AGRICULTURAL RESEARCH PROJECT PROPOSAL PREPARATION [1]

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INTRODUCTION

Agricultural research is as old as mankind. This may seem to be an oversimplication of the field but if we reckon that changes in agricultural practices have taken place all the time and that these changes are as results of "trying" by farmers and others, then the general statement is true. However, "trying" is unsystematic and this justifies the new approaches to research. Systematic research is relatively young and dates back to 18th century during the agricultural revolution. In accordance to today's scientific research, the work carried out in Europe in the 18th century was essentially unscientific and characterised by lack of standard procedures, scientific theories were weak, at times unproven and superstition was mixed with scientific concepts. One of the typical misconceptions was the idea of transmutation of earth and water into plant tissues. Acknowledged systematic research was started by Boussingault in Alsace, France in 1834. The first agricultural experimental station had carefully planned field experiments and a support laboratory. World wide, there are now thousands of research stations, proven scientific theories exist, literature is available and there are scores of agricultural scientists. Agricultural stations in developing countries are still growing and the number of scientists is still small and consequently coverage of the various disciplines is patchy. The few scientists in the developing countries are faced with the problems of choosing a field of study, using efficiently the limited facilities and scarce resources. This paper addresses itself to these problems.

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[1] Paper prepared for Malawian workshop on formulation of Research proposals.

BACKGROUND INFORMATION

Justification for Research in Developing Countries

In general, developing countries (particularly small countries) have limited resources. Consequently personnel, research facilities, support services (library, technicians etc) and financial resources for recurrent expenses are all serious bottlenecks, therefore, some argue that developing countries should utilise the technology available from developed countries directly, thus saving the countries the various resources. It is however encouraging to see that this argument is largely not being heeded. The justification for agricultural research to be carried out in the developing countries is based on the fact that environments (agroecological zones) vary a lot and the direct application of technology from temperate countries is bound to fail and cause disastrous results.

It is also important to recognise the obvious constraints mentioned above which limit how much can be done and it is critical that the resources available should be utilized to the maximum and efficiently. In order to achieve this optimum use of resources agricultural scientists for developing countries should be trained to deal with wider fields, as there is a great demand for them to cover inevitable gaps in personnel. Further, agricultural scientists should learn to work with relatively inexpensive equipments. Scientists who have been trained in developed countries using sophisticated equipments have to adapt to conditions in developing countries and those who fail to adapt become frustrated.

Team approach is one of the best approaches in developing and executing effective research programmes. In developed countries, technologies generated through research are fitted into existing agricultural practices by commercial firms and well organized extension services. On the other hand, technologies generated through research cannot easily be imparted to small scale farmers in developing countries as the small farms are complex in organization. A typical small holder keeps livestock (chickens, goats, sheep, cattle or pigs), grows his own food crops and grows cash crops. If he is to progress he needs all types of technologies e.g. animal husbandry, crop production and grain storage

Attempts to develop one subsector results in imbalances. An example is an emphasis in cash crop production during the colonial periods resulted in neglect of food crops and livestock. A combined approach would have averted imbalances. In addition to this, one finds that even within one crop there is a need to combine several disciplines. If one considers a research programme on the introduction of a new maize variety scientists have to test for adaptability, disease resistance, nutrient and water requirements, day length, weeds, pests, milling quality and technological suitability. Only a team can tackle this.

Definition of Agricultural Research

There are several definitions. One of the simple ones is given in the Pocket Oxford Dictionary as "Endeavour to discover new or collate old facts etc. by critical study". Research administrators such as Klopsteg define research in a more comprensive way as "Research is original and creative intellectual activity, carried out in the laboratory, the Library or the field, which endeavours to discover new facts and appraise and interpret them properly in the light of previous knowledge. With constantly increasing understanding, it revises previously accepted conclusions, theories and laws, and makes new applications of its findings. Whether it seeks to extend knowledge for its contribution to human welfare." While research has variations in definition, the classification of various activities into research per se is generally universal.

