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Resource Allocation to Agricultural Research

Proceedings of a workshop held in Singapore, 8–10 June 1981

Editors: Douglas Daniels and Barry Nestel

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The untimely death of Dr J.D. Drilon, who was to attend the workshop as a representative of IFARD, is a great loss to all concerned with improving the welfare of the rural poor. This publication is dedicated to his memory.
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The System of Resource Allocation to Agricultural Research in Kenya

S. N. Muturi

Kenya has had an organized tradition of agricultural research since the turn of the century. Research services have advanced as the situation has demanded. In Kenya, research serves the development of the country rather than its own right. Most research activities have therefore been in the applied sciences.

The first agricultural research institution, the Scott (now National) Agricultural Laboratories was established in 1903. This was followed by the Coffee Research Services (1908), the Veterinary Research Laboratories (1908), and the National Plant Breeding Station at Njoro (1927). The extensive development of agricultural research services, however, occurred in the forties and early fifties when 16 more major research stations were established under the control of the Department of Agriculture.

The same period saw the creation of five main regional research establishments under the aegis of the East African Community. The research establishments were concerned with agriculture, veterinary science, fisheries, and forestry. The main objective of these research establishments was to concentrate on regional problems and strategic science common to the three East African countries (Kenya, Uganda, Tanzania). The national research establishments were to concentrate on local problems and tactical science.

Other research establishments related to agriculture and land use were established in the early sixties. These included research in wildlife management and conservation, and meteorology. The social sciences have also appeared on the scene, the major development being the establishment of the Institute of Development Studies in 1965.

Various agricultural education institutions were also established to provide scientific human resources for the management of agriculture, which was becoming increasingly complex. Thus, the Egerton Agricultural College was upgraded to a full technician training level in 1952. Local training of laboratory technicians came later with the establishment of the Kenya Polytechnic (1961) and Mombasa Polytechnic (1974). The present University of Nairobi (1970) grew from the original Technical and Commercial Institute (1947), which became the Royal College of Nairobi (1961), having been for a time the Royal Technical College of East Africa (1951). The University of Nairobi has fully fledged Faculties of Science, Agriculture, and Veterinary Medicine through which the majority of the existing research workers have been trained.

**Management of Agriculture Research**

Government thinking on the need for formal machinery for making and implementing policy for science, technology, and research in all sectors of the economy started immediately after Kenya became independent in 1963. It was noted that there was no centralized responsibility for the formulation of scientific policy. Responsibilities for research policy and management lay with individual departments of Government ministries and there was little coordination between the various agencies. There was, for example, no linkage between veterinary research in the Department of Veterinary Services and animal production research in the Department of Agriculture although the two departments were in the Ministry of Agriculture. The same situation prevailed in research establishments in other sectors.

In 1970, stock was taken of the financial and manpower resources allocated to science and technology (Table 1). The scientific and technical activities were estimated to involve about K£24 million of which K£5 million was allocated to research and development (R&D) and K£19 million to other

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Table 1. Financial resources (millions of K£) and manpower resources allocated to science and technology in Kenya, 1970 (from Development Plan 1974-78, Government Printer, Nairobi).

<table>
<thead>
<tr>
<th>Science group</th>
<th>Expenditure</th>
<th>R&amp;D</th>
<th>STS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>5.14</td>
<td>19.71</td>
<td>569</td>
</tr>
<tr>
<td>Medical</td>
<td>3.57</td>
<td>10.33</td>
<td>371</td>
</tr>
<tr>
<td>Natural</td>
<td>0.56</td>
<td>6.03</td>
<td>557</td>
</tr>
<tr>
<td>Industrial</td>
<td>0.53</td>
<td>2.01</td>
<td>68</td>
</tr>
<tr>
<td>Social</td>
<td>0.40</td>
<td>0.92</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>5.14</td>
<td>19.71</td>
<td>569</td>
</tr>
</tbody>
</table>

*R&D = research and development; STS = scientific and technical services; Sci. = scientists; and Tech. = technicians.

The estimated total gross expenditure on R&D was equivalent to 0.91% GDP. The Government funded 75% of R&D and 81% of STS, representing 2.30% and 11.17% of the national budget, respectively. The remainder was funded by higher education and the private sector. Fundamental research was largely undertaken in the University of Nairobi, representing approximately 1.7% of the total research expenditure.

