultural Extension and Research Liaison Services (AERLS), now expanded to National Agricultural Extension and Research Liaison Services (NAERLS), based in Zaria. The objectives of NAERLS are to assist the transfer and dissemination of research findings and appropriate agricultural technology, ensure feedback of research relevant to farmers' needs, provide necessary in-service training, and provide advisory and consultancy services. In addition to the services of NEARLS, the various agricultural research institutes have attempted to aid commercialization of their findings through the organisation of training programmes for State Extension Services (Ministries of Agriculture, Agricultural Development Projects, ADPs). Another avenue for commercialization which has since proved most effective for the dissemination and commercialization of research results from universities and research institutes is the establishment of the National Seed Multiplication Centre (renamed National Seed Service, NSS). The function of this unit is the multiplication of any improved seed variety as well as their consequent distribution to farmers at subsidized rate. The industrial research institutes' approach to commercialization includes the organization of training workshops for would-be entrepreneurs, consultancy services in the preparation of feasibility reports, assisting in the fabrication of equipment and licencing agreements. These institutes encourage commercialization through participation at exhibitions and trade fairs, publications and distribution of pamphlets, and granting newspaper, radio, and television interviews.

3.2 Private sector

The private sector has not been active in the commercialization of research results for the obvious fact that they are not the funding agencies. Another reason is that most of the industries in Nigeria are outposts of foreign-based industries which are not interested in commercialization of local research efforts. Nigerian-owned industries are biased towards foreign technology and foreign technical partners and therefore not favourably disposed to adoption or commercialization of local research results. The effect of the Structural Adjustment Programme (SAP), which encourages local production rather than promotion of foreign products, may help in changing the attitude of Nigerian Industries. The efforts at and approaches to commercialization of research and technological breakthroughs by the government and its agencies have not been very successful. According to Koleoso (1989) only about 20% of the completed projects reach the commercialization stage.

The reasons adduced for this low success rate in commercialization include:

- Extension services are not strong and widespread enough. The links between NAERLS, Research Institutes, AERLS, State Ministries of Agriculture, and ADPs have been very weak.
- The government which funds research activities is not a commercial organization and hence not in a position to commercialize results emanating from such activities.
- Most small-scale, low-cost agricultural equipment developed in the universities and agricultural research institutes remains uncommercialized due to lack of interest by various engineering companies who prefer short-term gains to long-term benefits.

4 Problems of commercialization of research findings and technological breakthroughs

Various problems have been identified as being responsible for the commercialization of research findings and technological breakthroughs in Nigeria. These problems include: inadequate publicity of research results and technological advancement, mode of research result presentation, inadequate technology for implementation, financial constraints, commercial feasibility of research results, risk factors and cultural barriers, inadequate and unreliable infrastructure, and lack of access to resources.

4.1 Inadequate publicity

Inadequate publicity of research results and technological advancement has been adduced as being responsible for the low rate of adoption and/or commercialization of research results and technological breakthroughs (Ojanuga 1989). Most research is carried out in universities and research institutes, and the results are published in scientific journals and learned papers which are limited in copies and addressed to non-user audiences. The extension system to disseminate the information is poorly coordinated and ineffective in translating the vital research findings to user farmers and large-scale investors.

4.2 Mode of research presentation

Closely related to the first problem is the mode of research result presentation. Research results and technological breakthroughs, especially in Nigerian agriculture, are highly theoretical and technically quoted with imported components. The mode of research implementation and result presentation are Western-oriented with most assumptions alien to the Nigerian environment. The assumptions of

single-output production function rather than multiproduct production function for instance, makes any application of results incompatible with reality. Consequently, most research results lack practical imagination and are only realizable within an "exotic" socio-economic and cultural environment.

4.3 Inadequate technology for implementation

Most agricultural research is carried out with modern and highly advanced technologies which also require the same mode of practicalization and/or commercialization - a transfer of technology syndrome. What is forgotten is that technology is never transferred, but the skills are. If the right skills are transferred from the owner to the learner then the latter will develop a technology when highly motivated. Improved varieties which requires tractors, combines, herbicides, insecticides, and fertilizers are useful research, but require inputs outside the immediate domain of the farmers.

