Chapter 7
Planning and Writing a Research Proposal

Good fortune is what happens when opportunity meets with planning.
Thomas Alva Edison (1847–1931)

Research is a costly venture. In a research organization inclusive of university and college departments, funds for research are released only after careful scrutiny of the merit of the proposed work. A formal research proposal and its approval are also necessary for thesis works of students. In addition to the in-house funds of the organization, scientists may get funds from external agencies—both national and international. Fortunately, there are several funding agencies to promote research and development in specified areas, usually on project mode, by providing grants to individuals and groups. Therefore, instead of waiting for the meagre resources of parent institutions, scientists can approach a suitable external agency for financing research projects. Your success in obtaining a research grant means that you and your institution are benefited in various ways.

The funds for research normally come in the form of grants from agencies specifically created for the purpose. Most of such donor agencies are government controlled, but grants are available from private donors and international agencies too. The term *grant* denotes a sum of money disbursed by a donor, often a government department, corporation, foundation, or trust, to a recipient such as an individual, non-profit organization, educational institution, or business institution for a specific project or purpose. Unlike *loans* that must be repaid with or without interest, funds provided in the form of grants need not be repaid. However, you have to compete for research grants by presenting your research proposal in the prescribed format, and funds for research are released only after careful scrutiny of the merit of the proposed work. A formal research proposal and its approval are necessary for thesis works of students as well.

Often, there are two kinds of grant applications for research—by an individual scientist or by an organization. In the case of application by an organization, it must be a collective effort under a group leader. Most institutions must have set up a mechanism for approving research projects through a formal research proposal and a pre-funding appraisal. Research proposals to external agencies must additionally

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meet certain specific requirements outlined by them. Remember that proposal writing is a skill, which requires sufficient knowledge in the subject and practice. The final proposal should be neat and tidy, typeset with elegant typefaces, and attractively bound with all the necessary details.

Scientists should be well aware of various funding agencies, and the procedures they must follow for getting financial assistance. Often, enough funds are available for this purpose, but number of applications may be limited. In majority of cases, when the requests for grants are not approved, the ostensible reasons may not be technical inaccuracies, but faults in the application! Many young scientists find the task of writing research proposals for grant more demanding than executing the project. Consider grant writing as a part of scientists' job, and equip yourselves with the necessary skill and competence.

7.1 Research Projects

A collaborative venture carefully planned and managed to achieve some specific objectives involving definite tasks is called a *project*. It involves a combination of inputs such as human resources, equipment, supplies, communication, travel, and sometimes training to produce some desired outputs. A *project proposal* is a formal request submitted to a funding agency to carry out a project. A project proposal must defend each item in the list of things so that a funding agency can decide if it wants to approve a part or the entire request for fund.

Research Projects and Development Projects
Projects can be development projects or research projects. A development project is normally with the objective of improving the situation of something to make life better for the people. National and state governments spend huge sum of money every year on development projects ranging from creation of roads and other infrastructure to providing drinking water and basic amenities. On the other hand, a research project is designed with the objective of improving existing knowledge on something, solving a problem, or developing a new technology. Although research projects may not have direct impact on development immediately, the results from such works may be useful for future development projects.

Request for Proposals and Call for Proposals
Grants for research or development are sanctioned based on some form of 'grant writing', often referred to as a research proposal or project proposal. It is usually submitted in response to a request for proposal (RFP) or call for proposal (CFP) in pre-defined areas. 'Request for proposal', often abbreviated as RFP, is an open invitation made through media by a funding agency to submit a funding request for consideration. The phrase 'request for proposal' is generally used in connection with development projects, and more often, it is 'call for proposals' in the case of research projects.

Certain funding agencies such as the Science and Engineering Research Board in India accept proposals throughout the year. In these cases, there may not be separate 'call for proposals'. However, majority of funding agencies issue 'call for proposals' periodically based on project review and priorities. If you miss that deadline, you have to wait until the following year. Therefore, always be vigilant about the 'call for proposals' by visiting the websites of potential funding agencies.

Letter of Inquiry and Concept Note

Sometimes, instead of a formal research proposal, the funding agency may be inviting a letter of inquiry (LOI) or concept note. This is a better idea to save time for the investigator and the donor. Full proposals take a long time to prepare, and you may not like to spend this much time unless you are sure that your proposal will get due consideration. Donors are also freed of the burden of reading lengthy proposals, which they may not like to fund. In response to an RFP, those who seek grants for their development projects submit LOI. The LOI includes the purpose of the project, the objectives, and financial requirements. A concept note or concept paper is also similar to LOI; but generally, it is a summary version of a full proposal. Most funding agencies provide the format of a concept note, which normally includes the sections as background, brief review of works done, objectives, materials and methods, activities and duration, expected outcome, project associates, and budget outlay.

Ad Hoc Research Project and Competitive Grant Fund

A scientist can submit a research proposal to a potential funding agency, either on his/her own initiative or in response to the RFP or CFP from the agency. Many agencies give grants for ad hoc research projects but some agencies invite applications for grants in competitive grant fund (CGF) mode. Ad hoc research is designed for a specific purpose, which is conducted on a one-off basis (only once and not regularly) as opposed to regular or continuous research, for example, the CGF projects. CGF research projects are different from ad hoc research projects in that they are created to bring about lasting changes in the research structure of a country.

