Introductory overview to South and Eastern Mediterranean national agricultural research systems

Hariri G.

Etat de l'agriculture en Méditerranée : recherche agronomique et sécurité alimentaire

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Introductory Overview to South and Eastern Mediterranean National Agricultural Research Systems

Ghazi Hariri
ISNAR (International Service for National Agricultural Research), The Hague (The Netherlands)

Abstract. Since the 1970s, most of the countries located to the East and to the South of the Mediterranean have sought to overcome their food deficit by increasing imports of cereals and other foodstuffs, generally at prices which were unbearable over the long term. The challenges facing agriculture to satisfy food needs are becoming ever more complex and urgent. Indeed, leaders in agricultural development today face challenges which are of a technological, socio-political, economic, and institutional nature. The NSAR (national systems of agricultural research) play a vital role in the perfection and transfer of new technologies. Only the national research heads are in a position to reflect on the policies relative to agricultural development which their governments are undertaking and to exercise influence in this area. They alone can determine the needs and priorities of national research, evaluate – with respect to the local context – the results obtained by the international scientific community, and assure that research portfolios of the latter faithfully reflect the preoccupations of the countries in the region.
Following this general introduction, the present document takes stock of the current situation of the NSARs of the region by describing, on the one hand, research institutes (in terms of number and type), and on the other hand, research programs and projects as well as available resources.
A third part analyzes the pressing questions which must be considered by policy makers and research leaders concerned with improving the efficiency of the NSARs. At issue here are the needs to establish practical information systems for managing different domains, to institutionalize relations between research and involved parties, and to perfect efficient methods of planning, establishing priorities, and managing human, physical and financial resources.

Key words. NSAR – Rural Development – Technology Transfer – South Mediterranean – East Mediterranean – Information Systems

Titre. Vue d'ensemble des systèmes nationaux de recherche agricole du Moyen-Orient méditerranéen et de l'Afrique du Nord.

Résumé. *Depuis les années 1970, la plupart des pays situés à l'Est et au Sud de la Méditerranée ont cherché à combler leurs déficits alimentaires en augmentant les importations de céréales et d'autres denrées, moyennant des prix insoutenables à longue échéance. Les défis que doit relever l'agriculture en vue de satisfaire la demande de nourriture, se révèlent de plus en plus complexes et urgents. En effet, les défis auxquels font face les responsables du développement agricole sont d'ordre technologique, socio-politique et économique, et institutionnel. Les SNRA (systèmes nationaux de recherche agricole) jouent un rôle prépondérant dans la mise au point et le transfert de technologies nouvelles. Seuls les responsables nationaux de la recherche sont bien placés pour réfléchir sur les politiques relatives au développement agricole que mène leur gouvernement et pour exercer une influence dans ce domaine. Eux seuls peuvent déterminer quels sont les besoins et les priorités de la recherche nationale, évaluer – par rapport au contexte local – les résultats obtenus par la communauté scientifique mondiale et veiller à ce que les portefeuilles de recherche de celle-ci reflètent fidèlement les préoccupations des pays de la région.*
A la suite de cette introduction générale, le présent document fait le point sur la situation actuelle des SNRA de la région, en décrivant d'une part les institutions de recherche (du point de vue nombre et type) et, d'autre part, les plans et les programmes de recherche et les ressources disponibles.
Une troisième partie analyse les questions pressantes que doivent considérer les décideurs politiques et les responsables de la recherche soucieux d'améliorer l'efficacité des SNRA. Il s'agit de la nécessité de mettre en place des systèmes pratiques d'information sur la gestion dans différents domaines, d'institutionnaliser les relations entre la recherche et les parties prenantes et de mettre au point des méthodes efficaces pour la planification, l'établissement de priorités et la gestion des ressources tant humaines que physiques et financières.

Mots clés. *SNRA – Développement rural – Transfert de technologie – Sud Méditerranée – Est Méditerranée – Système d'information*

I. – Introduction

In all countries of the West Asian and North African (WANA) part of the south and east Mediterranean region, agriculture continues to be the critical sector of the economy. The future is threatened by rising deficits of consumption over production of staple foods and rising real costs of food to consumers. The traditional subsistence systems, which have been practiced for hundreds of years, can no longer meet the overall food needs created by rapidly rising populations, and a change in the pattern of demand of food due to increased income and urbanization. In addition, agriculture is called upon to generate taxes and foreign exchange to support economic and social development programs, create a market for goods produced in other sectors, and provide employment. The tasks demanded of agri-

culture are numerous and improved technology lies at the center of most plans of action to deal with these issues.

Most countries in the region have since the seventies been meeting their food deficits by increasing imports of cereals and other foodstuffs at unsustainable rates. Even those countries which have appeared most successful in their agricultural development have used up many of their easy options; future increases in production output are likely to be both more expensive and more difficult to attain. With new land becoming increasingly scarce in most countries of the region, improved technology for intensifying sustained agricultural production must be considered the key to progress.

1. Major challenges facing agriculture

The challenges facing agriculture to meet food needs in the future will grow increasingly complex and urgent. Not only will the need for food expand with population growth, but composition of demand will change with expanding urbanization and rising income levels. At the same time, these forces of change will lead to intensified pressure on the natural resource base, highlighting the threat of environmental degradation and jeopardizing future productivity. To meet rising food needs, agriculture has to be not only highly productive but also sustainable and efficient in the use of traditional resources and new inputs. Above all, it will have to be supported by strong research systems, rational food and agricultural policies, and adequate infrastructure, to ensure efficient distribution of inputs and products.

The needs of the future pose a clear and significant challenge to agricultural research to develop technologies and to generate knowledge on which sound food and agricultural policies can be used.

The food production-population race, food security/self-sufficiency, income growth, and urbanization are the key variables shaping food and agriculture product demand. In the region, the average annual increase in demand for food is between 5% and 6%, while gross agricultural production during the eighties registered an annual average increase of less than three percent. The demand for food is increasing as a result of growth in population and per capita income, requiring corresponding increases in domestic production and/or imports.