When one attempts to sub-classify research into e.g. basic vs applied; academic vs practical; pure vs applied; one is faced with the problem of bias. The basic problem in the classification is the inherent characteristics of the various classes tend to overlap and therefore classifications are based on subjective judgement. The ambiguity is most common in agricultural research as research activities in agriculture are aimed at application by the farmers and logically one can argue that agricultural research has no basic aspects.

But agricultural scientists have developed their own criteria and define basic research as one which investigates new principles and understanding of underlying processes. Applied research is one which aims at adapting new principles and techniques to specific environments or problems. With these definitions it is clear that the two types of research are complementary.

Research funding organizations tend to favour "applied research" in developing countries but who judges that a particular activity is applied or otherwise? It is up to the scientists to convince the sponsors that the planned research activity has direct application or potential for adoption in agricultural practices. Let us consider a proposal on the study of the life cycle and ecology of a common grain weevil Sitophilis Species. Is this a basic study or an applied study?

As the judgement as to whether a proposed research activity is applied or basic is subjective, it is best to use other criteria in choosing a research topic, namely relevance to national aspirations and general objectives of agricultural research.

National Aspirations: Agricultural Perspectives

Without exception all countries desire to be "self-supporting" in food production and avoid depending on other countries. While many countries cannot produce all types of foods required due to agroecological limitations it is preferred that a country should not be a net-importer of foods as importations cost scarce foreign exchange and dependency on food imports exposes the country to possible external manipulations.

Malnutrition is common in developing countries and many countries wish to improve the nutritional levels through increased supplies of foods and better quality foods. National resources should inevitably be directed towards this.

In the course of industrialisation, developing countries logically start with agricultural processing industries and this inevitably creates a demand for specific raw materials. It is only through sustained production of raw materials that the industries can run.

Agriculture has to produce export crops to earn foreign exchange which can be used to sustain agriculture and other industries. Initial capital for industries and infrastructural development also always arise mainly from agricultural exports.

The majority of the people in developing countries are engaged in agriculture and governments' aspiration is for increased productivity and improvement of the living standards or rural people.

These aspirations are in fact the basis for agricultural policy and priorities.

General Objectives of Agricultural Research

The contribution which agricultural research makes in ensuring that the national aspirations are met is in the generation of technologies. In drawing up the objectives aimed at generating technologies the following stages are involved:

1) Understanding of the status quo ,
2) identification of the problems,
3) defining explicitly the problems and
4) suggestion of alternative solutions which are experimented on.

For each study the objectives are very specific, therefore the general objectives listed below are intentionally not detailed.

i. To increase productivity per production unit. The production unit can be a crop or an animal on a unit land.

In the course of increasing productivity it also aimed at increasing the efficiency of utilisation of inputs of labour, energy, fertiliser, animal feed, pesticides/fungicides, water for irrigation, etc. Ultimately increase food supplies and incomes and raise standards of living.

ii. To determine optimum levels and combinations of inputs for economic returns.

iii. To stabilise the agricultural and related industries through long term strategy e.g. droughts, bird invasions, locust invasions, crop/animal breeding programs, marketing, germ plasm storage, range monitoring, employment generation, raw material supplies for the industries, inputs for manufacturing industries.

iv. To improve the quality of agricultural products such as protein quality, flavour, processing quality, presence of toxins and other consumer preferences.

v. To solve imminent catastrophes eg. new insect pest, outbreak of a new cattle disease, toxins in stored products, breakdown of vaccines etc.

Identification of Research Topics

Pre-requisite: An agricultural scientist has to understand the agricultural industry to enable him to identify the problems and choose among them the most limiting factors (problems) to be tackled first as in may cases it is not feasible to study all the problems at once. "There is always the danger for the researcher to identify problems that motivate him irrespective of the insignificance of the problems"

Actually the law of diminishing returns applies in agricultural research, initially, relatively simple and empirical experimentation may give spectacular results; however, a stage is reached where further progress is dependent on a greater research effort.

Examples:

Maize yields improvement through: hybridization and fertilier usage
Milk production improvement through: cross breeding and supplementary feeding.