4.4 Financial constraints

For easy access to credit and to facilitate commercialization of research findings, the government has established the Nigerian Agricultural and Cooperative Bank (NACB), the Nigerian Bank for Commerce and Industry (NBCI), the Nigerian Industrial Development Bank (NIDB) etc. These banks have the general notion that research conducted in the universities and research institutes is not practically oriented and only for academic promotion. The small farmers who are the intended beneficiaries of these good government moves find it extremely difficult to benefit from these financial establishments. Also there is a general prejudice that internal rates of returns on agricultural ventures are low.

4.5 Commercial feasibility of research results

The feasibility reports based on research results are themselves inaccurate, a consequence of the paucity of data and fanciful paper presentation to satisfy the clientele but lack of applicability in real life.

4.6 Risk factors and cultural barriers

Most Nigerian investors are averse to risks and agricultural enterprises are very risky due to the uncertainty of weather and climatic conditions including the availability of inputs needed. Also there are cultural barriers to adoption. Examples are the rejection of the IITA-developed yellow maize by the farmers in the Western states and the rejection of short-stand high-yielding sorghum by the Northern farmers (long stands are low yielding but serve other functions such as mending fences and roofing houses).

4.7 Inadequate and unreliable infrastructure

Inadequate and unreliable infrastructure such as public water supply and electricity have often necessitated additional huge investment as in the provision of boreholes and generators. These additional investments have created disincentive to the commercialization of research findings.

4.8 Access to resources

In agricultural R & D, land, farming equipment, supply of basic inputs such as fertilizers, seeds, herbicides, pesticides etc. constitute major constraints. Most times, farmers do not have access to these improved inputs and at other times these resources are inadequate in supply.

5 Case studies of hybrid maize, minisett yam technique, and yam pounder

In this section 3 technologies are examined and the problems associated with their commercialization outlined, namely:

5.1 Hybrid maize

Hybrid maize can greatly increase maize production and farmers income in Nigeria.

The characteristics of hybrid maize technology are:

- Hybrid maize seed is expensive and not readily available.
- Seed produced by a farmer who grows hybrid maize is not hybrid maize seed.
- Each farmer must purchase new hybrid seed every year.
- Hybrid maize requires careful and skillful management by farmers to ensure that farmers are adequately rewarded.
- Hybrid maize requires herbicides, seed treatment (furandam), and fertilizer (8 bags/ha of NPK, and 2½-3 bags/ha urea or 5 bags/ha CAN).
- Water availability is compulsory during one week around flowering.
- Time of planting is specific.

If these characteristics are adhered to, the farmer will obtain 5-6 t/ha of maize as compared to 1-2 t/ha from his traditional varieties. These characteristics also represent the hindrance to the commercialization of this research breakthrough. The input seeds, herbicides, and fertilizers are not accessible to the farmers. With respect to fertilizers OLUKOSI (1989) observed that the most readily adopted

technology in Nigeria today is the use of chemical fertilizers in some parts of the country particularly in the North.

According to KIM (1989b), the most important problem which farmers face in growing hybrid maize is lack of fertilizer. In addition, the scarcity and high cost of herbicides are problems faced by medium- and large-scale farmers (KIM 1989a, HAHN 1990). The non-commercialization of hybrid maize is due to 'import content' of the technology, which is not easily accessible to clientele farmers.

5.2 Minisett yam technique

The minisett yam technique was evolved to ameliorate the search for seed yam needed for planting. The technology, which was developed by National Root Crops Research Institute (NRCRI) and improved by IITA, produces about 80,000 tubers/ha of seed yam and over 30 t/ha of water yam. Despite this increase in yield, the technology has not been widely commercialized and/or mass-adopted. According to HAHN (1990) farmers could not adopt the technology due to lack of access to the plastic mulch which is imported at a cost of \$ 300/ha or about N 6,000/ha. However, efforts by a Lagos-based company to locally provide the plastic bags at a cost between N 1,000 - 3,000/ha may quicken the pace of commercialization.

