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MAJOR ISSUES IN RESOURCE ALLOCATION

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I - INTRODUCTION

The topic which will be discussed deals with: "Setting Research Priorities". The first part has been referred to as: "Major Issues in Resource Allocation".

There are two ways to treat this problem. First: the problem can be seen from society's point of view. Mainly, why consider investment in agricultural research as a priority for the public sector? In other words, one major issue is: how to increase the total funds allocated to agricultural research. This issue has been given inadequate treatment in literature. The second way to treat the problem is: in terms of establishing priorities to allocate available research funds. This aspect has received considerable coverage in economic literature.

Our discussion will cover both aspects, giving major attention to the way of increasing overall agricultural research funding.

II - FORMULATION OF A DEMAND FOR AGRICULTURAL RESEARCH

The increase in agricultural research activities results from a conscious perception of need for the new knowledge, expressed as an effective demand for new technology made by private and public sectors. As a result, research institutions are created by both sectors, eventually resulting in the supply of agricultural research services.

Two relevant questions can be raised:

- a. How does demand for agricultural research emerge; how does it grow?
- b. How can government be made to properly interpret this demand?

The demand for agricultural research is different from, say, food demand. In fact, there is no organized market for agricultural research activities where a price and relevant quantity can be established.

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Still, the demand for agricultural research is derived from the product and production factor markets.

Let us trace this process: Initially, a given country has an equilibrium condition between its population and natural resources. The population is stable, or grows in proportion to the increased cultivated areas. The technology is based on land and labour. Technical change, if any, is not significant.

In other words: as food demand grows, supply responds through expansion of the so-called agricultural frontier. As long as this is possible, without increase in production cost, there is no demand for agricultural research and resulting new technology. There may even be pressure from a selected group, with outside motivation provided by the developed countries; still, there is very little chance for development of agricultural research institutions. The existing trade-off between expansion, through bringing into production new lands and increasing productivity of cultivated areas, favors the first.

As the country grows, it changes. Industrialization steps in and some social services, like health, improve. Demographic growth increases, wealth grows, poverty decreases. Exports need to be increased. Increased urbanization, as a result of rural exodus, creates a fast-growing food demand that the traditional food supply can not satisfy.

The following chain of events eventually creates demand for agricultural research services:

- a. Food prices grow in urban areas. Low-income groups, many from a new urban population that came from rural areas, are the ones that are hurt most. Social disturbances become a real danger. The stability of government

and other established institutions is endangered. These social conditions create an urgent need for agricultural development.

b. The expanding food demand puts pressure on the cost of traditional production factors such as land and labor. The struggle of the agricultural sector is to obtain higher prices and often subsidies. There is a conflict of interest between agricultural producers and urban consumers. This potential conflict exists between cities and rural areas. It also involves new industry and traditional agriculture.

c. Exports of agricultural surpluses are diminished resulting in a balance of payments problem.

d. The country now is in a situation where there is an absolute necessity to increase the productivity of land and labour. This involves the use of modern agricultural inputs that replace the need for additional land and labour. It also includes the integration of bio-chemical technology, replacing mainly land, with mechanized technology substituting labor.

The increased cost of production, due to growing prices and agricultural inputs, results in producers demanding higher commodity prices. This leads the consumers to react, sometimes violently, to food-price increases.

Even though consumers, producers, and even exporters do not consciously speak about agricultural research, the demand for an accelerated development of the agricultural research system has been created. But it is not easily recognized by the government.

In the Brazilian case, the search for a solution to the crises, provoked by an increase of agricultural prices, went through the following stages:

a. An attempt was made to expand the occupation rate of new agricultural frontier lands, first through building railroads, and later through large highway construction schemes.

b. Since construction of a transportation infrastructure was not enough, an additional program of building a storage infrastructure was undertaken. This was justified, since it was presumed that 15% of the commodities produced were lost during marketing and transportation. Decreasing this loss could supply a part of the growing food demand.

c. The food shortages continued. There was a clear indication that land productivity had to be increased. It was assumed that there was a sufficient amount of knowledge one part accumulated by progressive farmers and the other part stored in the archives of the agricultural research workers. Based on this assumption, a massive technical assistance and extension program, including large investments in subsidized credit for modern inputs and guaranteed minimum price, was undertaken. At the same time, research funding was decreased, since it was assumed that it was possible to have self-sustained agricultural productivity growth without major investment in agricultural research.

d. Finally, starting in the seventies, it was realized that only through a systematic effort in organizing and expanding agricultural research, could a self-sustained agricultural productivity growth be achieved. In other words, several failures to increase food and other agricultural production, based on extension and supervised credit, had to be experienced before the real needs of agricultural research activities were fully realized.

