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NEEDS AND OPPORTUNITIES FOR STRENGTHENING NATIONAL RESEARCH
SYSTEMS AS SEEN BY FAO

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NEEDS AND OPPORTUNITIES FOR STRENGTHENING NATIONAL RESEARCH SYSTEMS AS SEEN BY FAO

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1. Introduction

This meeting marks a significant change of emphasis from previous discussions on agricultural research by the Bellagio Group, where the focus was on how international research could accelerate progress in the developing countries.

The present theme reflects a growing awareness that, despite the success of the International Centres in developing new varieties and improved technology, their results will not be widely adopted unless there is a sound national research and extension base. Indeed, we may have been late in appreciating this because the initial success of IRRI and CIMMYT was so dramatic. Flying down the Indo-Gangetic plain one sees the Himalayan peaks but clouds and distance obscure the foothills, and in aspiring to the potential new horizons opened by the work of the International Centres we have perhaps failed to foresee the hard ground to be crossed before the peaks could be reached.

A main reason for the relatively slow progress in moving up from the lower range of the productivity curve has undoubtedly been the weakness of many national research systems; which, for numerous reasons, have proved unable to apply principles or adapt technology developed elsewhere to the specific needs of their local environment, or to develop their own indigenous research.

Although FAO has been attempting for many years within its limited resources, to help countries build up their national research capabilities it is only relatively recently that we, the International aid community as a whole, and most of the developing nations themselves, have discovered the very real constraint which this weakness has placed on the development of their agriculture. The potential revealed by the International Centres has undoubtedly had something to do with this; but if it is to be fully realized, and the Centres eventually phased out, the effort now being channeled to their support by the Consultative Group must be balanced by a parallel and equally well planned effort to strengthen national systems. This was emphasized by the 1972 FAO Regional Conferences, at the 1973 general conference, and will be a major theme of the 1975 Conference and possibly the World Food Conference. We see this Bellagio meeting as a further constructive step towards this important objective.

2. The Need to Strengthen National Systems

The hard facts of the weakness of most national systems are driven home by Evenson's recent paper to the Consultative Group ⁽¹⁾ and by some further data prepared by FAO for TAC (Annex 1). These reveal that:

- i. research is chronically under-financed, investment in developing countries still representing only 15 percent of overall expenditure on agricultural research in 1970, despite a four-fold increase over the last twenty years. ^{1/}
- ii. there is an acute shortage of trained scientists, with only half as many researchers per dollar of product as in developed countries, and these generally trained to a lower standard. There are particular weaknesses in basic research due to the heavy commitments of universities to teaching, and their generally poor liaison with national government stations.
- iii. research planning and administration is correspondingly weak with tremendous fragmentation of institutions and responsibilities between various Ministries, departments and semi-autonomous agencies. Sixty percent of research institutes in Africa, 50 percent in Asia and Latin America, and over 40 percent in the Near East have less than 10 workers; over all developing countries 70 percent have less than 10 workers. This results in dissipation of resources, an absence of inter-disciplinary effort, and accentuates the manpower constraint.
- iv. research is poorly aligned to national needs and priorities, due largely to poor communication and understanding between planners and research directors, and inadequate machinery for review and appraisal of the validity of research programmes to changing national goals or wider objectives.
- v. most scientists are starved of funds for travel or publications, and are therefore poorly informed as to the state of knowledge and availability of materials emanating from international or other institutes outside their own countries.
- vi. conditions of service (lack of equipment, mobility, and inadequate intermediate level field and laboratory staff), often inhibit sound research while salaries and career prospects fail to provide adequate initiative to keen young scientists.
- vii. liaison between government research institutions and extension and other services essential to successful implementation of their results is poor, and results are often transmitted to farmers in a way which is of little meaning because of failure to integrate biological and socio-economic information.

While this analysis shows that we should be under no illusions as to the difficulties which have to be faced in strengthening the research capabilities of developing countries, the data I have quoted also suggest that there is a very real potential for increasing efficiency and reducing costs per unit of research output by improvements in organization and sharpening of priorities. This should be an important and immediate objective of international assistance, but the quantitative and qualitative weaknesses of

^{1/} Evenson's analysis covers only crops and livestock. Had it included forestry, fisheries and the social sciences the picture would almost certainly have been bleaker.

many national research establishments are such that it is unlikely to be enough. If national social and economic goals are to be secured a substantial increase in research manpower and better equipment and supporting services is also likely to be needed over the next twenty years, implying correspondingly higher expenditures both on research itself, and on education and training.

Table 1.