National Level: It is needless to emphasize the fact that agricultural research in each country must apply itself to solving the problems of her farming community and the needs of the country as a whole; and must be planned on a long term basis. Further, agricultural research must respond to changing social economic environment and must therefore be dynamic. A sound national agricultural research resource allocation priorities is essential. Excellent papers on agricultural research resource allocation and priorities were presented in a workshop in Singapore (see Resource Allocation to Agricultural Research, Proceedings of a Workshop held in Singapore 8-10 June 1981 IDRC-182e).

Identification of Research Topics by Researcher(s)

In developing countries the areas of study are wide open and scientists are faced with the problem of deciding on the topics. While the opportunities are vast the researchers are obviously constrained by insufficient funds, personnel and facilities. It is a reality that this is the general context within which scientists in developing countries have to make their decisions and work. The process of choosing a project is largely subjective but there are suggestions of using impirical methods. In this approach components are included in a mathematical model such as:-

$$\text{Index} = \frac{\text{estimate of value of research if successful} \times \text{estimated chance of success}}{\text{estimated cost of the research project}}$$

One of the major problems in using the formula is that there is a lot of guess-work involved in putting figures in the various components.

Some countries notably Peru (Paz, 1981) are adopting a rating system which is based on the importance of a crop or animal to the national economy. The objectives of; contribution of a commodity to total agricultural production; the value of the product per hectare; contribution to farmers' income; contribution to farmers' food; savings of foreign exchange; value of imports required for inputs; employment generation; and cultivated land are weighted. Qualitative aspects of; potential for productivity increment; importance of incorporation of new land; possibilities for industrialization and potential for production due to ecological diversity are also weighted. Each objective is weighted to its relative importance to add to an aggregate of 100. The ratings are made by a panel. Data on different agricultural commodities are collected and the relative importance of each commodity for each objective (parameter) is calculated. The weight assigned to each objective was then given a rank according to the relative contribution of each commodity. An example of the worked out ratings is given in a handout. Certainly a simpler rating system can be worked out and used. The rating also falls short of identifying the problems in each commodity or subsector.

The commonest method of selecting a topic of study is the use of common sense and intuition. This is improved where scientists use background information, data and inputs from other disciplines. Experience is also an asset. In subjective judgment the criteria used in the mathematical model and rating are used without weighting them numerically. The method is fast but can lend itself to misuse.by bias.

The following is summary of the factors that a scientist should consider in selecting a topic of study.

1. National goals and priorities:

   i. short and long term objectives
   ii. urgency of the research
   iii. neglected areas but of national significance.

A proposal should always fall within the existing national research goals and priorities. If there are no research priorities set one can extrapolate from national agricultural policy and priorities or development plans.

2. Importance of the commodity to be studied in form of absolute and relative contribution to:

   i. the agricultural industry
   ii. the gross national product (GNP)
   iii. the farmers' income
   iv. the food supplies
   v. the foreign exchange earnings
   vi. the foreign exchange savings
   vii. production of raw materials to the industries.

   Data can be obtained from central statistical units on the above. Emphasis should be placed on commodities which contribute significantly.

3. Productivity of the commodity:

   i. productivity per unit area
   ii. value of product per unit area
   iii. value of product per inputs

   As resources of land, labour and other inputs are scarce, commodities with higher outputs per unit area or inputs are likely to be more beneficial.

4. Likely impact of the utilization of the results:

   i. ease of adoption of technology by small farmers
   ii. social implications
   iii. potential productivity increment per unit area or animal unit.

iv. value of the product increment
v. contribution to nutritional needs
vi. value of required inputs to be imported.
vii. handling, storage, processing, marketing of products
viii. employment generation
ix. environmental impacts

Within the existing social economic set up can the technology be absorbed easily and what are the other implications? The above should be considered.

5. Technical feasibility

i. personnel - scientific, and support
ii. facilities - laboratories, field stations
iii. equipments - scientific and field

Are these available within and/or outside the country

6. Existing research programs

i. avoid duplication of efforts
ii. strengthen existing research programs and projects.

Make a review of existing and submitted research proposals in order to achieve i. and ii.