Research Proposal and Research Protocol

The differences between a research protocol and a research proposal must also be clearly noted. A research proposal is a document containing an initial set of ideas for funding research supported by background literature to justify the study. Most funding agencies start project evaluation based on a formal proposal. If the proposal is approved, probably, they ask for a detailed protocol. A research proposal usually contains a small introduction, objectives, brief review of literature supporting the study, data collection procedures, and financial requirements. However, a protocol is a detailed set of activities for the project proposed, which happens only after the proposal stage is over. The protocol acts as a practical guide and timetable of various activities related to the research project. It should also show some foresight into what the investigator is trying to achieve. Therefore, an adequately clear and detailed protocol must be produced, which could be used by all those who are involved in

the study. In short, a protocol should act as a script for the research work! Formal protocols are insisted in many disciplines especially clinical studies that require the cooperation and coordination of many volunteers and participants.

Research Proposal and Research Paper
It is interesting to compare a research proposal and a research paper. A research proposal and a research paper are similar in structure because both have some similar components. For example, both should normally have an abstract, introduction, objectives, review of literature, methodology, and conclusion. However, the 'results' and 'discussion', two important parts of a research paper, are missing from a project proposal. If you consider the whole research process as a chain of events, the research proposal forms the first few links in the research chain and the research paper is the last link. In a research proposal, you project the future work you propose to do before a selected audience for their approval; but in a research paper, you report the outcome of past research for the benefit of a wider audience as a part of information sharing. The research proposal not only deals with research but also with human resources and money. Therefore, it should be planned meticulously and lucidly so that it attracts the attention of the funding agencies and the reviewers.

7.2 Finding a Research Problem

How to start the research activity is a formidable challenge for many new researchers. Often, the research process sets in motion from an idea, an unsolved problem, a hypothesis, or a continuation of previous research done by the investigator or somebody else. Even for a seasoned scientist, first thoughts may be hazy and ideas uncertain. The idea might seem impressive, but usually overestimate the resources or underestimate the time. Initially, researchers may have only a general and diffuse notion of a particular problem, but eventually they have to have a clear idea of the nature of problem. Otherwise, they can hardly get very far in solving the problem with a research agenda.

It is impossible to set any rules or directives for finding a research problem. For a novice researcher or research student, this might be the most difficult part. Researchers often find ideas or problems from many sources such as experience, literature, Internet sources, request for proposals, extension workers, colleagues, research guides, patients, and farmers.

Experience: Most often, you carry some research ideas based on your experience. As a professional or teacher, you may confront with several questions or problems pertaining to your specialization. The background, culture, education, and practical experience of researchers influence the ideas and the way in which they think. Once an idea strikes you, write it down immediately, and explore whether it is suitable for a thesis work or general study. Based on your critical evaluation of the problem, develop an outline. Be optimistic about the idea, and work on it earnestly until a proposal emerges out.

Literature search: A usual source for research idea is the literature in your specific fields. This will help you to understand the present status of the subject and to know the problems encountered by fellow scientists in the field. Normally, just looking at the titles of articles and reviewing them will give you an idea for your own study. Recent textbooks and reference books may also be of immense help. As you gain more knowledge in your discipline, it is relatively easy to find new ideas. You can even use the idea of an already published study for a research problem of your own. Repeating a study in a different context to see if the results hold in the new situation is also helpful. In many concluded reports, there will be a separate section on 'future line of work'. This will also provide you many ideas.

Internet search: A general search on the Internet is helpful for getting new ideas or developing your topics further. General search engines such as Google, Bing, Yahoo! and many others will lead you to a wide range of suitable web pages. Wikipedia, the world's largest online encyclopaedia is helpful to have a broad understanding. Databases such as PubMed, PubAg, and CAB Direct are also helpful (for more information on Internet search, see Chap. 9). These sites are rich in scholarly content, and contain abstracts and links to a variety of sources. However, be careful about biased or spurious sites, and depend only on websites sponsored by governments, universities, international agencies such as FAO, established research institutes, and reputed companies. Always avoid sites of lobbyists and advocacy groups.

Daily observations: You can learn many things from nature. If you keenly observe, ideas will be forthcoming. Observations may be active or passive. Active observation involves detecting something and making a note of its significance by relation to something already known. Suppose you have just observed a malformation in a crop. You may try to attribute some reason to this malady, if there is active involvement of your mind. In passive observation, there is no involvement of mind. Active observation is also helpful to relate many problems that come to you for solving. Farmer's field visits and mixing with farmers and extension workers will provide many ideas for research.

Request for proposals: Requests for proposals (RFPs), call for proposals (CFPs), or the notification inviting research proposals on specific topics from donor agencies are also a good source of research ideas. By describing some problems that the funding agency would like to address, these RFPs or CFPs are giving the researcher some clues or ideas for pursuing research. Usually, the RFP describes the problem that they like to address, the contexts in which it operates, the approach they would like to investigate the problem, and the maximum amount they would be willing to pay for such research.

Field problems brought by farmers and extension workers: In agriculture, animal husbandry, and medicine, farmers and extension workers bring to the notice of the research workers problems they could not solve. If the problems are new and need investigation, the researcher can proceed with the idea of problem solving. New diseases and epidemics are such avenues for medical professionals.