5.3 Yam pounder

Yam pounder as described earlier is a technological breakthrough developed at Obafemi Awolowo University to help reduce the drudgery associated with turning yam into pounded yam. However, this equipment was not commercialized by a Nigerian industry but a Japanese firm. Since the equipment is imported it is beyond the reach of those who could have benefitted from this technological breakthrough.

6 Conclusions

It is clear that commercialization of research findings and technological breakthroughs in Nigeria has not been easy because the funder of research findings - the government - is not the end user of the results. With the funding group different from the user group, it is difficult to translate research findings to practical reality. According to KIM, to achieve self sufficiency in food in general, government officers in administration, extension, and research must think positively and develop a sound philosophy for their contribution. The government must continue to improve the infrastructural facilities such as good roads, steady public water supply, and electricity to reduce investment cost on the part of entrepreneurs.

P.O. ERHABOR, E.M. OMOREGIE und F. S. IDACHABA: Die Situation der Agrarforschung und die ökonomische Nutzung ihrer Ergebnisse in Nigeria

Nigeria besitzt ein ausgedehntes landwirtschaftliches Forschungssystem mit einer großen Anzahl von Forschungsergebnissen und technischen Neuerungen. Diese werden jedoch nur ungenügend im privaten Landwirtschaftssektor angewendet. Ursachen dafür sind ungenügende Publikation, schlechte Präsentation, Mangel an Verfahren zur breiten Praxiseinführung, finanzielle Hindernisse, Risikofaktoren und kulturelle Barrieren.

Am Beispiel von Hybridmais, Minisett Yams und Yam pounder werden die ungenügende Nutzung dieser Verfahren untersucht und die Ergebnisse vorgestellt.

Verbesserung der Infrastruktur, vertiefte Zusammenarbeit zwischen Forschung und Beratung und Teilnahme der potentiellen Nutzer (Bauern) an der Festlegung von Forschungsaufgaben werden vorgeschlagen.

P.O. ERHABOR, E.M. OMOREGIE ET F. S. IDACHABA: La situation de la recherche agraire et l'utilisation économique de ses résultats au Nigéria

Le Nigéria possède un vaste système de recherche agricole avec un grand nombre de résultats de recherches et des innovations technologiques. Ceux-ci ne sont malheureusement utilisés que d'une façon insuffisante dans le secteur agricole privé. Les causes en sont la publication insuffisante, la mauvaise présentation, le manque de méthodes permettant une large mise en pratique, des entraves financières, des facteurs de risque et des barrières culturelles. A l'exemple du maïs hybride, de minisett yams et de yam pounder, on étudie la faible utilisation de ces procédés, et l'on présente les résultats. Sont proposées l'amélioration de l'infrastructure, une coopération plus étroite entre recherche et consultation et la participation des utilisateurs (paysans) potentiels à la fixation de tâches de recherches.

P.O. ERHABOR, E.M. OMOREGIE ET F. S. IDACHABA: La situación de la investigación agrícola y la repercusión económica de sus resultados en Nigeria

Nigeria dispone de un amplio sistema de investigación agrícola con una gran cantidad de resultados científicos y de innovaciones tecnológicas. Estos resultados son utilizados en forma deficiente en el sector agrícola privado. Causas de esto son: divulgación insuficiente, mala presentación, falta de métodos para una amplia introducción en la práctica, problemas de financiamiento, riesgos diversos y barreras culturales.

Tomando como ejemplo un híbrido de maíz, la yuca Minisett y la yuca pounder, se investiga la utilización insuficiente de éstos procedimientos y se presentan los resultados.

Como resultado de la investigación, se propone mejorar la infraestructura, profundizar la colaboración entre la investigación y la asesoría técnica y dejar participar a los campesinos en la elaboración de programas de investigación.

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