R and D in Agriculture in DD2 (Developing Countries)

	1970	1975	1980	DD2 (Total)
Total GDP (\$ b.)	295	375	525	3,925
Agriculture (as % GDP)	33	30	26	29
Agricultural GDP (\$ b.)	97	112	136	1,142
R and D (as % agric. GDP)	0.2	0.3	0.5	0.34
R and D (\$ million)	200	340	680	3,900
Public budget for agric. (as % of GDP)	1.1	1.2	1.3	1.2
R and D (as % of public budget for agriculture)	6	7	10	8

Table 1 shows some very tentative estimates constructed by FAO for the UN World Plan of Action on the Application of Science and Technology to Development, ⁽²⁾ based on the DD2 macro-model, and Table 2 sets out our assumptions on how these might be broken down in terms of financial support.

Table 2.

Sources of Funds for R and D in Agriculture in DD2

	\$ million			\$ billion DD2	Growth rate p. a. in DD2
	1970	1975	1980		
Developing countries	140	200	300	2,100	8
Advanced countries	40	80	200	1,000	17
International ^{1/}	20	60	180	800	20
Total	200	340	680	3,900	13

^{1/} An increasing proportion for International Centres and related programmes.

These proposals would represent more than doubling the estimated flow of funds for R and D in agriculture in DD2 compared with DD1, with an increasing proportion coming from bilateral and international assistance. It is interesting to note that while our estimates for 1970 are rather close to Evenson's, they diverge substantially from what seems likely to be the evolution thereafter; since both Evenson and Evans ⁽³⁾ conclude that direct support from external agencies to national research is likely to fall rather than to increase over the decade. This is disturbing not only because of the very real need, but because it appears to confirm fears expressed by developing countries that support to international research via the Consultative Group will be to the detriment of help to their own programmes.

Even if these fears are not well grounded the mere fact that this Bellagio meeting is being held suggests a felt need for some serious re-examination of the current directions of aid to research to see how more can be done to strengthen national efforts if possible without detracting from that being channeled to international centres or programmes. However, a need is not necessarily a priority, and it may be that some donors have had reservations that support to national research may not be the best use of scarce resources. FAO believes that this should have a high priority rating in agricultural development for the following reasons:

i. There are strong indications that investment in agricultural research, if well planned and conducted, has a very high pay-off. Nor is the return necessarily slow compared to many alternative investments, such as major irrigation projects. However, most of the evidence of high returns comes from developed countries, and that from developing countries is very limited, although significantly to countries with a good research base such as India and Mexico. Clearly bad research can be a gross waste of resources, and this underlines the importance of raising the general standards, as well as the need for deeper insight into the factors determining successful returns to research investment in the developing countries.

ii. Successful transfer of technology is difficult for social as well as ecological reasons, (the Evenson-Kislov study ⁽⁴⁾ highlights this by comparison between wheat and maize), and the chances of success are greatly diminished where a country's indigenous research capacity is weak. A product of the weakness of many national systems seems to be an increasing tendency to look to the International Centres for help, which may overload them to the detriment of their core research programmes. Strengthening national research capabilities is therefore complementary to support to international research activities in more ways than one.

iii. There are numerous commodities and problems important to developing countries which are not covered by international or developed country research programmes; and, given resource constraints, never likely to be. Countries must be prepared to tackle these themselves, and the fact that they are not of global significance does not make them less challenging or their solution easy or cheap.

iv. National researchers must be able to respond to the needs of national planners for guidance on reaching decisions and making choices between alternatives, particularly on new and critical strategic issues such as the energy crisis, environmental management, and employment, where a multi-disciplinary systems approach is needed and existing concepts are being challenged. The answers may vary according to national goals and resource endowments, so that research must be undertaken at the country level, but few developing countries yet have the flexibility and skills to attempt it.

v. Research is essential to successful extension work, both to guide farmers on decisions relevant to improvements in existing production systems (choice of varieties, fertilizers, etc.), and to develop new systems and work out their biological and socio-economic implications.

3. Approaches to Strengthening National Research Systems

No two countries are alike in their problems, goals, and political and institutional structures and there is no stock solution to developing national research systems and related programmes. Clearly much must therefore depend on the countries themselves, but FAO believes that outside assistance can still do much to help build their national research capabilities, and I should like to explore with you some possible approaches. These include assistance in priority setting, the strengthening of information systems, the improvement of research organization and management training, the establishment of collaborative research networks, and the use of projects for testing research results.

i) Determination of priorities and choice between alternatives for research

This is a matter on which both aid donors and the countries themselves need to develop better criteria, and FAO in its 1972 issue of SOFA ⁽⁵⁾ indicated some possible guidances, e. g., relative importance of agriculture in the national economy; contribution to food supply; impact on foreign exchange earnings or savings; identity of beneficiaries (especially in relation to income distribution); the time horizon; the resources available, especially in terms of trained manpower; probability of successful outcome from research; probability of effective implementation of research results etc. Evans has suggested that the merits of a particular research proposal should be studied in the light of other claims on available resources including alternative research projects, and that particular weight ought to be given by donors to research proposals aimed at building up scientific and innovative skills at the national level. He argues that priority should also be given by donors to projects which can be linked to programmes of International Centres or centres of excellence or to some regional or international research network rather than outside it.