Increased production will have to come mainly from intensification of land use and through technological development. At the same time, environmental degradation must be controlled, efficiency of resource utilization increased, and genetic diversity conserved and fully exploited. It will also be vital to ensure maximum utilization of agricultural products through technologies which minimize post-harvest losses, utilize agricultural by-products, and efficiently convert commodities into forms appropriate for long term storage and transport. Thus, new production technologies are needed in both irrigated and rainfed areas for different producer groups under varying conditions. The technology challenge shapes the projection of trends for agricultural research and technology development.

Improved technology alone cannot ensure either increase of agricultural production or adequate nourishment for all sectors of a society. The political, social and economic environments of the agricultural sector also shape agricultural production and distribution. These factors must be taken into account when discussing agricultural production and future demands on the national agricultural research systems.

Technological development leading to a sustainable increase in agricultural productivity requires strong national research systems and a number of supporting facilities such as training institutions, credit and extension services, infrastructure, input-output markets, and transportation. Improved technologies can increase agricultural production only when farmers are aware of the technologies and know-how to use them; when required inputs are available at reasonable prices; when markets are accessible; and when there are remunerative prices for farmers' products. All these are pre-requisites for agricultural development and represent important institutional challenges for the future.

2. The central role of NARS

National agricultural research systems (NARS) play a central role in the process of technology generation and transfer. These are essential for identifying technology problems and for developing and adapting appropriate technology. Experience has shown that without a strong national research system advances in agricultural production are unlikely.

The leadership role of NARS must inevitably assume in the technology development process. Only national research leaders are in a position to reflect upon and influence their government's agricultural development policies, to define national research needs and priorities, to evaluate under local conditions the findings of the global research community,

and to ensure through formal and informal communication that the agendas of the global research community accurately reflect concerns of countries of the region.

Whether primarily technology generators or technology adapters, NARS must be strong and effective if they are to contribute significantly to agricultural development. This requires a supportive policy environment, sustainable research institutions compatible with the designated objectives and functions of research, and a coherent set of management processes which allow the system to produce in a continuous and cost effective way.

II. – Current Status of NARS

Public-sector research in the region has grown rapidly during the last three decades resulting in a marked expansion in infrastructure, trained staff, and research output. The number of researchers has increased sharply, their qualifications have improved significantly, and their experience has grown.

Many NARS in the region are effectively serving their country's agricultural development objectives and making important contributions to world of knowledge. They are attempting to build and maintain stronger inter-country linkages mainly through donor funded projects, and linkages with regional and international research. However, despite recent efforts to improve the efficiency and effectiveness of research, NARS in the region are fragmented and difficulty in coordination within and among them is a common problem. While there is a tendency to see structural change as the solution to problem of coordination, or as a means of stimulating new activities, there is often a failure to understand how complicated organizational and structural change can be and to recognize the usefulness of improved management tools in achieving the same ends. In many cases, the desired objective may be obtained through better approaches to strategic planning, program formulation, and program budgeting rather than through restructuring of organizations.

1. Research Institutions: Number and Type

In a broad sense, the national agricultural research systems consists of all those institutions carrying out agricultural research in various fields in the country. The institutions are often diverse and are distributed in various government and nonprofit institutions—non-educational and educational—commercial institutions having close links with agribusiness, development projects with research components, and nonprofit regional and international research institutions having their headquarters or offices in the country under consideration. *Table 1* summarizes the number and type of institutions in the eight countries of the region.

Structure and organization of NARS in the region varies from country to another. This issue covers the size of the system, the number and types of research institutes, their responsibilities and mandates, their relative degree of autonomy and control of decision making, their governance and resource acquisition mechanisms, their division of labor, the patterns they follow in communicating and working with each other, the channels of information flow within the system, the internal organization of research within the system, and the internal organization of research within individual institutes and experiment stations.

At the level of the individual organization, governance and resource acquisition mechanisms are the main differentiating characteristics. Using these as typological variables, three organizational models can be identified in the region:

Model I. The Ministry Department Model: Research is organized in one or more departments within the bureaucratic structure of a ministry or ministries. The basic feature of this model is that the unit responsible for research has a low degree of control over decision making, particularly in matters concerning resource management.

Model II. The Agricultural Research Institute Model: Research responsibilities are placed within an administratively semi-autonomous organization. The basic characteristics of this format is a high level of control over decision making with respect to program and administrative policy and internal resource allocation matters, which is usually exercised through an independent board of directors.

Model III. A combination of I and II: Research is conducted simultaneously by a ministry or ministries and semi-autonomous institutions.

Table 2 summarizes the current organizational formats of NARS in the eight countries of the region. Two basic types of system can be envisaged: single-organization systems, e.g., Cyprus, Lebanon, and Libya, where most research activities are carried out within one organization, and multi-organiza-

Table 1. Number and Type of Agricultural Research Institutions in the Country*

Country	Government and Nonprofit Institutions		Commercial Institutions	Development Projects with Research Comp.**	Regional/International Institutions
	Noneducational	Educational			
Morocco	INRA, DREF, SEHA	IAV, ENSA, EGRT, ENFI	+++	++	AFFA, CAFRAD, AOAD office, ICARDA office
Algeria	INRA, ITGC, ICMI, ITAV, ITEBO, ITPE, ITDAS, INPV, INSA, INSID, INRF	INA, ENV, ITA, ITAS	++	++	AOAD office
Tunisia	INRAT, CRGR, INRF, IO, IRA, BIRH, DRES, IRVT, DGRE	INAT, ENMV	++	++	ALECSO, ICARDA office, CIP office
Libya	ARC, ACDRDCD	FAFU, FAGYU, FVMFU, OMUAS	++	++	AOAD office
Egypt	ARC,DRC,WRC, NRC	FAASU, FAFU, FAAISU, FAALU, FAMU, FACU, FASCU, FAAZU, FAMAU, FAMOU, FAQU, FATU, FAZU, FCSHU, FVMALU, FVMASU, FVMCU, FVMZU, AUC	+++	++	IDRC office, ICARDA office, IRII office, AOAD office
Cyprus	ARI		++	+	
Lebanon	ARI	FAFS, FASLU, FSA, ESIAM	+++	++	ICARDA office, UCCIAAC
Syria	DASR, DS, DIWU, DCB, TRI	FADU, FAAU, FAAUD, FATU, FVMBU	++	++	ACSAD, ICRADA, AOAD office, ACOLID, AAU