As it was shown in the case of Brazil, establishing viable agricultural research programs in developing countries usually faces serious obstacles.

These obstacles delay the recognition, by appropriate authorities, of the signals that indicate growing demand for agricultural research.

Some examples of these obstacles follow:

a. As a result of the low-level of savings and shortage of capital, investment priorities have been oriented for short-term projects giving immediate returns. In other words, investing and obtaining the return should be done in the shortest possible period. These opportunities appear in the case of the consumption goods industry and the expansion of the agricultural frontier. This policy cannot include the investment needed to create advanced agricultural technology; the full cycle is rather long if we consider training the research workers, the development of new technology, and its adoption. It must be mentioned, that a research institution is just like a hydro-electric plant that initially takes some time and investment to build. However, once constructed, it provides a continuous supply of electric power. In the case of an agricultural research system, after the initial training and institution building period a continuous flow of some research results can be expected. Still, what may take a long period to obtain results are some particular long-term research projects of great importance.

b. Another parallel situation occurs in countries that have given high priority to forced industrialization, and as a result, have invested all their savings in urban-sector industries and services. Agriculture has been left to grow through incorporation of new land and additional labor. That is: an extensive, rather than an intensive form of agricultural production growth has been chosen. The agricultural research is conceived as a form of creating demand for modern inputs, requiring additional capital for the agricultural production process, and allocation of part of the savings to agriculture in rural areas instead of the urban-industrial complex. This is not considered a priority within the above-mentioned policy of accelerated urban-industrial development.

c. Agricultural research needs human capital in the form of highly trained research workers, laboratory personnel, and others. These types of professionals are in short supply. This is due to the fact that graduate training has not been institutionalized or is just incipient.

Proper institutional development of research systems requires paying salaries well above the existing scales for most public service personnel. In addition, the cost of hiring foreign technicians may have to be included. The political structure may not tolerate a high salary differential within public service. Once the differential is institutionalized, political pressures may develop, forcing, in part, allegiance rather than professional merit as the criteria for filling any high-paying position.

In addition, inflation may wipe out any established salary differential due to the common practice of adjusting salaries at a rate below the actual level of inflation. Thus, the critical mass of research scientists could easily be lost to the urban industrial complexes of developing countries, or may even be absorbed by the developed countries, before they are able to make any significant contribution to their own country and its agriculture.

d. Even when the government is mature enough to accept increased salaries for its research personnel, it may not be able to allocate additional resources for complementary expenses such as: foreign specialists, outside training, and the purchase of modern research equipment. In this case, international financing institutions become very important. It is worth mentioning that various bilateral and multilateral assistance agencies have, during last ten years, learned how, and have accepted the need to finance research. Still, there is a long way to go before the needed flexibility can be worked into foreign grants and loans given to agricultural research.

III - MOTIVATING INVESTMENT IN AGRICULTURAL RESEARCH

The question is: how can the public authorities be convinced to invest in agricultural research, when it becomes clear that the vertical, or productivity frontier, represents a better alternative for increased production, as compared to the traditional horizontal frontier, or the occupation of new agricultural areas? The last alternative may be based on opening new production areas in far away, and sometimes nonfertile lands with no infrastructure. It can happen, as in case of the Amazon basin in Brazil, that rational exploitation of new frontiers, located in a different ecological system, depends on new research results. Quite often a country may have run out of new unexploited land, and has no alternative except to increase the productivity of already cultivated land.

The major idea is to make society and decision-makers realize that: increasing the productivity of agriculture is a necessary condition to adjust the interests of consumers and producers; that it is the best way to stop rising food prices without diminishing the food supply and related items, and also to increase their competitive position in foreign markets. Finally, it is essential for the success of the overall development policy.

To change the traditional attitude of indifference, or even opposition to research, to one of full-hearted support needs time, particularly when little has been invested in education. Still, the only way is to start an action program that aims to educate the people and the leaders to its potential value and to the great need for building a strong national agricultural research system.

Mobilizing overall societal support, including support by special interest groups, is the best way to assure the continuous allocation of resources to a given activity like agricultural research.