New developments: Technological advancements and social developments are creating new problems and opportunities. For example, food security, genetically modified crops, pesticide residues, environmental pollution, water crisis, wetland

conservation, increasing popularity of certain crops, global warming, climate change, energy crisis, need for alternate fuels such as biodiesel, and new diseases (e.g. H1N1 swine flu) are some new developments, which warrant immediate research intervention.

Conferences/seminars/lectures/discussions: These will give you an opportunity to mingle with scientists, hear their views, and exchange new ideas. The interaction and the insights from such meetings provide you an excellent opportunity to seek clarifications or further enlightenment on the ideas.

Colleagues and guides: Sometimes, the seniors in your department or your colleagues would be able to lead you to researchable ideas. For young scientists and research students, this is an excellent way to find topics. Try to develop a research idea in consultation with them. For research students, the research guides are the major driving force in selecting and developing the idea into a project plan.

7.3 Analysis of Research Ideas

After you get an idea for a study, you must think about its feasibility critically. You can endeavour to carry out the study in a hassle-free environment, if there are unrestricted resources and enough control over the state of affairs. However, such ideal conditions seldom exist, and researchers are always forced to look for the best they can find in the prevailing situations. Before making a decision on the feasibility of a research project, consider several practical issues. The following points are important and must be considered carefully before finalizing a research project. If you are able to consider these points at the initiation stage of the project itself, then, most of the problems that you may confront later can be solved or eliminated altogether.

Attempt only feasible ideas: Research is done to solve problems. The new idea should be simple, viable, and the objectives clear. For example, everybody now accept that green revolution style agriculture along with the plenty has created a few unintended problems as well. However, to obviate the unintended problems of green revolution, if you are contemplating the 'post-modern' natural farming type of agricultural practises as certain diehard environmental activist swear, the possibility of a food crisis in the near future cannot be ruled out. Sustainable agricultural practices that also take care of environment are the viable alternatives to feed the burgeoning world population, which is set to reach 8.6 billion by 2030, 9.8 billion by 2050, and 11.2 billion by 2100 from the current 7.6 billion (UN 2017).

The idea must be practical: Never venture to take a work that is simply impossible to carry out in the prevailing circumstances. For example, the idea may require using an electron microscope or a difficult assay using high-performance liquid chromatography (HPLC). Unless you have access to these sophisticated techniques, such works could not be completed. Some ideas may be good, but need many workers and several years to complete. The cost would be prohibitive. Therefore, decide on a course of action only after considering these 'practical' aspects.

Novelty of ideas: Often, new ideas get wide acclaim. Originality and novelty are important considerations in proceeding with an idea. Before embarking on an idea, find out whether it is a new problem or duplication of previous work. Beginners may become disillusioned on finding that their ideas have already been investigated. Probably, the joy of getting 'new' ideas may be short lived, when you found after searching the literature that much has been done on this subject. Even if the idea has already been explored, it is worthwhile to think about this further because of some reasons. Sometimes, the methods employed earlier may have been unreliable; it could be meaningful to repeat it in a different environment or locality; or it would be feasible to extend the idea to some other fields. However, take care to avoid simple duplications.

Expected results: While analysing the research idea, consider the expected results too; but do not forget that results are unpredictable. You must understand that any result is worthwhile, even if it is negative! It is also important to consider the prospects of producing research papers based on the study, and ascertain whether such research papers based on the expected results would be accepted for publication by a journal.

Time available: Research is time-consuming; therefore, you should make sure that you have enough time to spare. Normally, a research grant lasts for only three years. In the case of academic research, the problem of time is acute. For a Masters project, never attempt problems that take more than one year. In the case of PhD work too, time is a major constraint. Normally, a full-time doctoral student is expected to complete all the academic activities including research within a period of three years, although extension of time is granted in specific circumstances. Therefore, do not be overambitious; develop only those projects, which could be completed in the specified period. Formulate the technical programme in such a way as to finish within the period stipulated as per academic requirement or as specified by the funding agency.

Opinion of colleagues: Discussing the research idea with your colleagues is usually helpful. Interacting with scientists who are doing similar works also helps. Consult experts in the field and laboratory, especially for new methods and difficult procedures. However, be careful about excessive fear or love of new ideas (neophobia and neophilia!). There is a general tendency among ordinary people and even scientists to oppose and turn down new ideas. Certain people are excessively neophobic, and they are unwilling to try anything new or break from routine.

Statistical treatment: In most universities, as a part of Masters and PhD programmes, basic courses on statistics including design of experiments are taught to equip the students well versed in experimental designs and analysis of data. Still, if the proposed work involves complicated designs and analyses, it is a good idea to consult a statistician and seek advice before the start of the work.

Competence of researchers: Research is a challenging task. You should do a thorough analysis, and decide whether you have the competence to undertake the project. If it involves too much work or is interdisciplinary in nature, collaboration with other scientists become essential. Contemplate how much work you yourself are going to do. You may land in trouble, if you simply dream up an idea in which you do not have enough competence expecting others do all the work!

Possibility of getting grants: This is important, if your institution is cash starved and not capable of funding the proposal. Think whether you are able to mobilize funds for the idea in your mind from external sources. Based on your research problem, identify an appropriate funding agency such as DST, ICAR, UGC, DBT, ICMR, or others (For a list of funding agencies, see Annexure). However, understand that these agencies agree to fund you, only if the ideas conform to their call for proposals.

7.4 Planning a Proposal: Some General Considerations

Once you are very clear about your idea, it is time to write it down in the form of a project proposal. Before you start writing the proposal, consider the following general aspects as well. This is all the more important, if it is for external funding.