* See *Annex 1*: Acronyms
** Intensity and type of NARS' involvement: + insignificant; ++ significant; +++ highly significant

Table 2. Organizational Structure of NARS

Country	I	II	III	Ministry Dept. for coordination
Algeria			+	DFRV
Cyprus		+		
Egypt		+		
Lebanon		+		
Libya		+		
Morocco			+	DERD
Syria	+			
Tunisia			+	IRESA

tional systems, e.g., Syria, Tunisia, and Egypt, where a variety of different organizations perform research activities. In the multi-organizational situation, the most important differentiating element is the existence or not of formal coordination mechanisms.

According to the presence of research divisions within or outside the research department or semi-autonomous institutions, models I, and II may be again classified into two subcategories:

– research divisions within the department/institution headquarters: Algeria, Cyprus, Egypt, Lebanon, Morocco, Syria, and Tunisia;

– research divisions are distributed among the main research stations: Lebanon.

2. Research plans, programs, and resources

The establishment of clear goals is essential for any research system since the way the system structures and manages itself is dependent on the goals to be achieved. This point is often missed in proposals for the reorganization of research systems where the reorganization of the system becomes the goal itself, or a means of improving management of the system without reference to the higher goals to be achieved.

One of the concerns of governments of the region is increased food security. Food security requires a country to be able to meet target consumption levels on a year-to-year basis. To achieve food security a country must ensure first availability of food, through domestic production or imports, and second, access to food by its residents either through home production or the market. Governments must address the question of access to food through the market through a variety of socioeconomic policies; the research system is

more concerned with addressing the availability of food of the equation.

The region's food security has been affected by the persistent decline in its self-sufficiency during the last two decades. The severe instability of agricultural production, especially from rainfed farming, and reliance on world markets to fill the gap in the region's food and feed deficits, call for a major effort to improve food and feed supply management systems. The deficits are particularly important in cereals, animal feed, vegetable oils, sugar, and red meat.

Self-sufficiency in the main commodities of the region is the lowest among major regions of the world. Government decisions to increase self-sufficiency will involve research, extension, and input costs. At the same time, it may affect the balance of resources devoted to irrigated versus rainfed areas, the particular crops that are emphasized, and the employment that will be generated. In general, the research systems in the region are not in a position, through information and clear explanations of the implications of alternative strategies, to help decision makers in their task.

The research systems lack research policies and strategies in which development objectives and strategies are translated into broad research goals and objectives and the main priorities and broad allocation of resources are decided—in terms of commodities, regions, and natural resources.

In general, there are no long-term research strategies and plans in the region's countries. Currently, national research strategies and plans are formulated to match the country's five-year development plan, and are the sum of research proposals by scientists. In some countries, five-year strategies and plans are published to guide research studies and experiments, e.g., Egypt. However, in 1987, Tunisia, with ISNAR's assistance, developed a long-term research plan (10-15 years' perspective). DASR in Syria has developed a research strategy for the nineties and beyond, which needs to be discussed at cabinet level for approval and government commitment. Attempts are underway to develop strategies with long-term perspective in Egypt for university agricultural research and ARC, and in Lebanon for ARI.

There are inconsistencies among countries in the region in how much of the agricultural GDP is spent on research. The ratio of research expenditure to agricultural GDP is low, less than 0.7 %. The ministry of agriculture and other relevant ministries are the main sources of government support for agricultural research.

There is some evidence that the largest and best staffed systems in the region are experiencing a pressure on operating budgets. Moreover these systems are faced with inadequate levels of financial support, instability of funding, poor disbursement of funds, and problems created in handling donor funds. However, the sustainability of the research systems in the region is really a question of employing and maintaining the productivity of their human resources. The encroachment of salaries on operating budgets does not mean, however, that scientists in those systems are handsomely paid. There is usually co-existence of the phenomena of salaries consuming a large part of budgets and scientists being poorly paid. In this way the financial and the human resource problems are closely linked. Developing sound research strategies and policies and programs could help in solving these problems.

Available data on agricultural research personnel in the region shows that quantity and quality of scientific staff have improved rapidly during the last decade. Updating available figures in number of scientists in each system is a problem since modern data bases on researchers are either unavailable or unaccessible. Attempts are underway to establish functioning computerized data bases on researchers and their research activities in research institutions in the region, e.g., ARI and faculties of agriculture in Lebanon, ARC and faculties of agriculture in Egypt, and DASR in Syria (on research activities). These data bases will help in improving research planning, programming, monitoring, and evaluation.

Despite that the critical mass of scientists exists in overall terms at system level, it may not exist at the institute, station, and substation levels. In most countries, scientists are either concentrated in the capital and large cities or spread too thinly among multiple programs and stations.

III. – Building Effective NARS: Urgent Needs

1. The need for a practical management information system

Information needs for research institutions could be classified in the following categories:

– scientific and technical information where libraries and documentation centers deal with this type of information to assist scientists in their research

activities, and librarians to collect, process and store and retrieve information;

– administrative information, which covers file keeping, correspondence, human resources, etc.;

– financial information;

– technical information on research activities to assist researchers and statisticians to collect, process, and store and analyze information;

– research program management information to assist research managers, policy makers, and researchers in managing research programs.