With this magnitude of resources devoted to R&D and STS, the Government felt the need to establish a system for policy formulation and execution of scientific and technological activities. It was not, however, until 1977 that through an Act of Parliament, the Government established the machinery for advising itself on all matters relating to scientific and technological activities, the research necessary for the proper development of the country, and for the coordination of research and experimental development. This machinery comprises: (1) the National Council for Science and Technology (NCST); (2) the Sectoral Scientific Advisory Research Committees (ARCs); and (3) the Statutory Research Institutes (SRIs).

This machinery establishes a series of circuits that connect the requirements of socioeconomic development with the utilization of science and technology for development. The machinery links the executive level with the management and policymaking level and the execution and operations level. They provide lines through which ideas and policy flow. The three functional levels that have been established are: (1) policy and strategy; (2) management and tactics; and (3) execution and operations.

The first functional level (policy and strategy) comes under the review of the National Council for Science and Technology, which is legally required, among other things: (1) to advise the Government on a national science policy, including general planning and the assessment of the requisite financial resources; (2) to advise the Government on the overall financial requirement for the implementation of the national science policy and on the disbursements to the agencies concerned; and (3) to review generally and advise on the program and budgets for the promotion of research and related scientific activities proposed by ministries and ensure that they are in harmony with the national science policy.

This science policy circuit (NCST) brings eminent scientists (appointed members) and the policymaking officers of the Government (Permanent Secretaries) together in a socioeconomic forum to debate the use of science and technology for development. The scientists provide the technical inputs and ideas of promising developments. The policymakers know the political and socioeconomic constraints at the highest level. The NCST is so constituted that a consensus among its members as to a course of action has real authority and places an onus of implementation on those concerned, especially its members (Permanent Secretaries). Where, however, NCST considers that the matter requires Cabinet approval, it places before it the necessary recommendations for approval. This applies to such matters as the national budget for science and technology, legislative requirements, and subjects with significant political constraints. The NCST is largely self-advisory on this matter because its ex-officio members know when Cabinet or ministerial endorsement is required or desirable.

In advising on the allocation of resources, the NCST has responsibility for ensuring that all science groups are catered for in both R&D and STS. Government allocations to various science groups in the 1979–80 fiscal year are indicated in Table 2.

The Government’s expenditure of 70% of the budget on agricultural sciences is in keeping with the role the sector contributes to the GDP (about 35%) and the infrastructure that agricultural research has built over the years. It is the Government’s stated policy that the gross national expenditure on research and experimental development (GNERD)
should attain a level of 1% GDP. The GDP in 1978–79 was K£1600 million, which suggests that the GNERD for that year should have been K£16 million. The country is therefore far from achieving the target of 1% GDP expenditure on R&D even if stock were taken of R&D funds allocated by parastatal organizations and the private sector.

The second functional level, management and tactics, involves promotion, sponsorship, and coordination of research. This is the responsibility of the advisory research committees (ARCs) catering for the various science groups (agricultural, medical, industrial, and natural sciences). Some of the functions of the ARCs are: (1) to advise on the details of research programs and projects required to implement the research priorities arising from the national science policy; (2) the concomitant budget requirements so arising; (3) to advise on a quinquennial (or other suitable period related to the Development Plan) program for research and the estimates of the concomitant budget; and (4) to review, annually, the progress in research and to prepare for each Ministry its detailed program and expenditure for the following year.

The ARCs constitute the R&D circuit through which the technical ministries and executive level institutes are linked. The ARCs serve as forums for the establishment of research programs. ARCs are composed mainly of research scientists at the executive level, because the primary interest of the policymaking officers is taken care of at the science policymaking level (NCST). Their membership is so spread by discipline as to assure that the research programs have a full complement of research projects to solve the problems giving rise to the demands for research. They are also concerned with the quality and efficiency of the scientific research that comes under their review.

Table 2. Government expenditure (K£'000) in research and development (R&D) and scientific and technical services (STS) during the 1979–80 fiscal year.