Building this support includes various activities such as: organizing debates at the universities, and at other educational institutions, leading to continuous coverage by the popular press. Special seminars and other cultural activities, dealing with particular subjects, may have to be organized, taking into consideration the special situation of each country and/or a particular region. Some examples of the topics are given below:

- * The role of research in improving nutrition and stabilizing food prices.
- * The role of research in improving the quality of food and reducing environmental pollution.
- * Research as an instrument of self-reliance. This, it could be argued, is due to decreasing dependence on imports.
- * Research as a means to increase export earnings. The agricultural surpluses, resulting from increasing productivity, could pay for imports needed for development programs.
- * The income distribution effect of research. Here, one can show that increased food prices affect mostly the low-income population since a decreased food budget provides the largest percentage of additional income for the same group.
- * Research as a factor for social stability. Since food shortages contribute to inflation and may result in public disturbances, this may affect the stability of government and other institutions.
- * Research as a means of stabilizing and increasing rural income. Better yields and control of the environment will decrease the risk, stabilize production and will increase the individual income of the rural population.

- * Relate research programs and results to major problems affecting the country. Just listing the actual and potential program and results, without showing the linkage between these and the great problems faced by the country, may have little impact. Thus, the program and expected results must be presented within the context of the social and economic problems faced by the country.

Too often, this task falls upon traditional research workers and research administrators who are used to dealing with scientists and technicians within research establishments, and not people outside the research institutions. As a result, poor communication between the researcher and general public may constitute a major bottleneck. Thus, these efforts have to be undertaken by professionals acquainted with social sciences such as economics, communications, public relations, and politics.

The general effort to influence the general public is a slow process. The work on special-interest or target groups may have a faster pay-off.

These groups include those that at present hold political and economic power and influence the process of allocating public and private resources. Since the research must be based on long-term financial stability, building a support base can not be limited to members of the existing power structure. Due attention should be given to those that may eventually replace the current power structure.

Among special target groups one can mention:

- a) Elected and appointed executives including the congress
- b) Members of the established press
- c) Economists and other social scientists
- d) Members of military establishments

- e) Church organizations
- f) Producers' organizations and labor unions

To be able to influence these groups, some techniques can be listed:

- a) Preparation of special, short, and easily readable material showing potential and actual benefits of research.
- b) Organization of special events with wide participation such as: opening and inauguration ceremonies of new research units, release of new cultivars, and other public activities.
- c) Lectures given by researchers and research administrators during various public events.
- d) Organized visits and guided tours of research units with special emphasis on showing research results.
- e) Providing special advisory services to selected farms or whole regions.
- f) Undertaking joint research projects with the private sector.
- g) Special children or student programs including specially selected schools from various neighborhoods. In some cases, parents can be easily influenced through the creation of a good image among their sons and daughters.
- h) Organizing media programs on television, on radio, through popular newspapers, through magazine articles, etc.
- i) Special efforts to establish good relations with the resource allocation and decision-making community such as: state and federal officials, legislatures, and others.

- j) Participation in academic activities, when possible, with University systems, particularly through graduate training programs.
- k) Joint activities with international institutions that are offering technical and financial assistance so as to maintain research in the spotlight for obtaining financial and technical assistance when needed.

It is worth mentioning, that often agricultural research is spread among a large number of public institutions without any coordinating structure. In this case, it is advisable to establish an ad hoc committee to coordinate the above mentioned activities. This due to the fact that individual efforts to get recognition by each institution separately may hurt the whole system or result in duplication of efforts and waste of precious resources such as the researcher's time and money needed for experimental work.

The agricultural research system, in addition to young and established research professionals, must include two special skill groups. First, it must include Professional Journalists with established reputations and access to communication media; they will help to create a good, direct contact with the media, and show the research community how best to deal with the general public. The other group must consist of economists trained and experienced in macro-economics who will relate their research to aggregate, sectoral, regional planning, and relevant resource allocation activities of various governmental and private organizations.

Finally, it is worth emphasizing again that it is of paramount importance to have research workers trained and experienced in relating not only to professionals, but also to the general public. They should be able to give talks and make public appearances, whenever possible. Always presenting their individual results without exaggeration, excess humility, or shyness. They should

know how to appear on television, radio, give interviews, and prepare news releases for the popular press. There must be a continuous effort to promote and recognize good research workers, to obtain society's respect, and even admiration for these professionals, when possible.

IV - RESEARCH PRIORITIES

Once a sufficient amount of resources have been mobilized, all efforts must be made to allocate these resources in the most optimal form. This section deals with the problems of establishing priorities to allocate resources within a research institution. In the case of mature and established research institutions, with a tradition and a mission, this process is rather self-perpetuating and has a self-correcting feedback system. The problems come in the case of new organizations that are in the process of institution-building and searching for the best alternative among various possibilities, including identifying the target groups. Here, the situation will vary from country to country, and from one region to the other.