Study the Call for Proposals Carefully
Before writing the proposal, make yourself familiar with the funding agency and its programmes. Study the description of various funding programmes, and carefully read the outline of the call for proposals or request for proposals and understand various provisions indicated. If something in the outline is not clear, clarify it from the concerned agency or source. Ascertain whether the funding agency's programme will address the researchable topic that you have in mind. If several programmes are available, identify the most suitable programme for your research. For example, the Department of Science and Technology, Government of India has several programmes. Once you have decided the most suitable programme, study the application form and instructions relevant to the programme carefully.

Start filling in the form after you are thorough with the programme.

Stress on Contemporary Issues
A successful research proposal, especially those written for external funding, should address some of the contemporary issues. If the proposal is able to address these aspects, chances of getting grants are very high. Some current problems, which may attract the attention of donors include climate change, food security, population explosion, solid waste crisis, pollution, energy crisis, lifestyle diseases, genetically modified organisms, and pesticide residues. Give a clear indication in the proposal that if you do the project immediately and come with suitable findings, some current problems can be solved. Convince the funding agency that spending money on this project will not be a waste, and that something worthwhile will come out. Assert that your institution is qualified to take up the work and have the human resources and the infrastructure to do the work. In short, the agency and the reviewers must understand that the researcher is badly in need of support to sort out some important issues.

Good Writing Skills
Often, most researchers may not have the required writing skills to come with a flawless research proposal. However, through hard work, language skills and vocabulary

can be improved; and with a little bit of patience, any individual can master good writing skills. Use forceful words in the proposal to make the points clear and definite. Always use positive language and avoid 'perhaps…', 'may be…', 'probably…', etc. Use short sentences and make them readable. Remember that good written English is simple and clear. Certain writers have a penchant to use passive voice for everything. Do away with this practice, and use the active voice, with the present and future tense as often as possible. Make the project simple to read and understand. Ensure that each sentence should have a meaning leading towards a conclusion. Try to avoid unnecessary words and phrases, clichés, and bureaucratic and wasted words. A proposal prepared using correct words and phrases will create a good impression. For more details on improving writing skills, refer to Chaps. 16–18.

For highlighting certain points, bullets can be used. Supporting or substituting text by maps, charts, photographs, boxes, and graphs are also helpful. If you have to use 'we', always be unambiguous and identify clearly in the proposal which scientist or partner will do what. After giving final changes to the draft, seek the help of a language editor, if you are weak in English grammar.

Time Analysis and Management

A researcher should analyse the time available to him/her for the completion of the work and manage the time effectively. Research requires time, and make sure that you have enough time to spare. Normally, a research grant lasts for three years. For a postgraduate research, time available is still shorter. Underestimation of time is most acute, if you are new to research, or if you do not have the experience of doing a project similar to the planned one earlier. Similarly, you may fail in estimating time required to design and test a new equipment or machine. Usually, one's overall time estimate is much shorter and less realistic when compared to the actual time requirements of individual steps. Most researchers also forget to include time estimates for delays, setbacks, and unexpected problems.

The proposed research may involve several steps. Consider and determine how much time is needed for each step. You must also check the influence of potential intervening problems on time estimates. Most researchers do not give much attention to time analysis and may neglect the broader concerns. You may even claim that since you are so busy in doing many things, you do not have time for planning! Careful planning of an experiment determines its value leading to success. Failure to consider the time constraints creates some of the more common experimental errors and pitfalls.

7.5 Proposal Outline

Most funding agencies issue a specified format for preparing the research proposal, and this should only be used for applying grant. A research proposal should be arranged neatly and legibly by developing the sections according to the format of the agency. A typical format contains the sections as noted below:

- Title page
- Information regarding investigators and location
- Abstract/executive summary
- Introduction
- Objectives/aims
- Methodology (Materials and methods)
- Time schedule of activities and activity milestones
- Ethical considerations
- Facilities available
- Work programme
- Indicators
- Budget
- References
- Curriculum vitae of the applicants
- Institutional endorsement.

Title Page

A separate title page is necessary that contains the title of the research proposal, the applicant's name and address, and the date of submission. Avoid contradictory, ambiguous, or misleading titles; instead, use winning titles. The title is important as it creates the first impression of the project. It should be able to convey the highest possible information in lesser words—usually not more than 12–15 words. It should indicate the area of research and introduce the research question.

Normally, titles are stated in terms of a functional relationship indicating the independent and dependent variables. Make the titles attractive and legible. Titles can be shortened by deleting familiar phrases that give no additional information. A title may become lengthy and awkward, if you add several prepositional phrases to qualify it. Avoid low impact expressions that add nothing to the meaning such as 'Effect of…', 'Studies on…', 'Research on…', 'Response of…', and 'Investigation on…'.

Do not use abbreviations in titles. However, if the abbreviations are more familiar than the words, they stand for, for example: DNA and pH, such abbreviations can be used in titles. If you are not sure about this aspect, use the term in full and its abbreviation in parenthesis.