The first category could be dealt with management of central support services.

The administrative and financial information are managed according to government procedures and regulations. However, use of modern information technology will assist research managers in dealing more efficiently with these types of information.

Technical information on research activities, related to experimental design and statistics, will assist researchers in monitoring, evaluating, and executing research activities.

Lack of information on research program management can be a major impediment to effective management of research programs. Research managers need to know exactly what experiments/studies their researchers are doing, with which facilities, and at what costs. Without this type of information, research managers cannot perform nor improve essential functions such as planning, programming, coordinating, monitoring, and evaluating research activities. For improving the availability of information on research program management to researchers, research managers, and decision makers, modern information technology could be used successfully.

Computerized data bases on NARS researchers, and their research activities are functioning in some NARS in the WANA region. These are used as a management tool to facilitate planning, programming, monitoring, and evaluation of research by providing detailed information on research personnel, specifically on their biodata, in-service short-term training, and time allocation between various activities, and on research activities. These also provide information at various levels of decision making through aggregation and disaggregation of information to enable:

– researchers to assess programs towards research objectives and to help in utilizing their time efficiently;

– research managers to identify problems in research activities of individual researchers or in aggregate, to identify if personnel is being over- or under-utilized, to assist in priority setting of research proposals, and to facilitate the efficiency of activities by incorporating information and minimizing duplications;

– NARS management and decision makers to aggregate information on disciplines, commodities/groups of commodities, locations, natural resources, production systems, agroecological zones, and objectives of research to determine if operational costs and personnel allocation are sufficient, and to make decisions for coordination and linkages of research.

2. The Need for Efficient Planning and Priority-setting Processes

National agricultural research systems set priorities and implement research obviously with varying levels of success. The processes vary from country to country and from institution to institution but follow a general pattern where research program priorities are carried out in relation to other planning activities at the national or institutional level.

The major and continuing task of research managers is to maintain the relevance of the research program to the institution mandate and to stakeholders they strive to serve. Efficient planning helps them to achieve this task.

The national development policies provide a frame of reference and a set of principles for determining what and how research should be planned, prioritized, allocated with resources and implemented. Therefore, there are needs to translate the development policies through research planning process into relevant research activities which all bear improved technologies to be utilized by large numbers of farmers and other stakeholders.

The planning process produces two sets of five documents:

– The first set is concerned with the preparation of three government documents guided by the national economic policy and development plans to develop the government agricultural research policy and strategy and five-year research plan, and by the government procedures for resource allocation to

prepare the research institution annual plan and budget.

– The second set is concerned with the preparation of two technical detailed programs. These are the long- and short-term research program plan, the preparation of which is guided by the research policy and strategy, world knowledge, and technical possibilities to solve agricultural constraints; and the annual research program (action plan: experiment and study proposals), the preparation of which is guided by long- and short-term research program plans, world knowledge of current results, and stakeholder circumstances. The long- and short-term research program plan will guide the preparation of the five-year plan for research to be submitted as part of the agricultural development plans; and the annual research program will guide the preparation of the annual budget.

In most countries in the region, research institutions lack national agricultural research policies and strategies to guide the preparation of detailed long- and short-term research program plans covering research activities on which five-year and annual plans and budget are based.

In general, formal long-term planning of agricultural research was undergoing development and implementation during the last three decades. Three approaches could be identified:

Bottom-up approach. Pre-1960s' and 1960s' literature on research management seem to emphasize a mainly traditional bottom-up "spontaneous generation" viewpoint of research activities, as if research were rather autonomous. The research managers were advocated as the ultimate sounding body against which the researchers test their research proposals, i.e., "a bottom-up" research planning system. In this approach, individual researchers worked out their projects with the perception of the research needed for the farming scene. The individual projects would be aggregated and, in theory at least, these projects match approximately with the national needs. This informal approach is characteristically found when the research budget is increasing or where there is no formal system for establishing research policy at the national level.

Top-down approach. The period of the seventies and early eighties was dominated by the view of science policymakers on science described as "science as problem solver". In such view science is considered as an object for "rational planning" in which more emphasis were put on interaction of the research plan with development plan. Therefore, the implementation of research priorities is seen as the logical next step that follows priority-setting. Directions were advocating a mainly "top-down" research planning approach, i.e., systems approach with goals, objectives, and a general management-by-objectives style. In this approach research was considered far too important to be left to the researchers to decide priorities at broad level. Tighter links between research and the economic development needs were being advocated. Additionally, with an increasing need for accountability, particularly where priority-setting in government policies becomes important as with static or declining budgets, a "top-down" approach was increasingly favored.

Strategic opportunity approach. Nowadays science is considered more as "strategic opportunity". Such a perspective, emphasizing as it does the search for opportunities, leads to particular concern about the requirements of conducting research and for effective implementation of research priorities. With increasing demand for research to respond, researchers could no longer afford to plan and manage it in a random manner. Thus, research has to be very closely tied to strategic business planning; i.e., "strategic opportunity" planning. It is a modified "top-down" and "bottom-up" approach usually found where the determination of priorities is vested in a hierarchy of formally constituted bodies, after consultation with researchers and wide range of stakeholders. In this approach, a national research policy and strategy may be outlined and the budget allocated in accordance with priority choices determined by researchers and stakeholders groups or committees. These research choices are distributed between production systems, commodities, or groups of commodities, natural resources and other non-commodity research areas, and production factors by priority-setting, and distributed within them by disciplines. This approach involves a multi-actor interaction in the priority-setting process and ensures that the research system will not be overcharged by unrealistic expectations. It will become more responsive to opportunities taking into account the dynamics and capacity of the research systems. The strategic planning exercise is characterized by that the implementation aspects are integrated with the planning process; broad minded scientists, policy makers and users of research results are involved from the outset; and the emphasis is not on strictly rational decision making but on converging the views of all the people involved.