Clearly there may be differences of opinion between donor agencies and individual countries as to priorities, and any attempt to dictate priorities is likely to be resented by developing countries as another form of neo-colonialism.

There could nevertheless, be real value in trying to obtain an "overview" of national needs and priorities as well as of those of donors. FAO through its Conferences, country perspective studies, seminars, and expert panels, ^{1/} UNDP through its country programming exercises, and IBRD through its economic and agricultural sector reviews

^{1/} FAO has perspective studies in Egypt, Iran, Iraq, Morocco, Nepal, Pakistan and Sudan. It has research seminars completed for the Guinean and Soudanian zones of Africa, and planned for Latin America and the Near East in 1974/75. It has some 30 experts panels including representatives of both developing and developed countries.

all receive inputs which would be valuable for this purpose; the International Centres must have definite views in their fields of activity; bilateral donors also have antennae out to countries as well as being able to indicate their own areas of interest and priorities.

This overview of research priorities would need to be linked to a stock taking of national research capabilities and on-going programmes of the type attempted in the CARIS pilot project. If this could be done an enormous step forward would have been taken in rationalizing aid to research since it would:

- (a) indicate where a country required a major programme or project to build up its research capability before anything much was feasible in the way of developing individual research projects;
- (b) enable donors to identify countries and subjects suited to aid at the research project level, and their probable location and costs;
- (c) help International Centres align their core and outreach work to national needs.
- (d) reveal areas and fields of research where there was sufficient commonality to justify a regional network or even a new International Centre or programme;
- (e) facilitate global projections of the overall costs of strengthening national research systems in developing countries as well as training programmes, with appropriate assumptions of the share which might be borne by the countries themselves and by the international community. The difficulties encountered by FAO in attempting to do this for ACAST highlight the need for this.

I believe that, difficult as it might seem, it would be very worthwhile for this meeting to consider how such a systematic effort might be launched to consolidate, analyze, and utilize all the information at our disposal with these objectives in view.

ii) Improving the information base

Two kinds of information are needed for strengthening national research capabilities; first, current awareness of research establishments and their main programmes, secondly information on the results of past research.

Evenson points out that very little solid data exist on which to base the improved formulation of international policies toward national research and stresses the need for better information systems as a means to doing this. He suggests that this would help to improve complementarities between International Centre Programmes and national programmes, and also to provide a more rational basis for grants to national research projects by International donor agencies and for guidance to World Bank lending policy. However, he notes that it may not be efficient to attempt to achieve these objectives with the same type of information system as would be needed to improve communication between scientists, for which he suggests that a simplified CRIS type of system may be the solution.

In the CARIS pilot project FAO attempted to combine both approaches, using a modified CRIS system for recording and classifying project information, and in a separate section of the directory listing the research establishments. I hope that by now at least some of those present will have studied the two versions of the CARIS directories and that we might get some guidance from this meeting as to the validity of this approach. (6) The information in CARIS on current research taken together with that on past research stored in the AGRIS system, by CAB etc. should provide a comprehensive information system to scientists; but its compilation is more time-consuming than would be a simple record of research establishments and broad programmes of the type which might be sufficient to guide aid policies to national research. To attempt to do the two separately, over different time horizons would, however, be more costly than a simultaneous exercise. Better information seems so fundamental that we would hope that these issues will be given careful consideration at this meeting.

iii) Improving research organization and management

This, like better information, is essential both to the correct identification of research priorities and related projects and to the efficient allocation and use of resources for their implementation. It is probably the field in which most rapid short-term progress could be made. An essential first step is the establishment of internal machinery linking national planners, ministries responsible for agricultural development, research directors, universities, and the private sector, probably through the medium of a National Agricultural Research Council, with links to national science councils where these exist. Such a body can also provide a focal point, through its Secretariat, with external assistance agencies, and for coordination of their activities in relation to agricultural research and training with national programmes and with each other.

Many countries still lack such machinery, and an aim of technical assistance should be to foster its creation, together with provision for feed-in/feed-back systems between planners and researchers, and for periodic review of the direction and impact on development of on-going national research programmes.