For those countries with a large urban industrial complex, the major preoccupation is with food supply for the urban population. For another, trying to keep their population in rural areas, the emphasis is on improving per capita income, nutrition, and the food supply at the farm level. In other word, one has to identify with care the location of major social problems and the current trends, in terms of population movement and rates of migration. The following are the resulting implications for allocation of resources in research:

- 1) The research projects portfolio. It is necessary to have in mind that the research projects must be selected in such a way as to help the institution to get established and to grow. For this reason the great majority of the projects selected have to be able to present results

in a short period of time with potential impact on the relatively large areas. The crops that are easier to work with are those that have been under research for a long period of time in the advanced and developing countries. In these cases, it is possible, by adaptive research to obtain results in a short-run. But it may happen that these crops are cultivated in large land holdings and are export crops. Conflicts of interests with the small farmers and consumers are likely to appear. In addition these crops may not be included in the priorities of the donor community that supports the interests of the small farmers. If the interest of consumers and small farmers in research is really strong, the tendency for the research project mix is to concentrate on the crops for the internal market mostly cultivated by the small farmers. But in most of the cases these crops have not been researched and consequently it is possible that the results will not come in the short-run and this may lead to the discrediting of the research institution. In the selection of the research priorities, it is therefore important to balance the interests of the pressure groups like small farmers and consumers and the needs to obtain results in the shortest period of time possible.

- 2) Welfare of urban and rural population. When one makes the welfare of the rural population the major criteria for selecting priorities in agricultural research, the emphasis on small-farmer technology becomes evident, given the larger number of small producers. However, the small scale production of these farmers results in small surpluses, if

any, to be offered to the urban sector. If the larger part of the total population is located in the urban sector, including the majority of low-income groups, the supply of technology to the low-income farmers, to improve their economic condition, may further deteriorate the food supply and increase the poverty in urban areas.

At the same time, a country may be experiencing rural migration to such an extent that, by the time technology for the small farmer has been developed, he may have already emigrated to the city, and there are no more small farmers in a particular area to use the technology developed for them. Or, these small farmers may have formed a cooperative to use modern large-scale technology, and some have grown into larger farmers and are not interested in small-scale technology. In this case, the resources allocated to create technology, specially and solely adopted to the small farmer, may not be of any use and constitute a lost cause. As a result, one has to consider the existing trends and project the movement of population and time needed to generate special kinds of technology, so as obtain the proper technology mix at some future time that will best serve all social groups involved. That is, research must follow the historic trend of social progress and related technological development and not go against it.

The conflict of interest, if any, between large and small farmers can only be analyzed in terms of the level of urbanization of the country and the real objectives of economic development policy. In addition, research institutions can not neglect economically strong interest groups, within commercial agriculture, who could have influence in terms of overall mobilization.

With the increase of urbanization, a new area of research: marketing losses between producer and consumer become a priority. These losses can grow to the extent that they may cancel most of the increase in productivity at the farmer level, as far as consumers are concerned:

3. Expansion of new arable land, as opposed to the increase of productivity of already cultivated land. Some countries still have large, potentially arable areas, and have very little available knowledge about their agricultural potential and limitations.

The research benefits derived from the best way to cultivate these areas are not obtainable in a short period of time. This is due to the fact that agricultural activities, first have to be implemented, and only then one can see the actual fruits of research. There are always strong political pressures to develop these areas. Thus, agricultural research institutions sometimes have to, in spite of their need to generate quick results, get involved in long-term undertakings with no immediate results to show to the public. There is a temptation of starting the research in new areas by first producing a detailed inventory of existing natural resources including photogrametric mapping, soil surveys and establishing a climatic data bank. This type of research work does not provide concrete results in terms of increased agricultural production as far as general public is able to conceive. Even though this work is essential, an immediate action program should be undertaken aimed at the problems of the already established agricultural producers in the area. This may include introduction of new crops and livestock production.

4) Production for local consumptions, as opposed to energy and export crops. The problem appears in the newly industrializing countries with a high percentage of urban population and an urban-rural conflict of interest. In general, most of the crops consumed locally are produced by small farmers. At the same time, export, and more recently energy crops, in some countries like Brazil, are dominated by large commercial farmers, usually well represented in the existing power structure. It is difficult for a research system to be established and have continuous financial support without showing concrete results related to these crops. At the same time, the society undergoes a transition that affects food habits, and moves toward increased consumption of meat, fruits, and vegetables. This includes mostly higher income groups. The low-income population still follows the traditional subsistence diet based on starch and vegetable protein. Since these commodities have a low income and price elasticity of demand, the commercial producers try to avoid these crops. As a result, these products either show high increases in prices, heavily affecting the urban poor, or drastic lowering of prices at the farm level, affecting producers without substantial price decreases for urban consumers, with most of the benefits absorbed by the intermediate sector. The political implication of these rises and falls in price are dramatic for the research establishment. Sometimes the research is made the scapegoat, and blamed for neglecting basic food crops. There is no way but to insure adequate coverage of these crops, in terms of research projects producing results fast. Still, changing preferences and habits have to be included in medium to long-term programs to avoid future criticisms.