A. Research Policy and Strategy

The basic purpose for strategic planning is to allow the research organization to achieve a realistic and functional balance among competing needs and

opportunities. Faced with both continuing resource constraints and the complex of agricultural problems, national research systems should be able to revise strategies to cope with these changing constraints and problems. The research strategy is also the formal link between the research system and policy makers. Research will be increasingly called upon to provide technical inputs into decision making on improving production systems, natural resource use, and other policy issues.

The strategic planning refers to a process, by which a research system or institute develops the most desirable vision of its future, outlines the essential elements of a course it intends to follow to realize that vision, and provides a justification for the identified course. Regardless of how it is prepared, a research strategy should include the basic components of a strategy: stakeholders and external environment, internal environment, current strategy, mission of the research system, guiding values reflecting business philosophy of the research system, strategic business areas specified in the formal mandate and mission statement, strategic issues reflecting major strengths and weaknesses of the research system and the threats and opportunities it faces, priorities assigned to major research areas, and operational implications representing a scenario for organizational change for moving the research system from its present state to a desired future state.

The overall planning for system development involves identifying the broad priorities for research, designing a system structured to address those priorities, and securing the resources required to implement them. By shaping its own future through strategic planning, the research system builds consensus on its objectives, fosters commitment to change, and enlists the support of policy makers and other stakeholders.

B. Research Program Plan

For the research policy and strategy to be implemented, there are needs to translate it to operational plans, in which long- and short-term and annual research programs are included to match long- and short-term agricultural needs. Once research program operational objectives, priorities and broad resource allocation are defined at program level, it is important to define research operational objectives, priorities and resource allocation at project level within each program, which will be followed to achieve goals and objectives or research by identifying possible research activities in each project and selecting the most appropriate and cost effective for implementation.

➤ **Definitions.** A research **program** is focused on either a commodity or a group of commodities, an agroecological zone, a production system, or a production factor. A program is made up of research projects (may also be called areas, themes, or thrusts). It may be carried out by a single institute or more.

A **project** is the operational unit of a program. It has an operational objective to achieve program goals, time frame (short 1-3 years, medium 3-6 years, and long 6-10 years), allocation of resources, locations, and expected outputs. A project is made up of experiments/studies.

An **experiment/a study** is the implementation unit of a project. An experiment is carried out at the laboratory and/or field; a study is desk research.

➤ **Levels.** The research program planning consists of three levels.

i) **Long-term program planning** which determines the strategy for the program over the long-term, by describing guidelines and priorities, and by estimating resources needed. It stops at the identification of project themes. It is initiated at the policy/institute level, but it also involves the scientists who will work on the program and research stakeholders. It covers a long-term of about 10 years.

ii) **Project formulation** starts where long-term program planning stops. Project proposals corresponding to the project themes identified during long-term program planning are elaborated by the researchers. These proposals provide detailed information about the projects: activities, methodology, resources, expected results, and schedule for completion. The length of a project varies: 3-4 years for agronomic practices, 8-10 years for breeding, and even longer in the case of trees and livestock. Project formulation is initiated by researchers at the implementation unit level (station/laboratory) and reviewed by research directors and program leaders.

iii) **The annual program** provides the detail of experiments, studies, and resources needed for the following year, based on review of results achieved thus far. It is carried out at the implementation unit level, managed by researchers, and reviewed by research managers.

➤ **Characteristics.** Good research programs should be effective, efficient, necessary, and comprehensive. It is effective by responding to national development objectives, to users needs and to potential for adoption. The research is efficient

when objectives are realistic in terms of resources (the program doesn't try to cover more objectives than resources permit); resources are allocated on the basis of relative importance to reaching objectives. The research is necessary by building on past research, and opportunities for borrowing technologies from outside and adapting them to local conditions have not been overlooked. The program is comprehensive by including all experiments and studies necessary to reach objectives.

➤ **Steps for long-term program planning.** Review sector, analyze constraints, evaluate research, determine research objectives and strategy, identify projects, set project priority, perform source gap analysis, outputs.

All those with an interest in the implementation and outcome of the research program should be represented in a program planning group. Depending on the particular program, group members might be a mix of researchers and managers, policy makers, producers, and extensionists. The group will ensure that important issues will be dealt with. The participation of those with interest in the program planning will ensure comprehensive and unbiased analysis of constraints, build consensus on research objectives and priorities, foster support of policy makers and developers for research program for implementation, and increase chances of research results being rapidly transferred to farmers.

C. Annual Research Program

The objective of designing the annual research program is to solve the problem on hand in an optimal manner, but with minimal efforts. The design embraces several methodical and organizational aspects. The annual research program is usually determined on the basis of current research staff, facility and financial resources, within the guidelines of research strategy and program plan. The annual research program is by definition dynamic, adaptable to changing conditions, and incorporates the realities of the research capacity within a given system. It consists of a set of experiments/studies proposed by scientists and approved by management through programmatic selection.

The characteristics of experiment/study proposals should be:

– appropriate to the country in terms of size, sophistication and realistic in relation to their environment and resources availability;

– relevant to the client groups as targeted within the adopted criteria for performance;

– high quality that penetrate to the core of the problem within minimal effort, and designed scientific and statistical care so valid conclusions can be drawn;

– clearly defined to facilitate audience understanding;

– fiscally responsible to reflect a realistic budget for key research within limited resources.

Inputs necessary to delineate the annual program formulation process are:

– the long-term research program plan, which provides parameters within which to orientate the annual program formulation at the researcher level;

– well trained research personnel, researchers and technical staff, are essential inputs;

– current available physical resources;

– appropriate funding where research proposals, ranked by priority, should be prepared based on preliminary funding estimates to allow in the prioritization process for unworthy proposals to be terminated;

– information flow on all the stakeholders to be served are important to the researchers to propose and conduct experiments/studies designed to serve the primary stakeholders;

– appropriate body is necessary to reach decisions on alternative choices of experiments/studies.