A further step towards concentration of effort and reduction of fragmentation which has already been taken by several developing countries, ^{1/} is the creation of a central National Agricultural Research Institute grouping all main physical, biological and social science within an umbrella organization which has sufficient strength and flexibility to enable research to be undertaken either within disciplines or on a multi-disciplinary task force basis for specific commodities and problems. Their governance varies, but there is a tendency to give them semi-autonomous status under a representative governing body rather than placing them directly within Ministerial hierarchy so as to reduce red tape and give their Directors greater freedom to allocate resources flexibly once programmes are

^{1/} Ethiopia, Egypt, India and Malaysia. Other countries which in recent years have attempted to improve their national research organizations include Algeria, Afghanistan, Burma, Brazil, Cuba, Cyprus, Colombia, Indonesia, Iran, Jordan, Libya, Liberia, Indonesia, Kuwait, Mexico, Nigeria, Pakistan, Philippines, Syria, Tanzania, and Thailand.

approved by the Board. In other words something after the International Centre pattern.

A crucial task of any national research institute is to develop decentralized programmes which cater adequately for the main ecological variants and other localized problems. Here the essential objective must be to combine the minimum investment in fixed capital with the maximum liquidity in the deployment of scarce resources. In many countries a sharp axe could be wielded on the number of research stations, and their staff regrouped into strong teams based on a few well equipped centres; using mobility and co-operating with extension service centres, cooperatives and private farmers to spread the load and achieve multiplier effects in applied research. FAO's experience in Libya and Ethiopia ⁽⁷⁾ suggests that this sort of approach not only helps to overcome location-specificity without excessive fixed commitments, but also greatly enhances the impact of the research, since it is done under the noses of the farmers and in close cooperation with local government services.

FAO has assisted some 35 countries over the last 12 years, either through advice on organization and management of research, or in some cases in establishing and co-operating in the operations of national research institutions (Annex 2). It will continue to do so both through its regular and field programmes to the extent resources permit. These, however, are inadequate to the magnitudes of the task, and there is a number of ways in which a concerted international effort might advance progress. These might include:

- (a) Research undertaken in advanced countries to develop more scientific approaches to the determination of priorities and the allocation of resources to research projects. Various mathematical and other systems are already under study or in use experimentally in those countries, and the evolution of a methodology applicable to developing countries would be an objective worth sponsoring, perhaps under contract. FAO has a monograph on this subject by Professor Arnon awaiting publication, but much more could be done to refine and simplify techniques currently in use.
- (b) Characterization of model research systems likely to prove appropriate to a range of defined situations and constraints in developing countries, based on a comparative analysis of existing arrangements in a range of countries, evaluation of technical assistance to research, and study of developed country institutions.
- (c) Provision of an advisory service, possibly supported by the Consultative Group or its co-sponsors, and able to call on a wide range of expertise, to countries seeking advice in research policy formulation, organization, and management. The service could provide consultants or if requested operational staff on contract. It might be coordinated by the FAO Research Centre in cooperation with the FAO/IBRD Cooperative Programme.
- (d) Training in research management through seminars, short courses at International and other selected 'Centres of excellence', scholarships to appropriate overseas universities, or possibly the establishment of a regional University course linked to applied work at a strong research centre e.g. the IRRI - Los Banos arrangement. This important aspect of research is badly provided for at present.

iv) Training

This, of course, is only one aspect of what is in many countries the main immediate need in building their research capabilities: the availability of more - and better-trained scientists and intermediate level supporting staff. This is explicitly recognized in the Consultative Groups objectives and the mandates of the International Centres.

In its contribution to the UN World Plan of Action FAO drew attention to the fact that there were 265 cases where a country had over a hundred thousand hectares under a major foodcrops, and in 63 of these the area exceeded a million hectares (Table 3).

Table 3.

Numbers of Countries per Region Exceeding 100, 000 ha
of the Major Food Crops ^{1/}

	Africa South of Sahara	North Africa	Near East ^{2/}	Asia and Far East	Central and S. America	Total
Wheat and barley	2 (1)	4 (3)	8 (5)	5 (3)	10 (1)	29 (13)
Maize	20 (2)	1 -	3 -	8 (3)	17 (4)	49 (9)
Millet and sorghum	23 (9)	1 -	3 -	7 (2)	6 (1)	40 (12)
Rice	8 -	-	4 -	16 (10)	7 (1)	35 (11)
Sub-total cereals	53 (12)	6 (3)	18 (5)	36 (18)	40 (7)	153 (45)
Roots, tubers, plantains	14 (2)	-	1 -	8 (2)	7 (1)	30 (5)
Food legumes	15 (2)	2	6 (1)	7 (2)	9 (2)	39 (7)
Vegetables	N. A.	2	7 -	6 (2)	7 -	22 (2)
Fruit	N. A.	2	5 -	9 (3)	5 (1)	21 (4)
Total	82 (16)	12 (3)	37 (6)	66 (27)	68 (11)	265 (63)

^{1/} Figures in parenthesis show number of countries with more than 1 million ha under the crop.