Titles need to be captivating. Ideally, the title, apart from being catchy, should be such that it gives a clear idea of what the project aims to achieve. Before finalizing the most appealing title, try several attempts, and decide the most pleasing one. An appealing style is to use a colon in the title dividing the title into two parts, a pre-colon part and a post-colon part. Make the pre-colon part short and attractive using appropriate words. However, the post-colon part must be serious, scientific, and convey the needed information. See two examples:

Original title: Studies on ground water recharge through rainwater harvesting

Improved: Water for posterity: Groundwater recharge through rainwater harvesting

Original title: An exploratory study to identify and document useful weeds
Improved: Weeds as resources: Identification and documentation of useful weeds.

Information Regarding the Investigators and Location
You must indicate the names of the principal investigator and co-investigators with full addresses and contact numbers for correspondence. The location of the research and collaborating institutions must also be clearly shown. Usually, the following information shall be included:

Name
Designation
Department
Name of the Institute
Address
Date of birth
Sex (M/F)
Telephone/mobile/e-mail.

Abstract
Most funding agencies ask for an abstract or executive summary of the project proposal. An *executive summary* is intended to provide a brief overview of the proposal. It usually contains a concise account of the proposal along with background information and conclusion. It is intended as an aid to decision-making by the reviewers. An *abstract* is still shorter than an executive summary, and it is prepared as a précis of the document.

Generally, an abstract of a proposal must include the justification for the study, the hypothesis or the research question, and the methods in a brief format. Remember that abstract or executive summary is an important part of the proposal, as it is the first impression of the proposal. The abstract is often written as a brief summary of about 300 words. Certain funding agencies (e.g. DST, Government of India) ask for still a shorter *project summary* not exceeding 150 words. Please note that for students' outline of research work (ORW), abstract or summary is not usually insisted. If you are asked to provide key words, select the most appropriate keywords (usually less than 6) and include them after summary.

Introduction
The 'introduction' part may appear in different forms according to the formats of funding agencies. In some formats, instead of 'introduction', you may be writing 'background'. After reading the introduction, the reviewers should know why you are interested in the project and why you have selected this particular problem. It must analyse a situation stating the problem or need statement and a short review of relevant literature. You should indicate your hypothesis and the assumptions with all the background logic. The rational and justification for taking up the study must be given. The introduction generally includes the project rationale, research hypothesis or research question, brief review of literature, and practical utility.

Project rationale: Present the rationale of your proposed study in simple language, and show its practical utility. As funding agencies want to support important research projects, it is essential to demonstrate the significance of the project so that your study gets high priority. For example, if the research is based on some issues in agriculture, explain what the results will do for farmers' interest or how they will affect productivity, improve food security, conserve environment, generate employment, or save resources. It is important to explain how the implications of your research are not limited to the narrow confines of the research field or laboratory.

State the research hypotheses or research questions: As a part of introduction, you must define the problem. Indicate major independent variables (causes or treatments) and dependent variables (effects that result from causes), and state your hypothesis, if any. Research hypotheses show the relationship between your research variables and expectations (see Sect. 5.2). Research hypotheses are normally found in research proposals involving experiments that compare differences or relationships between independent variables and dependent variables. For exploratory or descriptive studies, you may not have research hypotheses, but research questions only. You must identify and formulate carefully defined research hypotheses or research questions in unambiguous terms.

Brief review of literature: An important step in the formulation of research project, which should be done in the initial stage itself, is proper screening of relevant literature. Include a brief review of the seminal studies and important recent ones. Often, the literature review is incorporated into the introduction section as a part of it. However, certain proposals demand a separate section, which allows a more thorough review of literature.

It is essential to do a thorough literature search to understand what studies have already been done on the subject and to identify any glaring gaps in the literature. It also demonstrates your understanding of the theoretical and practical issues related to your research question. Read and make notes on as much literature as possible. Generate a few keywords to search and locate relevant literature. With the keywords in hand, you can search a database such as CAB Direct or PubMed for articles and other materials relevant to your research topic (refer Chap. 9 for more details on information retrieval). Selectively review the literature related to your research subject; but while writing the proposal, limit their numbers to 6–10 most relevant sources. Include only the most relevant literature and show the sources separately as 'References' (More details on literature review and citation rules are given in Chaps. 10 and 15).

Benefits or practical utility of the proposed research: The introduction often concludes with the benefits or scientific utility of the proposed research. Concerted efforts are needed to convince the reviewers the importance of the proposed work based on scientific considerations. You may also state clearly the benefits of this research to the stakeholders and the society.

Objectives and Aims

For a research proposal, probably 'objectives' is the most important section. It must target the attention of all reviewers, as all of them will go through it. Understand that if

the objectives are not important and urgent, financial support may not be forthcoming. Some researchers use 'aims' and 'objectives' interchangeably confusing them to be synonymous. They are for a rude shock when they see that certain funding agencies ask for both 'aims' and 'objectives'! We generally undertake a research project with an overall aim and probably with more than one objective.

Aim is a broad statement of desired outcomes or the general intention of the research project. In most cases, to accomplish our aim, we may conduct more than one experiment with separate objectives. Each experiment will usually examine a small aspect of the overall topic with specific objectives. In general, a research project will be having not more than two or three aims, whereas, it may have a number of objectives consistent with the experiments included.

Objectives are the specified tasks researchers should undertake in response to the research hypothesis or question to accomplish the overall aim of the project. Some funding agencies just ask for 'broad objectives' (aims) and 'specific objectives' instead of aims and objectives probably to avoid confusion. 'Long-term objectives' and 'short-term objectives' are also on similar lines.