Problems can be successfully solved only if each step, from the formulation of the problem till its solution, is carried through in conformity with the problem and without error. However, in this context, it should not be forgotten that too detailed instructions discourage initiative on the part of researchers.

D. A Formal Priority-setting Procedure

Priority-setting in national agricultural research systems has traditionally been intuitive, largely informal and subjective exercise. Research managers are often reluctant to set priorities because they do not want to openly state that some research will have to be left out. They are under political pressure to consider all possible research. Furthermore, they are very suspicious of a formal priority-setting process; they see it as a technocratic, bureaucratic process replacing researchers' best judgment.

In trying to understand the priority-setting process, particular attention should be given to its purposes and to the difficulties in the attempts to make it more formal, objective, systematic and quantitative to complement experience and intuition, and to make more effective use of scarce resources.

There are several reasons for a more formal and systemic priority-setting process to:

• **Reveal unrealistic expectations**. Expectations are often unrealistic, because the demands on agricultural research are growing, while funding is stagnating if not declining. Formal priority-setting techniques help reveal unrealistic expectations.

• **Evaluate impact systematically**. The likely impact of research activities is difficult to evaluate, because of the number of intervening and interacting variables. Quantitative methods set values on each variable, holding the others constant, and make the interactions explicit.

• **Promote consultation**. Priority-setting is a tool to help people decide how to allocate resources. It requires intensive consultation among decision makers, development managers, research managers, researchers and research results users. A formal process promotes and facilitates consultation, because it systematically considers key variables, ensures that all interested groups are represented, and is iterative.

• **Stabilize research program direction**. Research is often a long-term undertaking. A formal priority-setting exercise will help minimize the pressure to change the direction of a research program in the short-term, especially where there is a rapid turnover of decision makers.

A formal priority-setting procedure is not a substitute for the judgment, experience and knowledge of researchers and research stakeholders. On the contrary, it makes systematic and explicit use of this experience, by translating it into quantitative measures. Whatever formal priority-setting tool is used, the results that are output will not be better than the information that is input.

Responding to national development objectives: Nationally-determined development objectives dictate the direction of research at the program level. Other kinds of objectives, like scientific quality, will come into play when choosing among experiments and studies within research projects.

Resources are scarce. They need to be allocated in such a way as to maximize the contribution of research to achieving the development objectives of the country. National development objectives can usually be grouped in three categories:

i) **Efficiency (or economic growth):** raising the average level of well-being of the society. For agricultural research, this means increasing the production available for consumption and improving product quality. Improvement can be achieved in production or in processing, through: increasing yields per unit of labor (or restoring declining productivity in the case of environmental degradation), decreasing unit production costs or a combination of both.

ii) **Equity:** increasing the well-being of particular groups of producers or consumers. This means focusing on research that will benefit targeted groups.

iii) **Sustainability and security:** ensuring an even flow of outputs over time. This means research that aims at reducing year-to-year income fluctuations, increasing the country's self reliance or ensuring environmental sustainability.

There are three levels of priority-setting in agricultural research planning:

i) **among programs:** commodities, production factors and other major research areas.

ii) **among projects within a program**, where projects correspond to constraints and ways to solve them.

iii) **among experiments and studies within projects**, where each experiment/study is the annual implementation unit of the research operations.

The three development objectives (efficiency, equity, and sustainability/security) are relevant at program level:

– Some constraints are more severe (have more effect than others on productivity (efficiency or economic growth objective).

– Farmer adoption of improved technology depends on resource endowment. Some technologies are more demanding of various scarce production factors, such as water, land, labor, capital (equity objective).

– Farmer benefit from improved technology depends on location. If a technology is developed for a certain agroecological zone, it may not be appropriate for another (equity objective).

– Environmental impact. Some technologies may have a positive impact, while others may be neutral or even have a negative impact (sustainability objective).

Types of priority-setting tools: The priority-setting and resource allocation is a process, which must be institutionalized as part of the overall process of resource management. A number of priority-setting tools has been developed to assist researchers, research managers and decision makers establish priorities and allocate resources with the basic purpose of injecting more objectivity into this type of intuitive and subjective exercise. There is no “right” or “wrong” tool for priority-setting in all circumstances. There are seven broad techniques for establishing priorities listed as follows in an approximate order of increasing sophistication: Congruence, checklist, scoring, domestic resource cost ratios, cost-benefit analysis, mathematical programming, systems analysis and simulation models.

The first three methods could come under scoring techniques, which are most widely used (checklists and scoring are already being used in several countries). The rest are models requiring varying degrees of quantitative analysis using a great amount of econometric data. Domestic resource cost and cost-benefit analysis are frequently used in project analyses and general economic planning and appears favored by economists. Mathematical programming and systems analysis appeal to systems research people and those with access to good computer systems.

3. The Need of Institutionalizing Linkages of Research with its Stakeholders

It is important for NARS to maintain strong linkages with their stakeholders, mainly other research entities within the country and external sources of knowledge, extension, farmers and other producers, and policy makers.

A. Linkages with sources of knowledge

Maintaining linkages with sources of knowledge can provide NARS with scientific assistance, material inputs, and collaboration. Experience has shown that (i) universities' agricultural research in the region could potentially collaborate with national research institutes, (ii) collaboration which exists between research institutes and university agricultural research is usually on a scientist to scientist basis and informal in nature, and (iii) university is engaged primarily in agricultural research of a didactic nature.

Leaders of both universities and national research institutes are aware of the schism which exists between them and have been willing to seek greater collaboration. However, different criteria for hiring and promoting staff, different conditions of service, different mandates of research institutes and universities have made it difficult to have a movement of staff between institutions or joint appointments in any meaningful sense. During joint meetings in the region, both research and university representatives have underlined the role that universities can play in providing the opportunity for research staff to improve their formal qualifications while retaining their research positions. Most recognize, however, that the university's comparative advantage is: in instilling a proper research ethic and skills in future researchers, and perhaps in carrying out basic research and not in competing in applied and adaptive research.