^{2/} Includes U. A. R., Turkey, and West Asia but not Pakistan (under Asia).

Yet relatively few of the countries concerned had sufficient trained staff to man even one well-equipped station to cover all crops and other sub-sectors of agriculture as well. For macro-economic research we estimate that supply (including those now being trained) will only meet about half the number required: the theoretical gap in socio-economic micro-level researchers is probably much greater. (8) According to projections made for the I. W. P. (9) 115, 000 graduates and 570, 000 technicians would be required by 1980 to staff government extension and supporting services compared to 80, 000 and 400, 000 respectively in 1970; the actual increase would be much larger because the 1970 requirement would not be met.

However, while it is generally accepted that demand for formal training of agricultural research workers in all disciplines is very large, most training arrangements are scheduled ad hoc because hardly any developing countries have master plans defining their needs for trained manpower. Both in terms of their overall requirements and its breakdown by disciplines we are virtually flying blind. Moreover, in addition to formal training there is a great need for re-training up-dating, as IRRI's rice extension and FAO's agricultural planning courses clearly show.

Taken overall there is a massive task to be undertaken and one to which we have almost certainly given insufficient and insufficiently systematic thought. Yet it is of overriding importance, since manpower shortage not only hampers countries in tackling individual problems or projects but also prevents them cooperating effectively with the Centres, or in regional networks.

The Centres have made an outstanding contribution to training, but their overall capacity is limited, and in the case of IRRI and CIMMYT probably saturated. Yet there is a very great training potential in the developed countries and certain scientifically advanced developing countries, and it would be valuable to have the Centres views on how this could be tapped. Is there a "chicken-egg" situation, with the developing countries being unable to provide enough potential trainees both because of their own needs and the limitations of their educational system in quantity and quality? It was stated at the Washington seminar that there are only 20 M. Sc. courses in socio-economic studies in all developing countries.

What could be done to help by the International community? Should the TAC sponsor a survey of manpower or training needs for research, at least for its main priorities, related to a list of appropriate institutions in more advanced countries willing to accept trainees in designated disciplines? Could a training fund be established possibly by the Consultative Group, to be allocated according to a specific programme - perhaps based on such a survey, or on the overview referred to earlier; and would developed countries be prepared to accept trainees free as part of their contribution to it?

v) The establishment of research networks on selected priorities

Even if we cannot yet qualify the absolute magnitude of the gap between supply and demand for trained staff, all the evidence suggests that it is likely to be a limiting constraint on national capabilities for a decade or more. The question which has to be faced, therefore, is how we can live within this constraint, get the essential research done on which to move agriculture ahead, and if possible build up national strengths through in-service training.

While outreach programmes from International Centres can play a valuable part here, the most promising device at our disposal to serve these purposes is probably the cooperative research network, for which models already exist in rice and maize, with IRRI and CIMMYT acting as nerve centres and basic sources of genetic material. Such networks can be either commodity or problem-oriented - solving the problem of drought stricken areas such as the Sahel might be one example of the latter. They may also, as in the case of the genetic resources network centered on FAO, be in support of rather than directly concerned with research.

The approach is attractive in offering a means of involving research institutions in both developed and developing countries, International Centres and agencies, universities, foundations, etc., in a jointly planned effort. If the objective is well chosen in line with a generally accepted need this sense of involvement should be reflected in the interest of participants both in the success of the programme and in the wide application of the results. Networks can be quite flexible in the conduct of research; provided that the planning and coordination are sound all cooperating institutions do not have to contribute exactly the same input, they can participate according to their capabilities. Publication of the results is subject to less restraints and can be more widely disseminated than for those from individual national programmes, and the externalities of the network management make it easier to transmit its findings to planners or those in the corridors of power.

These advantages, the flexibility they offer for donor participation, and the low ratio of capital to operating costs, have stimulated considerable interest in networks as an alternative to the establishment of further large internationally supported research centres or to support to individual developing countries where the impact might be relatively limited.

While FAO believes that networks do have certain unique features, and that it would be valuable for this meeting to examine potential new subjects for research by this means, the snags should not be overlooked. Leadership is essential, if a strong focal point cannot be agreed on a network is unlikely to succeed. Cooperation is also essential - not least in the selection of the topic for research, leadership must therefore not become dictation. Continuing financial support must be assured preferably with inputs from all cooperating countries, but without implying strings or political interference with the conduct of the research.