<table>
<thead>
<tr>
<th>Type of science</th>
<th>R&amp;D Amount</th>
<th>% of total</th>
<th>STS Amount</th>
<th>% of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>7611</td>
<td>70.2</td>
<td>41074</td>
<td>43.5</td>
</tr>
<tr>
<td>Natural</td>
<td>1240</td>
<td>11.4</td>
<td>4503</td>
<td>4.8</td>
</tr>
<tr>
<td>Medical</td>
<td>1234</td>
<td>11.4</td>
<td>22812</td>
<td>24.2</td>
</tr>
<tr>
<td>Industrial</td>
<td>557</td>
<td>5.1</td>
<td>18263</td>
<td>19.4</td>
</tr>
<tr>
<td>Social</td>
<td>—</td>
<td>—</td>
<td>3312</td>
<td>3.5</td>
</tr>
<tr>
<td>Physical</td>
<td>—</td>
<td>—</td>
<td>548</td>
<td>0.6</td>
</tr>
<tr>
<td>Other</td>
<td>201</td>
<td>1.9</td>
<td>3870</td>
<td>4.1</td>
</tr>
<tr>
<td>Total</td>
<td>10844</td>
<td>100</td>
<td>94382</td>
<td>100</td>
</tr>
</tbody>
</table>

In the agricultural sector this responsibility lies with the Agricultural Sciences Advisory Research Committee (ASARC). The ARC is concerned with research activities related to agriculture, livestock development, forestry, wildlife, and water development. ASARC is required to work closely with the boards of management of the various research institutes, the management committees of the technical services of the Government, as well as the associations and unions of the private sector.

The third functional level, execution and operations, involves the carrying out of actual projects for scientific research, technical services, innovations, and education and training on institutional basis. These are the institutions that receive resources for R&D and are responsible for the implementation of the program of action and technical services.

This circuit is largely internal to the research establishments themselves. Representatives of NCST and ARCs are, by legislation, entitled to participate in the boards of management of the R&D institutions. In this way, the institutions are linked to both ASARC and NCST.

Criteria for Resource Allocation to Agricultural Research

Provisions of the Development Plan

In Kenya, the socioeconomic development policy is spelled out in 5-year development plans that have been in existence since independence. In these plans, the goals to be met are established. The activities of the public and private sectors are subsequently geared to meet the stated objectives.

Simultaneously, the National Council for Science and Technology analyzes the scientific and technological components of the development plan programs of action and publishes the National Science Policy for the plan period, out of which an assessment of the financial demand for research is undertaken. The financial requirements for R&D in the Government sector during the Fourth Development Plan (1979–83) for all sectors of the economy are shown in Table 3.

The theme of the Fourth Development Plan (1979–83) is "alleviation of poverty" through the provision of "basic needs" (food and nutrition, health, water, housing, and education). Because most social and economic problems such as poverty, malnutrition, disease, unemployment, and illiteracy are found in the rural areas, where about 85% of the population lives, the alleviation of these problems is
foreseen to lie in the development of agriculture in order to lead to greater productive employment and income growth. Thus, the greater share of the R&D budget is devoted to agricultural research. The planned expenditure is shown in Table 4.

### Commodity Research Institutions

Research in export commodities is mainly financed by commodity marketing boards with only token contribution by the Government. Thus, research in coffee is financed by the Coffee Board of Kenya and in tea by the Tea Board of Kenya. The Ministry of Agriculture has, however, considerable influence on the research policy regarding commodity research, mainly through participation in the boards and research management committees.

Commodity research institutions have a relatively higher level of expenditure per scientist. They are also better placed to attract and retain high calibre research scientists than similar institutions in the Government sector. They are also in a position to call upon the assistance of expertise from Government research institutions when such expertise is not available in their institutions.

The other type of commodity research institutions are those that deal with industrial crops that constitute the basis of local agro-based industries. Research in these commodities is financed jointly by Government and industry. For example, research in pyrethrum, sugarcane, and irrigation receive support from the Pyrethrum Board of Kenya, the Kenya Sugar Authority, and the National Irrigation Board, respectively. Similarly, the National Cereals and Produce Board provides grants to maize and wheat research.

### Disbursements to Research Establishments

Government supported research stations prepare, annually, a 3-year forward budget and estimates of recurrent and development expenditure for the year in question. The submissions are aggregated at the ministry level for discussion with the Treasury. Simultaneously, requirements for additional personnel take place with the Directorate of Personnel Management in the Office of the President. Both the approved estimates of expenditure and personnel establishment are published in the Estimates of Recurrent and Development Expenditure in an aggregated form. Thereafter the responsibility for disbursement of resources (usually lower than what was bid for) lies with Directors of Research in various Ministry headquarters. No consultations take place with the directors of research stations regarding the allocation of the resources that have been availed.