Much research in the region is carried out in isolation from, and often in replication of the same activities in neighboring countries with similar agroecological conditions. Networks are an efficient inter-institutional arrangements for developing the scientific and technological capabilities of their members. The establishment of networks between researchers in the region has been the object of many serious efforts (e.g., FAO Near East regional projects, UNDP funded regional projects, IARC's research networks, European networks—and international, in specific commodities, disciplines, production factors, and natural resources). However, networks centered around external agencies have contributed much to the region, but there is yet considerable potential to be exploited by networks created by countries of the region. In this respect, experience of European countries and elsewhere may offer relevant lessons.

B. Research/extension/farmer partnership

In many countries of the region, there is a functional gap between research, extension, and farmers. This gap has both structural and management aspects to it. There are great differences of opinion to how these linkages should be achieved and who should perform which aspects of technology adaptation and diffusion activities and what structure and linkages would make the process function as a whole. There are, at least, two main reasons for the failure of extension/research and farmer partnership: the lack of good, usable research results to extend; and the differences between national and private bene-

fits of technology adoption, which can be very large. Farmers are business people; they make decisions on the basis of potential benefits they see for themselves. If the national benefit is high, but the private benefit is low, the technology will not be adopted. A way to bridge this gap must be found.

Identification of farmers' priority production problems should involve scientists and extension. Indirect feedback through extension staff is quite useful but does not provide sufficient or appropriate information to scientists to enable them to analyze problems in sufficient depth. Successful research depends on: identifying the important problems, formulating them in such a way that they are susceptible to research; developing successful solutions, and adoption of these solutions by farmers. Thus, researchers must accept a larger responsibility beyond the development of technologies. They must become partners in the process of technology transfer to farmers.

In countries where the transfer of technology is primarily the responsibility of extension, the problems arise from weak formal links between research and extension services. The research and extension services must have built-in mechanisms for close interaction to fulfil their respective mandates. These mechanisms should provide for joint activities in the production of technological packages, testing, demonstration and adoption by farmers. The two systems must develop linkages at both formal and informal level. Suggestions to improve the relationship include establishing: (a) a clearly stated strategy of cooperation; (b) a common commitment to the goal of serving farmers in more direct manner; (c) jointly agreed upon national programs and annual work plans; and (d) regular orientation training for the staff of both services to help each understand the others' purposes and programs.

Some of the responsibilities which researchers should accept as partners in the process of transfer of technology includes:

- verification and demonstration trials on farmers' fields;
- yield maximization plots on research stations;
- on-farm research with a farming systems approach;
- feedback from extension;
- package of practices;
- sampling agronomic environments;
- training;
- feedback from farmers;
- information communication;
- other research-related services.

4. The Need for Efficient Management of Research Resources

Experience has shown that deficiency in developing and managing human, financial, and physical resources required for research is an important factor among other critical factors which determine the efficiency and effectiveness of national agricultural research systems in the region.

A. Human Resource

To be successful, a research system must hire a cadre of experienced research personnel of appropriate size, disciplinary mix, and educational level, and must be able to solve problems encountered in retaining and making this cadre productive. Thus, planning and development of human resource should be given a high priority to assist research systems in maintaining dedicated and efficient staff. Provision for degree and in-service technical and management training, sabbatical leave, and attending scientific meetings help in maintaining high quality staff with improved ability to contact other scientists, opportunities to gain scientific recognition and progression advancement, and better opportunity for promotion based on merit.

B. Physical Resource

The availability and proper maintenance of appropriate buildings, land, equipment, supplies, and support services to conduct laboratory and field experiments, as well as studies, is a necessity for any agricultural research activities. However, having a vast complex of expensive buildings and laboratory facilities, extensive land holdings, or a multitude of machinery, equipment and supplies does not automatically ensure good research. Research needs should dictate the planning and development of physical resources, keeping in mind the need to limit recurrent costs which can be a drain on scarce financial resources. Delineation of the research needs does not, in itself, totally drive the planning process, where the facility becomes an integral part of a research complex. It is that the buildings, land, equipment, and supplies be complementary in terms of size and capability, and that the research planners understand the magnitude and necessity of recurrent costs of maintenance.

C. Financial Resource

In many national research systems, the salary costs reach between 60% to 70% of the total annual bud-

get, sometimes even 80% or more in exceptional cases; while direct operational costs (including operational and experimental inputs) vary between 15% to 35% of the total annual budget. The remaining 5% to 15% is for overhead costs (indirect operational costs). These ratios are efficient if the budget level is high enough to pay good salaries to the research staff (50%-60% of the total budget) and still provide enough operational funds to use equipment efficiently, to conduct reliable on-station and on-farm experiments and studies, and to ensure the required mobility of staff.