The International Centres have stressed that networks are costly in terms of management time, and CIAT have indicated their belief that, if they are to be successful, funds may have to be channeled to the support of research being carried out by national institutions as well as to any central coordinating body. ⁽¹⁰⁾ FAO experience supports this, and indicates that around 10 percent of costs ought to be reserved as 'seed money' for national workers cooperating in such research projects, preferably in convertible foreign currency. This is used for purchase of small items of equipment and books, hire of vehicles for internal travel, statistical or other clerical assistance, etc., and helps to give much-needed flexibility to the operations. As things stand no provisions exist for providing such support and you may wish to consider this question also.

vi) The use of field projects as a means of supplementing national research

Another device for assisting national research could be through collaboration between countries and development assistance agencies in the use of field projects as test-beds for the application and evaluation of new technology and socio-economic factors affecting its use.

FAO with UNDP or bilateral support was operating 1, 639 projects in 1973, plus 900 related fellowships, and while relatively few had formal research or research training as their objectives a number had research components. Evans reports that IBRD have had

research components in 76 projects, generally designed to stimulate production-oriented work at farm level, but sometimes to generate an improved technological package for a larger, follow-up project. While it would be valuable to undertake an analysis and synthesis of these and bilateral experiences, there seems to be a good case for a more deliberate approach to building research elements into future field projects, or designing projects specifically to test the use of promising research outputs.

Such projects could stand on their own or form part of research networks co-ordinated by the International Centres or other selected centres of excellence, or by other Agencies such as FAO, and they could be administered, operated and financed by the UN system (IBRD and UNDP), or bilaterally, with specific guidance on advanced technology coming from the appropriate Research Centre. FAO does not think it apt for the International Centres themselves to divert resources from their primary research tasks in order to manage such projects; however, projects of this type could offer a most valuable means of developing symbiotic relations between international and national researchers, national planners and development agencies, which would both benefit the farmers and help avoid some of the errors made in the past due to failure to take social and economic factors into account when trying to introduce new farming methods. They would also, if well organized, provide an invaluable training ground for national socio-economic and technical research workers in developing an inter-disciplinary problem-solving approach.

vii) Linkages with research institutes and universities in developed countries

These have proved most valuable in improving research capabilities of developing countries; not only through education and training but also by helping set up agricultural universities (e. g. the Land Grant College links to Asia), research institutes (e. g. in Francophone Africa), by providing consultants and research staffs on secondment, and by joint research projects with part of the work in the developing country and part in the developed. In some cases e. g. the aflatoxin research by the Tropical Products Institute in the U. K., an entire programme has been undertaken by an institute with advanced facilities on behalf of developing countries, thus releasing their resources for other research. As official bilateral aid involving career expatriate research staff and financing of entire institutes is progressively phased out in many countries, the sort of linkages outlined above will become increasingly important. They could involve contractual arrangements e. g. for specialized services or facilities, aid to selected research projects in which both partners have a mutual interest, or training. The compilation of a register of institutions in developed countries with interest or expertise in the problems of tropical agriculture, as suggested earlier for training, could be equally useful for assistance to research.

4. Conclusion

There is clearly much to be done to strengthen national research systems, and FAO believes that international assistance can play as important a role in helping developing countries to do this as it does in support of international research on behalf of those countries.

We recognize that present efforts in this direction are not negligible, but they are undeniably ad hoc, and there is need for better planning and coordination both at the global level, and within countries. Evans has suggested that there may be merit in establishing consultative groups of donors within countries, ^{1/} and in reviving regular contacts between FAO, IBRD, and UNDP on this subject. These are useful suggestions, but it may be worth recommending that the Consultative Group devote a day of each Centres week to reviewing not only the Centres links to national programmes, but what is now being done by other member organizations, and what more might be attempted. Out of this could come a concerted effort.

If this suggestion or any of the other ideas proposed in this paper seems to pose difficulties or even to be Utopian we should perhaps recall that research is the spearhead of progress. If we fail to help strengthen national research capabilities we are jeopardizing not only the effectiveness of the International Centres, but the whole future of agriculture in the developing countries.

Some Selected References

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^{1/} In fact these have already been established in some countries, e. g. Indonesia.

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**LIST OF FAO'S WORK TO STRENGTHEN
AGRICULTURAL RESEARCH AT NATIONAL LEVEL**

The present list of FAO's work in the field of agricultural research at national level concerns only Regular and Field Programme activities from 1960 up to 1973-74, excluding:

- a) Inter-Regional and Global projects even if they involve the strengthening of national institutions.
- b) National projects in support of specific subject matter fields or mono-disciplinary aspects of research.
- c) Projects dealing with surveys or the support of specialized research facilities and training.
- d) Projects concerned with agricultural development involving some research elements.