While finalizing the aims and objectives, it is a good idea to decide them after calling all the scientists associated with the proposed project (other colleagues can also be invited) for a brainstorming. From the ideas generated, pick up those most relevant to your project. Do not be over-ambitious; include only those objectives which could be managed by you. Similarly, do not include objectives for which your study cannot provide results. Remember that after the completion of the project, the funding agency will check whether all the objectives have been achieved. In short, the objectives should be SMART, that is, specific, measurable, achievable, realistic, and time bound (Challa et al. 2006).

Methodology

Methodology or 'materials and methods' section must describe the tasks needed to complete the research job. This section should contain sufficient information for the reviewers to determine whether the methodology is sound, and you should explain how you would conduct your research in as much detail as possible. The materials required and the proposed activities necessary for successfully completing the project must be described well. Ensure that the methods and experimental designs included are sufficient to meet the objectives. Be specific on the studies intended to undertake and the reasons for including them. It is also essential to describe the possibilities of failure in techniques and feasible approaches to overcome the difficulties.

Keep the description of the methods brief. Describe the evaluation plan of results, statistical tests, and quantitative and qualitative measure of data. Responsibilities of each of the investigators must also clearly be defined and indicated. As a part of the methodology of experiments, you must also state the location, name of the laboratory, and the places where the experiment will be done.

Time Schedule of Activities and Activity Milestones

Certain formats, especially of the development project types, ask for time schedule of activities and activity milestones in a separate section. The timetable should explain

what activities would take place at what time of the year during the study. You can use a project management chart to demonstrate the timing of activities. *Milestones* are an important ingredient of a project management chart, which are distinct points in time when specified and measurable targets should have been achieved. You can assess your progress against expectations, and understand whether you will finish the project according to the original plan.

Ethical Considerations

If the study involves human subjects and animals, a section on ethics must be included. The main ethical concerns are whether the research will place the volunteers under undue risk, and whether they are fully informed about the nature of the study. State whether you have taken all the precautions to avoid any breach of ethics. If approval is needed from an ethical committee, it should be mentioned.

Facilities Available

In this section, convince the funding agency that your institution is qualified to do the work. When more institutions are competing for a similar grant, indicate clearly, why your institution is more qualified than others are. You may highlight better research facilities, more qualified scientists, and better institutional support. The strengths of co-investigators of the programme must also be highlighted. Show that the co-principal investigators too have the training and experience to do the research.

Indicators

Again, proposals on development projects may have a section in which the investigators must explain the likely impact of the study through indicators. *Indicators* are the criteria based on which the results or outputs of a project are evaluated; and therefore, these are important to evaluate the merit of the project proposal. Indicators reflect the essential aspects of a research objective in precise terms. By looking at the indicators, the impact of the results can be easily understood. Include only realistic indicators, and ensure that the changes observed are directly attributable to the project interventions. If asked for, both process indicators and impact indicators must be included. You may have to connect the indicators to objectives or activities.

Process Indicators

Process indicators measure the ways in which programme services and goods are provided. Commonly used parameters are:

- What are the expected results?
- How will you achieve the activity milestones?
- What are the steps involved?
- What are the benefits to your institution?
- Mention internal outputs at specified times during the project period.

Impact Indicators

Impact indicators are the criteria on which the impact of the project can be measured. These indicators provide information on the impact of the project on various yardsticks such as socio-economic conditions, productivity, profitability, cost of cultivation, poverty alleviation, food security, and environment protection. The following checklist can be used as impact indicators for a project in agriculture sector:

- Higher yields
- Higher income
- Gender specific impacts
- Use of indigenous knowledge
- Import substitution
- Creation of jobs
- Enhanced community participation
- Human health benefits
- Prevention and control of pests and diseases.

Budget

Budget is an important part of the project proposal, and it must be prepared carefully taking into consideration all the costs involved. Prepare the budget with realistic estimates. Bear in mind that the reviewers are highly knowledgeable on costs, and they may disallow anything which is estimated on the higher side. Include all categories of cost such as salaries/wages (for project associates and helpers), equipment, contingencies, travel, consultants, and supplies. You may spread the cost under both recurring and non-recurring expenses. Yearly expenses, rate of increase in salaries, costs for unforeseen expenditure, etc., must be shown. Make sure that the budget meets all the needs of your methodology. Remember that if you forget something to include at the time of submission, it would be very difficult to account for such an omission later. Normally, funding agencies provide budget proposal formats, and you have to prepare it according to their guidelines. A commonly followed model for preparing the budget is indicated in Table 7.1.

Sometimes, detailed budget estimates for each item as salaries/wages, consumable materials, travel, other costs, and equipment may also be asked to provide along with justification.

References

References are provided to indicate the sources from which the author has obtained information given in the proposal especially those in the ‘introduction’ and ‘review’ parts. Include only the most important references; there need be only 6–10, but they must be relevant and preferably recent. References must be typed out accurately following Name-Year system, as it is irritating for the donor of a grant to locate the references properly. For correct citation and listing of references; see Chap. 15.

Curriculum Vitae of the Applicants

Biodata or curriculum vitae (CV) of the principal investigator and the co-principal investigators must be neatly set out. Include sufficient details to show that you are

Table 7.1 A model for budget estimates

	Items	Budget			Total
		1st year	2nd year	3rd year	
A.	Recurring				
	1. Salaries/wages				
	2. Consumables				
	3. Travel				
	4. Other costs				
B.	Non-recurring				
	1. Equipment				
	2. Others				
C	Institutional charges				
	Grand total (A + B + C)				

competent to do the present work. However, avoid unnecessary bragging. Although synonymously used, the terms biodata and CV differ in essential features to be included. Another related term is resume.