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Annex 1

Acronyms

AAU	Arab Agronomist Union (Syria)
ACDRDCD	Arab Center for Desert Research and Desert Communities Development (Libya)
ACOLID	Arab Company for Livestock Development (Syria)
ACSAD	Arab Center for the Studies of Arid Zones and Dry Lands (Syria)
ALECSO	Arab League Educational, Cultural and Scientific Organization (Tunisia)
AOAD	Arab Organization for Agricultural Development (Sudan)
ARC	Agricultural Research Center (Egypt)
ARC	Agricultural Research Center (Libya)
ARI	Agricultural Research Institute (Cyprus)
ARI	Agricultural Research Institute (Lebanon)
AUC	American University of Cairo (Egypt)
BIRH	Bureau de l'Inventaire des Recherches Hydrologiques (Tunisia)
CAFRAD	Centre Africain de Formation et de Recherche Administrative pour le Développement (Morocco)
CIP	Centro Internacional de la Papa (Tunisia office)
CRGR	Centre de Recherche du Génie Rural (Tunisia)
DASR	Directorate of Agricultural Scientific Research (Syria)
DCB	Directorate of Cotton Bureau (Syria)
DERD	Départment de l'Enseignement, Recherche et Développement (Morocco)
DIWU	Directorate of Irrigation and Water Use (Syria)
DFRV	Direction de la Formation de la Recherche et de Vulgarisation (Algeria)
DRC	Desert Research Center (Egypt)
DREF	Division de Recherches et d'Expérimentations Forestières (Morocco)
DRES	Direction des Ressources en Eau et en Sol (Tunisia)
DS	Directorate of Soils (Syria)
EGRT	Ecole de Génie Rural et de Topographie (Morocco)
ENFI	Ecole National Forestière d'Ingénieurs (Morocco)
ENMV	Ecole National de Médecine Vétérinaire (Tunisia)
ENSA	Ecole National Supérieure d'Agronomique (Morocco)
ENV	Ecole National Vétérinaire (Algeria)

ESIAM	Ecole Supérieure des Ingénieurs Agronomes Méditerranéens, Saint Joseph University (Lebanon)
FAAISU	Faculty of Agriculture, Ain Shams University (Egypt)
FAALU	Faculty of Agriculture, Alexandria University (Egypt)
FAASU	Faculty of Agriculture, Assiut University (Egypt)
FAAU	Faculty of Agriculture, Aleppo University (Syria)
FAAUD	Faculty of Agriculture, Aleppo University, Dier Ezzor (Syria)
FAAZU	Faculty of Agriculture, Azhar University (Egypt)
FACU	Faculty of Agriculture, Cairo University (Egypt)
FADU	Faculty of Agriculture, Damascus University (Syria)
FAFS	Faculty of Agricultural and Food Sciences, American University of Beirut (Lebanon)
FAFU	Faculty of Agriculture, Fayoum University (Egypt)
FAFU	Faculty of Agriculture, Al Fatah University, Tripoli (Libya)
FAGU	Faculty of Agriculture, Gar Yunes University, Al Bida (Lybia)
FAMAU	Faculty of Agriculture, Mansoura University (Egypt)
FAMOU	Faculty of Agriculture, Monofia University (Egypt)
FAMU	Faculty of Agriculture, Minia University (Egypt)
FAQU	Faculty of Agriculture, Qualubeya University (Egypt)
FASCU	Faculty of Agriculture, Suez Canal University (Egypt)
FASLU	Faculty of Agricultural Sciences, Lebanese University (Lebanon)
FATU	Faculty of Agriculture, Teshreen University, Latakia (Syria)
FATU	Faculty of Agriculture, Tanta University (Egypt)
FAZU	Faculty of Agriculture, Zagazig University (Egypt)
FCSHU	Faculty of Cotton Sciences, Helwan University (Egypt)
FSA	Faculté des Sciences Agronomiques, Saint Esprit University (Lebanon)
FVMALU	Faculty of Veterinary Medicine, Alexandria University (Egypt)
FVMASU	Faculty of Veterinary Medicine, Assiut University (Egypt)
FVMBU	Faculty of Veterinary Medicine, Baath University, Hama (Syria)
FVMCU	Faculty of Veterinary Medicine, Cairo University (Egypt)
FVMFU	Faculty of Veterinary Medicine, Al Fatah University, Tripoli (Libya)
FVMZU	Faculty of Veterinary Medicine, Zagazig University (Egypt)
IAV	Institut Agronomique et Vétérinaire Hassan II (Morocco)
ICARDA	International Center for Agricultural Research in the Dry Areas (Syria and offices in Tunisia, Morocco, Egypt, and Lebanon)
IDRC	International Development Research Center (Egypt office)
IMPV	Institut National de la Protection des Végetaux (Algeria)
INA	Institut National Agronomique (Algeria)
INAT	Institut National Agronomique de Tunis (Tunisia)
INRA	Institut National de la Recherche Agronomique (Algeria)
INRA	Institut National de la Recherche Agronomique (Morocco)
INRAT	Institut National de la Recherche Agronomique de Tunisie (Tunisia)
INRF	Institut National de la Recherche Forestière (Algeria)
INRF	Institut National des Recherches Forestières (Tunisia)
INSA	Institut National de la Santé Animale (Algeria)
INSID	Institut National des Sols, de l'Irrigation et du Drainage (Algeria)
IO	Institut de l'Olivier (Tunisia)
IRA	Institut des Régions Arides (Tunisia)
IRESA	Institutions de Recherche et d'Enseignement Supérieur Agricoles (Tunisia)
IRRI	International Rice Research Institute (Egypt office)
IRVT	Institut de Recherche Vétérinaire de Tunisie (Tunisia)
ITAF	Institut Technique de l'Arboriculture Fruitière et de la Viticulture (Algeria)
ITAS	Institut de Technologie d'Agriculture Saharienne (Algeria)
ITCMI	Institut Technique des Cultures Maraichères et Industrielles (Algeria)
ITDAS	Institut Technique de Développement de l'Agronomie Saharienne (Algeria)
ITEBO	Institut Technique de l'Elévage Bovin et Ovin (Algeria)
ITGE	Institut Technique de Grandes Cultures (Algeria)
ITPE	Institut Technique des Petits Elevages (Algeria)
NRC	National Research center, Academy of Scientific Research and Technology (Egypt)
OMUAS	Omar Al-Mokhtar University for Agricultural Sciences (Libya)
SEHA	Service des Experimentations d'Hydraulique Agricole (Morocco)
TRI	Tobacco Research Institute (Syria)
UCCIAAC	Union of Chambers of Commerce, Industry, and Agriculture for Arab Countries (Lebanon)
WRC	Water Research Center (Egypt)