A complete "Register of FAO Activities Related to Agricultural Research" is currently under preparation.

I. AGRICULTURAL RESEARCH ORGANIZATION IN GENERAL

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**AGRICULTURAL RESEARCH INSTITUTES AND STATIONS
FREQUENCY CLASSES BY NUMBERS OF RESEARCH WORKERS**

The present inventory is a preliminary attempt to evaluate the agricultural research capabilities on the basis of eight frequency classes of numbers of research workers engaged in agricultural research activities in national agricultural research institutes and stations. The term research institutes and stations has been used in a broad sense as physically identifiable administrative units in different geographical locations where research activities are carried out and where research workers are working together irrespective of the size of the station (i. e. Research Centre Headquarters of a major Research Institute - versus - small isolated experimental stations).

The data are compiled from the more recent 1970-1973 surveys and directories available for agricultural research in Latin America, Africa and the Near East Regions. Those for Asia and the Far East Region are based on a survey carried out by FAO in 1962-63, as the more recent information from the ASPAC Directories were not available.

The major sources of information have been compiled from the following publications:

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Table 1. Countries of the Latin American Region
Number of Institutes by Frequency Classes of Numbers of Scientists

	0-2	3-5	6-10	11-25	26-50	50-100	101-199	undef.	Total
Argentina	3	12	11	10	2	1	1		40
Bolivia	13	1	1	(1)					16
Brazil	3+ $\sqrt{6}$		$\sqrt{24}$	$\sqrt{8}$	1+ $\sqrt{3}$	1			46
Chile	5	2	1	1	1	1		1	12
Colombia	4+(1)	5+(1)	2+(1)	7	1	1			23
Costa Rica	1	1	1	(1)	1				5
Dominican Rep.				1					1
Ecuador		1	1	2	1				5
El Salvador	3				2				5
Guatemala	5	5							10
Honduras	8	1	3		1				13
Mexico				2	5		2		9
Nicaragua		2			1				3
Panama	10	2	1	(1)					14
Paraguay	1			2					3
Peru	4+(4)	5+(1)	2	1		1	(1)	1	20
Trinidad-Tobago			1	(1)					2
Uruguay								7	7
Venezuela	5	4	4	1	1	1			16
Number	76	43	53	39	20	6	4	9	250
Percentage	30.4	17.2	21.2	15.6	8	2.4	1.6	3.6	100

Remarks: 1. Numbers in () refer to Universities' Departments or research centres of Faculties of Agriculture or Colleges of Agriculture for which the Scientific Staff is devoting only half of its time to research activities.

2. Numbers in $\sqrt{\quad}$ indicate the numbers of institutes for which the frequency class is only an average.

Table 2. Countries of the Near East Region
Number of Institutes by Frequency Classes of Numbers of Scientists

	0-2	3-5	6-10	11-25	26-50	51-100	101-199	200-300	Undef.	Total
Afghanistan					1					1
Cyprus										
Egypt	(2)	(1)	1+(2)	1+(3)	8+(7)	3+(2)	(5)		9	44
Iran	12+(3)	6+(2)	3	1+(1)	2	(1)			(6)	37
Iraq	9+(1)	4	1+(1)	1+(1)	(1)				5	24
Jordan										
Kuwait										
Lebanon		2	1		1	(1)				5
Libya	11	3			(1)	1				16
Oman	3	1	1							5
Pakistan	1		2+(1)	8+(1)	3+(1)	1+(3)	2+(1)	1+(1)	3	29
Qatar										
Saudi Arabia										
Somalia	3		1							4
Sudan		10+(1)	1	3	1+(3)					19
Syria	3	4	2	3					2	14
Yemen P. D. R.										
Yemen										
Number	48	34	17	23	29	12	8	2	25	198
Percentage	24.25	17.17	8.60	11.61	14.64	6.06	4.04	1.01	12.62	100

Remark : Numbers in () refer to Universities' Departments or research centres of Faculties of Agriculture or Colleges of Agriculture for which the scientific staff is devoting only half of its time to research activities.