(5) Intermediate Technology. A strong pressure is exerted on research to generate simple technologies with relatively low-energy inputs, easily adaptable to existing production systems and capable of assimilation by large masses of producers. As long as the spread of this kind of technology does not substitute for a more productive alternative technology and limit potential productivity of land and labor, it should be encouraged. However, if this types of technology has an opportunity cost in terms of sacrificing potential increases in productivity and total production, resulting in welfare loss to consumers and decreasing export earning potential, it has to be re-evaluated. In other words, in newly industrializing countries, with high percentage of urban population, overemphasis on intermediate technology, that does not make full use of available scientific knowlege and does not result in high productivity of agriculture, may lead to limiting overall growth and development. In this case, on a national level, a larger number of people will lose from not using the full capacity of science-based agriculture, as compared to the number of those who will benefit from the practice of less-than-optimum agricultural production technology.

As far as the energy consumption of various agricultural technologies is concerned, when energy and not land is the limiting factor, the proper technology assessment should be based on the production obtained from the use of a unit of energy, and not the traditional concept of the consumption of energy per hectare. At the same time, measuring the efficiency of energy should not be limited to on the farm consumption, but should be expanded to include total energy || it consumption until it reaches the consumers.

Sometimes the strong urban-industrial and marketing interests pressure agriculture to decrease the use of energy, or pressure them to make energy more expensive for the farmers. This pressure may result in a decreased consumption on farms, but an increase in transportation, storage distribution channels, and that

is where these groups have a vested interest. For example, a large-scale production of food, using few modern energy intensive inputs in areas far away from major urban consumption centers, resulting in a high transportation cost, may be less energy efficient when compared to increasing productivity through energy-intensive inputs in areas close to the urban consumption centers, and thus having a low transportation cost.

6. Social Sciences. There is a strong tendency and tradition, among agricultural research institutions of developing countries, not to invest in economic and rural sociology. At the same time, this type of research generates most of the information needed for establishing research priorities, based on actual and potential problems of the population, that must be addressed. For example, economic evaluation of potential adoption rate, and its extent, provides a feedback for scheduling various research programs and projects. Relating technical recommendations to market conditions will indicate the most economically sound, new technologies for immediate diffusion and adoption. In addition, as mentioned, the presence of a well-trained group of social scientists acts as a liaison, or go-between for the political and economic power structure that controls public and private resources.
7. Exclusion Principle. The rationale for any resource allocation system is based on the Exclusion Principle. This means that we assume that most of the technology developed for large farmers automatically excludes small ones; that the technology developed for commercial farmers excludes subsistence groups. Or, if the interest of the consumer is taken into consideration, this will exclude any benefit, or will hurt producers.

This may be due to fact that we are not properly using organizational technology and a new management systems approach that can solve many of the above mentioned potential conflicts. These so called small producers can be as sophisticated as the larger ones, when given proper technical assistance, and/or organized into cooperatives to solve economy-of-scale problems inherent in many modern technologies. An alternative to buying large-scale machinery is having machinery-renting firms, or cooperatives, that will provide mechanization, at cost, for any farmer, and will provide artificial insemination and other services not usually available to small farmers in developing countries. Examples of this can be seen in Puerto Rico, Japan, and some European countries. In other words, the Exclusion Principle, that constitutes the essence of most potential allocation conflicts, loses its importance when potential application of modern management or organizational technology, including data processing capacity, of new computer technology, is fully exploited.

V - FINAL REMARKS

This paper has concentrated on practical problems encountered by a young and growing agricultural research institution, in terms of having the society allocate a substantial flow of resources to agricultural research. As far as allocating these resources among alternative programs and projects is concerned, only some major issues have been mentioned that will facilitate an increase of overall allocation of resources to agricultural research and will stimulate discussion and indicate the need for establishing priorities. These priorities have to established for each developing country based on its stage of development and projected growth.

A rather extensive literature dealing with quantitative methodology, based on subjective and objective data, has not been covered. A rather detailed bibliography* of these studies is included as an appendix to be used by those interested.

* This bibliography is reproduced from: Prioridades e Alocação de Recursos na Pesquisa Agropecuária (Priorities and Resources Allocation in Agricultural Research, by Elísio Contini et. al. EMBRAPA-DDM. Brasília, 1983, pp. 40-46.

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