The Scientist and the Funding Agent

Scientists are always faced with the problem of procurement of funds for the execution of their research proposals and plans. The logical starting point for possible funding is the establishment of contacts (communication) between the scientists and the funding agent. This is followed by a dialogue.

i. Establishment of communication: Scientists should try to know as many funding agencies as possible through prospective literature, informal and formal contacts of their representatives. This information helps in knowing the mandate and modalities of operation of donor agencies and identifying those which are most likely to fund the proposed research. Within this the scientist(s) can forward his/her proposal to a prospective agent.

Donor agencies usually have identified target group(s) e.g. rural, urban, aged, infants, poor, school-age, refugees, etc. Within these groups, there are long term goals. Each funding agency has its own criteria for funding agricultural research and the following are typical criteria used:-

- Target groups: Many funding agencies are unlikely to fund studies aimed at improving groups which are already previleged.

- Urgency of research: Problems which need urgent attention usually get priority in funding.

- Meeting national goals and priorities: Projects within the national goals and priorities usually get national backing and support and are likely to be funded.

- Size of agricultural subsector: The contribution of the subsector to GNP, food supplies, enviroment, fuel energy, exports is usually considered in funding projects. The most significant contributing subsectors are likely to be funded.

- Technical feasibility: Given the present available scientific and technical staff, facilities and equipments, is the project a viable proposition?

- Likely contribution of research results: Will the results contribute to new knowledge? Proposals whose expected results are easily adopted by farmers are most likely to be funded.

- Length of study: Some agencies are unlikely to fund projects which will take many years before any results came out.

- Costs involved: Each funding agency works within a range of budget size and the likelihood of funding falls in the same range. The budget should also reflect the expected benefits of the research.

- Neglected study areas: Some areas have been neglected for historical reasons and some agencies give priority to these for funding.

There are some funding agencies which rate projects numerically by giving each criterium a numerical weight and each project proposal is scored against each criterium at any of the several grades scored. The listed criteria can also help the scientist to elicit information from the donor on donor's criteria and also in judging the prospective merits of getting financial support. The scientist should then send the proposal to the prospective funding agency through the proper channels of communication. Usually funding agencies respond fast and react as to whether there is interest in further development of the project or otherwise.

ii. Dialogue between the scientists and the funding agent: A dialogue between the scientist(s) and the representative of the funding agency develops after an initial interest by the prospective sponsor. One of the crucial things in the process of searching for funds is the adequacy of information provided by the scientist to the prospective sponsor. The information provided should be brief but informative on research personnel, institution, research proposal and country.

Scientists have to educate sponsors on their respective institutions in respect to their mandate and reputation of institution. Information on the country's geography, and demography and agricultural industry forms a good background information. Specific information on the subsector to be studied should be included and the roles of the product(s) in food supplies, foreign exchange earning, GNP, employment generation, enviroment, import substitution, raw materials supplies and potential.

How much should the representative of a donor agency influence the final research proposal? This is certainly an open question but it is important that sound original objectives and methodologies should be retained as the project is implimented by the researchers and not the sponsoring agent.

Formats of Research Proposals

The choice of formats for research proposals is unlimited and probably equal or exceed the number of research institutions and funding agencies. Therefore variations are great and expected. When it comes to specific institutions the formats are limited within an institution. Many have prescribed headings and subheadings. Attached are two examples of the formats excluding the budgets. Are they adequate?

Format: International Atomic Energy Agency - Research Contract Proposal

1. Name and address of institute:
2. Department where research is to be performed:
3. Title of project:
4. Project personnel:

   A. Principal Investigator
      Name and position held

B. Academic degrees held.

C. Previous experience.

D. Recent publications (within the past 2-3 years)

E. Additional scientific staff: (for each scientist.)

Names Academic degrees

Previous scientific experience

F. Other staff

No. Types of staff

5. Scientific background of the project.

A. Significance of overall problem.

B. Related Work Already Performed or in Progress at Other Institutes.

C. Related Work Already Performed or in Progress at Institute.

D. References to Relevant Literature.

6. Scientific Scope of the Project

A. Detailed Research Objectives.

B. Relationship of These Objectives to Present Knowledge and to Other Similar Projects at Institute or Elsewhere.

C. Detailed Work Plan for First Year, Including Proposed Methods or Techniques.

7. Please list Facilities (buildings, equipment) presently available which would be used for the project

8. Budget - salaries

- additional equipments

9. Budget.

An example of Research Proposal Format in Agricultural Sciences - IDRC

1. Title
2. Institution(s) and address(es)
3. Project personnel
   (a) Leader(s)
   (b) Team members and roles
4. Background information on country
   (a) Size of country and land use (cropping, livestock and forestry), ecological zones and soils
   (b) Population: size, distribution (rural, urban and migration) and growth rate
   (c) Agricultural industry:
   Agricultural production statistics (production levels, trends, contribution to GNP and export)
   Optional emphasis on any of the relevant areas
   (i) Livestock option: Livestock populations, distribution and growth rate livestock production (beef, milk, mutton), total and production indices (reproduction rates, growth rate, milk production, mortality, market offtake).
   Livestock products sold and value
   " " consumed per capita
   " " imported and exported
   Characterise existing production systems and identify problem(s) to be investigated.
   Potential for increased production in relation to government policy.

(ii) Crops Option: Crop production statistics (total production, production per unit area and relative importance of various crops in various ecological zones). Importance of crop(s) to be investigated. Quantities of crop(s) sold and value, consumption per capita, exports and imports of the crop. Identification of problems to increasing production and importance of problem to be investigated. Potential for increased production bearing in mind the government policy.

(iii) Post-harvest Option: Present patterns of staple food production and consumption (quantity). Present system of handling, storage and processing of earmarked staples and food preferences. Identification of problem(s)(quantity, quality) in the food chain. Likely impact of research results on availability of staple to population and quality of food available bearing in mind the government policy.

(iv) Forestry Option: Present land uses and trends in afforestation. Present systems of using forest products and trends in resource depletion. Identification of problems in foresty industry and problem(s) to be studied. Likely impact of study on

forests productivity, forest products utilization, and soil/water conservation.

IF THE COUNTRY IS LARGE AND STUDY IS RELEVANT TO ONE ECOLOGICAL ZONE ONLY REPEAT BACKGROUND INFORMATION FOR STUDY AREA ONLY.

5. Background information on institution
   (a) Name(s)
   (b) Mandate to conduct research and other activities.
   (c) Short description of institution
   (d) Related work already performed or in progress at the institute(s)
   (e) Facilities available for research.
   (f) Research team.
6. Objectives of Study:
   (a) General e.g. to increase production.
   " " efficiency
   " improve quality
   (b) Specific objectives.
   e.g. to select for high yielding maize variety
   to find optimum N and P fertilizer application rates
   to develop disease/pest control package
7. Methodology
   Describe methodologies to achieve each of the objectives listed above. Appropriateness of technologies being tested for adoption by farmers e.g. use of boom sprayer for weed and insect control vs use of hand sprayer.

(a) There should be a detailed chronological methodology for each objective. Each step in the methodology should include:

- method to be used
- who will do the work
- what equipment and materials are needed
- how long it will take

It may be useful to allow an extra six months in the project in the first year, to allow for hiring and training staff, purchase of equipment, and prepare for a baseline survey (if applicable)

(b) If consultants are needed their specific functions and the time for which they will be required should be outlined.

(c) If the research is to be carried out in co-operation with another institution the specific responsibilities of each shoud be clearly spelled out.

(d) As much as possible, data analysis should be done on equipment which can be found/maintained within the recipient institution.

(e) The methodology should include how the project will be evaluated. Where appropriate, economic feasibility and socio-acceptability testing should form an integral part of the methodology.

8. Beneficiaries of the project: Include short term and long term target populations and how they are likely to benefit from the results.

9. Schedule of activities: List activities shown in methodologies. The time plan should indicate who in the research team is doing what at a particular time. It should be accurate such that both the recipient and IDRC can determine whether time, staff, equipment and material requirements are adequate. It may be practical to allow extra time in the first year due to the need for preparations.

		Year 1	Year 2	Year 3
e.g.	Purchase of equipment	-	-	-
	" " seeds	-	-	-
	Plot establishment	-	-	-