Table 3. Countries of the Africa Region
Number of Institutes by Frequency Classes of Numbers of Scientists

	0-2	3-5	6-10	11-25	26-50	51-100	101-199	200-300	Undef.	Total
Algeria		1	1	2+(1)			(1)		30	36
Botswana	6	1+(1)								8
Burundi	6	2+(1)								9
Cameroon	10	8	2	1+(1)	1+(1)					24
Cent. Af. Rep.										
Chad	(1)	2	3	1			1			8
Congo	1		1	1+(1)						4
Dahomey	13	3								16
Ethiopia	1	2		1+(1)	1					6
Gabon	1	1	1	1						4
Gambia	3	1								4
Ghana	12	4+(1)	3+(2)	4	2					28
Guinea		2		1						3
Ivory Coast	13	6	4	5+(1)		1				30
Kenya	9	12	20+(2)	2	2+(1)	(1)				49
Lesotho	1	1								2
Liberia		2		1+(1)						4
Madagascar	10	8	2+(1)	3		2				26
Malawi	1	1	5	1+(1)						9
Mali	11	5	1							17
Mauritania	4									4
Mauritius	1		(1)	2+(1)	1					6
Morocco			1	1+(2)		1				5
Niger	9	2	2							13
Nigeria	12	8	5	2+(3)	7+(2)	1+(1)				41
Rwanda		4	1							5
Senegal	15	9	1	2	1					28

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Africa Region (cont'd)

	0-2	3-5	6-10	11-25	26-50	51-100	101-199	200-300	Undef.	Total
Sierra Leone	2	2			(1)					5
Swaziland			1		1					2
Tanzania	2+(1)	3	5	7+(2)						20
Togo	4	3	1						1	9
Tunisia	7	2	7	2	(1)				1	20
Uganda	15	10	3	2	(1)					31
Upper Volta	11	2								13
Zaire		4	2	2+(1)	(1)					10
Zambia	3	21	7		1+(1)					33
Number	185	135	85	60	26	7	2		32	532
Percentage	34.78	25.38	15.98	11.30	4.88	1.31	0.37		6.00	100

Remark: Numbers in () refer to Universities' Departments or research centres of Faculties of Agriculture or Colleges of Agriculture for which the scientific staff is devoting only half of its time to research activities.

Table 4. Countries of the Asia and the Far East Region
Number of Institutes by Frequency Classes of Numbers of Scientists

	0-2	3-5	6-10	11-25	26-50	51-100	101-199	200-300	Undef.	Total
Bangladesh										
Burma	5	2				1				8
China										
China (Taiwan)	1	7	11	6	4		1			30
Fiji										
India	28	29+(1)	16+(2)	12	3	8+(1)	2	2+(1)	(1)	106
Indonesia		1	1							2
Japan		1	3	5	5	4	4		6	28
Khmer										
Korea		1	1	2	4	1				9
Laos										
Malaysia	7	1	1	2		1				12
Maldives										
Nepal										
Philippines				4	2	1	1			8
Sri Lanka	1	1				1				3
Thailand	38	13	3	4	1			(1)		60
Singapore			1							1
Vietnam										
Hong Kong	1	1		1						3
Number	81	58	39	36	19	18	8	4	7	270
Percentage	30	21.5	14.80	13	7	6.66	2.96	1.48	2.6	100

Remark: Numbers in () refer to Universities' Departments or research centres of Faculties of Agriculture or Colleges of Agriculture for which the scientific staff is devoting only half of its time to research activities.

Table 5.

NUMBER OF AGRICULTURAL RESEARCH INSTITUTES BY FREQUENCY CLASSES
OF NUMBERS OF SCIENTISTS AND THEIR PERCENTAGES BY REGIONS AND ON A GLOBAL BASIS

Frequency Classes	Latin America		Near East		Africa		Asia & Far East		Total	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
0-2	76	30.40	48	24.25	185	34.78	81	30.00	390	31.20
3-5	43	17.20	34	17.17	135	25.38	58	21.50	270	21.60
6-10	53	21.20	17	8.60	85	15.98	39	14.80	195	15.60
11-25	39	15.60	23	11.61	60	11.30	36	13.00	157	12.56
26-50	20	8.00	29	14.64	26	4.88	19	7.00	94	7.52
51-100	6	2.40	12	6.06	7	1.31	18	6.66	43	3.44
101-199	4	1.60	8	4.04	2	0.37	8	2.96	22	1.76
200-300	-	-	2	1.01	-	-	4	1.48	6	0.48
Undefined	9	3.60	25	12.62	32	6.00	7	2.60	73	5.84
TOTAL	250	100	198	100	532	100	270	100	1,250	100

Table 6.

REGIONAL PERCENTAGE OF NUMBER OF INSTITUTES BY FREQUENCY CLASSES

Frequency Classes	REGIONS			
	LATIN AMERICA	NEAR EAST	AFRICA	ASIA AND FAR EAST
0-2	19.49	12.30	47.43	20.78
3-5	15.90	12.60	50.00	21.50
6-10	27.18	8.72	43.59	20.51
11-25	24.85	14.64	38.21	22.30
26-50	21.27	30.85	27.66	20.22
51-100	13.96	27.90	16.28	41.86
101-199	18.18	36.365	18.18	36.365
200-300	-	33.335	-	66.665