Factors that influence the disbursement of resources include the provisions of the development plan and the science policy, initiation of new research programs, traditional practices whereby certain research stations are financed at a certain level irrespective of the research program content, pressure by the farming community and marketing boards, foreign aid donor supported projects, which have priority in the allocation of resources, and the influence of directors of research institutions.

### Table 4. Agriculture research budget (KSh '000) for Government research establishments during the 1979–83 plan period.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Veterinary research</td>
<td>612</td>
<td>576</td>
<td>616</td>
<td>647</td>
<td>726</td>
<td>3177</td>
</tr>
<tr>
<td>Range research</td>
<td>404</td>
<td>396</td>
<td>372</td>
<td>432</td>
<td>417</td>
<td>2021</td>
</tr>
<tr>
<td>Animal production</td>
<td>734</td>
<td>714</td>
<td>833</td>
<td>732</td>
<td>773</td>
<td>3786</td>
</tr>
<tr>
<td>Crops research</td>
<td>2552</td>
<td>3034</td>
<td>3517</td>
<td>3795</td>
<td>4190</td>
<td>17088</td>
</tr>
<tr>
<td>Soils and seeds</td>
<td>297</td>
<td>230</td>
<td>236</td>
<td>285</td>
<td>310</td>
<td>1358</td>
</tr>
<tr>
<td>Economic research</td>
<td>280</td>
<td>660</td>
<td>780</td>
<td>800</td>
<td>700</td>
<td>3220</td>
</tr>
<tr>
<td>Joint services research</td>
<td>1583</td>
<td>1771</td>
<td>1946</td>
<td>2142</td>
<td>2354</td>
<td>9796</td>
</tr>
<tr>
<td>Total</td>
<td>6462</td>
<td>7381</td>
<td>8300</td>
<td>8833</td>
<td>9470</td>
<td>40446</td>
</tr>
</tbody>
</table>
Suggested Areas of Improvement

Decision-Making Process

The decision-making machinery that has been established in Kenya is considered adequate for resource allocation to agricultural research. Although the National Council for Science and Technology and the Agricultural Sciences Advisory Research Committees are both advisory, they are so constituted that their decisions have real authority and onus of implementation. The presence in the NCST of the Permanent Secretaries of the concerned technical ministries (Agriculture, Livestock Development, Natural Resources, and Water Development), the Permanent Secretary for Economic Planning and Development (socioeconomic development strategy), and the Permanent Secretary for the Treasury (the ultimate provider of resources) ensures that the interest of agricultural research is catered for. Similarly, ASARC's role of advising on the program of research and the concomitant budget required to implement the national science policy ensures a balanced allocation of resources among the various research programs.

Therefore, there appears to be no need to modify the existing decision and policymaking machinery. What is lacking at present is a solid data base on which to base research allocation in the future. To rectify this, the NCST and ASARC, with some financial assistance by IDRC, are undertaking a study on resource allocation at the institution, program, and project level. The study is designed to reveal resource allocation in relation to: (1) the agricultural commodity in terms of acreage, volume of production, monetary value, and nutritional value; (2) distribution among the various research agencies; (3) geographical and agroecological coverage; (4) personnel competence in terms of education and experience; (5) complementarity in terms of scientific disciplines; (6) adequacy of supporting staff and facilities; and (7) rationale on which the managers of agricultural research base the allocation of resources to various research programs and institutions.

It is expected that once the above study is completed, a better system of resource allocation will evolve.

Project Approval

Basically there are two sources from which demands for agricultural R&D emanate: (1) the need for development (from the farmer, extension service, or Government), which recognizes the need for research to provide answers to the technical problems inhibiting production; and (2) the research worker who envisions a breakthrough that will bring change to the understanding or technical control of his field and its application.

The first is now largely reflected in the Development Plan that, although not the basic source of detail, indicates the general plan and priorities according to the Government. Thus there are two influences at work in determining priorities. The first, and more traditional, is the upward demand for support of R&D based on the ideas and aspirations of research workers. The second, which is more recent, is the downward diffusion of policy based on the socioeconomic requirements of the country as stated in the Development Plan and the national science policy.