Curriculum Vitae (CV) is a Latin phrase meaning 'course of one's life'. A CV is more focused on academic achievements of a person. It is more detailed than a resume, and its size would be as per the requirement. A CV lists out academic and professional qualifications, skills acquired, professional experience including positions held, professional affiliations, achievements and awards, research publications, etc., in chronological order. A CV must highlight the general talent of the person rather than specific skills.

Biodata is the short form for biographical data, and in a biodata, the focus is on personal particulars like date of birth, religion, gender, race, nationality, passport details, permanent and temporary residence, marital status, hobbies, height, weight, and a photograph. The term biodata is mostly used in South Asian countries like India and Pakistan instead of CV when applying for government jobs or for research grants. However, biodata is not common in the international scene where personal information like age, gender, religion are not required to be submitted by candidates.

Resume is a related term. The term 'resume' is from French, meaning 'summary'. In a resume, one summarizes his/her education, skills, and employment especially when applying for a new job. A resume does not list out all details of a profile, but only some specific skills customized to the target job profile. Thus, it may not be longer than one or two pages of size A4. A good resume may contain academic and professional qualifications, professional experiences, awards and achievements, and accomplishments.

Institutional Endorsement

This is an obligatory part of project proposals for external funding. Include a statement from the Head of Institution stating the willingness of the organization to

endorse the proposed research project and indicate facilities, if any, that the institute would make available for the research project. Most funding agencies ask for a specified statement from the institution according to their requirement.

7.6 Presentation and Evaluation of Proposals

Writing a research proposal for funding requires patience and time. Do not show undue haste in preparation. Take your own time, and remember that it is not to be done instantly. Read the draft with a critical mind several times. Ask some of your friends to go through the proposal and comment on it. It is also a good idea to show it to a non-technical person such as your spouse or other relatives. Listen to all the comments with patience. Try to catch errors, repetitions, and inconsistencies. Edit the material to shorten, to make it clear, punchy, and appealing before taking the final print out. As Calnan (1976) outlined, a successful proposal must have answered the following questions:

- Why do I want to do this project? (the need)
- What do I want to do? (the plan)
- How am I going to do the project? (the method), and
- What do I need? (the resources).

Make sure that you have followed all this evaluative questions and prepared a fine research proposal.

Sometimes, the funding agency after preliminary appraisal may invite you for a presentation of the project before a reviewing panel. This is an opportunity for you to argue forcibly for your case. Often, based on the presentation you have made, the funding agency may inform their decision. Sometimes, they may ask you to revise the proposal and intimate you the quantum of assistance they are proposing to give you. Based on the suggestions, you have to prepare a modified proposal. If this is approved, the funding agency will send you a sanction letter with details of funding. Once the funding agency approved the project, you have to act quickly and take steps for starting the project without much delay.

Although there are no set rules to sanction a research grant, a funding agency develops certain criteria to be used by the reviewers as they evaluate the merit of the project proposal. The reviewers usually ascertain whether the proposed procedures address the objectives set out in the proposal. Writing style and the arrangement of the proposals into clear component sections are also important. Before you submit the project proposal, try to get an idea of the review criteria used by the donor agency. You should be aware of these criteria, as the way in which you address them will be a part of the assessment of merit of the project. With minor modifications, the same type of criteria is used at all levels of grant review. Usually, grant applications are evaluated using the following five questions (Kendall and Hawkins 1985).

- Is the idea important?
- Can it be done?
- Is the applicant competent to do the work?
- Can it be done within the specified time?
- Are the costs realistic?

After evaluating the project, the funding agency has to take a decision. The following may be the reasons for rejecting the proposal for funding:

- The researchable idea is not important.
- The applicant has not taken sufficient care to plan the project.
- Heavy dependence on others (Co-PI, project associates, personnel from other disciplines and institutes) to do most of the work.
- Budget is not within the limits.

There is no point in getting annoyed or disappointed, if your grant application is rejected. The funding agency may have some reasons. Sometimes, the agency would inform you the reasons. Otherwise, you have to assume the reasons based on the correspondence with the agency and the comments of the reviewers. Reflect on the reasons behind in rejecting the proposal, and rework on it so that you would be able to submit it to the same agency or similar agencies when they again issue notification inviting proposals.

7.7 Students' Outline of Research Work

In most academic institutions, for postgraduate studies such as M.Sc. (Ag.), M.Sc. (Hort.), MVSc., M.Tech., M.Phil., M.D., and Ph.D., research work is a compulsory part of the programme, and preparation of a research proposal and its approval are mandatory. Postgraduate research work conducted in colleges and universities/institutes also needs scrutiny in terms of quality and relevance. Each institution must have developed a mechanism to ensure quality control of students' research projects. Normally, postgraduate students in consultation with their major advisor or guide (allotted by the institution) prepare an 'outline of research work' (ORW) in a specified format, submit the ORW to competent academic bodies; and only if the approval is given, they can start the work and complete the thesis in the stipulated time. Research guides or major advisors have a greater role in formulating students' ORW. They should properly guide the students in finding a research problem and developing it with proper objectives and methodology with a good title.