A framework for program approval has now been established. As noted earlier, NCST has the responsibility for the science policy while ASARC is concerned with the details of research programs. At lower levels, a system has been established that enables the translation of the policy framework to concrete projects and experiments. The system comprises:

(1) Provincial Research Advisory Committees comprising senior extension officers and farmer representatives in a particular province and research scientists undertaking research in the geographical area. The Committee is chaired by the Provincial Director of Agriculture. In this forum the extension service states the factors limiting production and research scientists develop research programs to solve the problems.

(2) Specialist Research Advisory Committees that deal with specific disciplines of countrywide concern. Thus, specialist committees exist for commodities such as maize, sugarcane, wheat, and pyrethrum, and specialist disciplines such as soil science, plant pathology, and entomology. Specialist committees comprise research scientists from other institutions and research scientists actually dealing with the particular commodity or discipline.

Project Costing

Project costing is an essential prerequisite for proper management of an agricultural R&D system. Without it, only very broad allocations of resources are possible, evaluation remains a vague activity, and measurements of efficiency and estimations of the cost-benefit of R&D work cannot be undertaken. At present, it is often the practice in Kenya to be satisfied with the simple statement that a research station, for example a commodity-oriented one, is carrying out research on that commodity. Even development plans allocate money to research stations merely identified by location, with no indication as to really what activities are intended. Annual reports, often years behind, produce descriptions of
research and its results, the evaluation of which is often scientific and lacks other criteria. The efficacy and cost, both important factors, are not shown.

Research projects should therefore not be regarded as open-ended. Even where a follow-through or continuous activity over lengthy periods is a natural sequence to the establishment of a program, its various stages should be described in the form of completed or new projects. This is essential if account for the use of the national resources is to be sensibly displayed and a mark of progress is to be provided.

It is therefore suggested that the whole agricultural R&D scene must be accounted for and costed. Thus, any complete unit of R&D must be: (1) identified by a brief statement of its purpose; (2) costed in terms of estimated expenditure on manpower, material, and overheads; and (3) assessed in terms of duration.

Project identification and costing would provide the means by which the director of a research institution could display: (1) the use of his resources in a manner most meaningful to the higher levels of administration and policymaking (external use); (2) the actual activity and efficiency of his staff, which is a useful guide when considering their preferment (internal use); (3) the cost of research in relation to the value of the commodity concerned (economic use); and (4) the magnitude of the problem under research (scientific use).

Basic and Applied Research

There is considerable debate on the merits and demerits of basic research in a developing country such as Kenya. This controversy requires rationalization because it concerns allocation of scarce resources. The primary distinction between basic and applied research is that basic research produces knowledge and applied research produces know-how or technology.

Applied research is dependent, in the long run, on the results of basic research. New technologies, however, often make basic research feasible, after recognition of the need for better techniques or after acquisition of better data on which basic research is dependent. Therefore, both are, in their own right, dependent on the original ideas on what would be either interesting to know (basic) or useful to be able to do or produce (applied). The end product of basic research is manifest in the stimulation of further ideas. The end product of applied research is material production.

In Kenya the national science policy recognizes the need to support and allocate resources to basic research for the following reasons: (1) some applied research projects require basic research inputs to provide new avenues for further advancement; (2) the educational factor because, at postgraduate and higher levels, education becomes self-acquired through research, which could well be basic in nature; (3) the need to maintain and increase scientific excellence in the scientific establishments in the country; (4) the need to obviate the masquerading of basic research as applied research when bidding for resources; and (5) the factor of employment, particularly in respect of highly specialized scientists whose loss (by degrading their work or by their emigration) would, in the long run, amount to brain drain.

The initiative for basic research should, in the main, lie with individual scientists and research establishments. There is need to establish criteria against which resources would be allocated to basic research. The suggested criteria should include: (1) the scientific merit and efficiency of the institution and research scientists proposing the project; (2) the relevance of the project in scientific, economic, social, environmental, and political terms; (3) the priority of the project in terms of the national socioeconomic policy; (4) the predictability of results; (5) duration of the project; and (6) the cost of the project.

To the above criteria should, ultimately, be added considerations of the ratio of the total cost of R&D of all projects relevant to a given commodity in relation to its value. The criteria should be weighted according to the nature of the research project. Because applied research is heavy in socioeconomic terms, basic research should be heavy on personnel merit and scientific relevance.

It is suggested that resources availed to basic research in agriculture should be in the order of 5% of the Gross National Expenditure on Research and Experimental Development devoted to agriculture.