Universities also prescribe norms for formulation and finalization of ORW. The format of ORW differs widely between institutions. Sometimes, you may be given a specific format in which the proposal has to be written, or you have to develop a format by yourself. An ORW usually has the details such as the name of student, names of major advisor and members of advisory committee, title of thesis, location, introduction, objectives, review of literature, practical/scientific utility, outline of

technical programme, main items of observations, facilities (existing and additional facilities required), duration of study, time schedule of study, and financial outlay.

Although funds allotted for PG research is comparatively less, something worthwhile usually emerges because of the active involvement of the student, research guide, and members of advisory committee. Some universities prescribe a uniform ceiling of funding. For example, in Kerala Agricultural University, the ceiling for funding is Rs. 40,000 for a Masters Degree project and Rs. 100,000 for a Ph.D. project.

Some universities ask candidates applying for Ph.D. to submit a research proposal in a topic of their choice as part of the application. The objective of such a proposal is to prove that the candidates have thought out a worthwhile research project in their chosen fields, and that they have the competence and a proper work-plan to complete it. The quality of such research proposals is very important, as badly written proposals are usually rejected (sometimes, their candidature too!).

Often, the student and the major advisor prepare a draft ORW after a thorough literature review and discussing in detail various aspects of the chosen problem. The draft ORW should indicate how you would conduct the study with sufficient details on methodology and various facilities required in terms of land, equipment, and chemicals. If facilities available in another department (in addition to your parent department) are to be utilized, the major advisor may consult the department concerned and ensures possibilities of collaboration. Usually, a member from that department is also included as a member in student's advisory committee. The major advisor should form an advisory committee with experts from his/her discipline and related disciplines depending upon on the interdisciplinary character of the study. The major advisor will act as chairperson of the advisory committee. The draft ORW is first discussed in the students' advisory committee meeting. Once the advisory committee agrees and approves the draft, it should be presented in a seminar in each department or institution. All the faculty members and postgraduate students are expected to attend such seminars. In the seminar, the student shall explain the importance of the problem, scientific utility, and the technical programme. In the light of discussions in such seminars, the draft ORW is revised by the student and the major advisor, and submitted to the head of the institution for final approval.

7.8 Major Funding Agencies

There are several funding agencies or donors for research and development projects, both national and international, but you have to choose the agency depending upon your objective and area of interest.

International Agencies

International funding agencies are usually classified as *bilateral donors* and *multilateral donors.* Bilateral means that aid flows from one government to another government or non-governmental agency. Most bilateral funding agencies are established

by governments of developed countries for giving aids to developing and least developed countries. The source of funding usually comes from government funds of those countries. The following are some popular bilateral funding agencies. You can obtain more information on the pattern of funding by visiting their websites.

- ACIAR (Australian Centre for International Agricultural Research): http://aciar.gov.au
- The Belgian Development Cooperation: https://diplomatie.belgium.be/en/policy/development cooperation
- CIDA (Canadian International Development Agency): http://www.acdi-cida.gc.ca
- DANIDA (Danish International Development Assistance): http://um.dk/en/danida-en/
- DFID (Department for International Development, UK or UKAID): http://www.dfid.gov.uk/
- SIDA (Swedish International Development Cooperation Agency): http://www.sida.se/english/
- USAID (United States Agency for International Development): http://www.usaid.gov/.

Multilateral donors are made up of many members. The funds of such agencies are from various sources and mainly contributions from member countries. Among the multilateral donors, the United Nations Organizations (UNO) is the most important. The following three UN agencies fund heavily for agriculture and related works:

- FAO (The Food and Agriculture Organization)
- UNEP (The United Nations Environment Programme)
- UNDP (The United Nations Development programme).

Some other multilateral funding agencies are:

- AFDB (The African Development Bank)
- AFESD (The Arab Fund for Economic and Social Development)
- ADB (The Asian Development Bank)
- EC (The European Commission)
- IADB (The Inter-American Development Bank)
- IFAD (International Fund for Agricultural Development)
- IBRD (International Bank for Reconstruction and Development (World Bank).

There are certain funding agencies that operate with funds from private sources. These agencies get money from the profits of a corporation or company or by gift from a wealthy individual or group. The funding agencies that works based on private funding are usually called *Foundations*. Often, Foundations are created with a big sum of money, and it works utilizing the interests being accrued. Some of the large and popular Foundations funding agriculture-related activities include:

- The Ford Foundation (www.fordfoundation.org)
- The Rockefeller Foundation (www.rockefellerfoundation.org)

- The McArthur Foundation (www.macfound.org)
- The Toyota Foundation (www.toyotafound.or.jp/english)
- The Packard Foundation (www.packard.org)
- The Bill and Melinda Gates foundation (www.gatesfoundation.org).

Indian Funding Agencies

There are several funding agencies in India for supporting research and development projects for specific purposes. In agricultural research, the main government agency responsible for funding is the Indian Council of Agricultural Research (ICAR). The ICAR sponsors and supports different kinds of research schemes, which aim at filling critical gaps in specific scientific fields. The Indian Council of Medical Research (ICMR) is the major organization for research in biomedical sciences. The Department of Science and Technology (DST), Science and Engineering Research Board (SERB), State Councils for Science and Technology, and the Department of Biotechnology (DBT) are the major funding agencies in India, which support science and technology projects. A brief introduction to various funding programmes of these agencies is provided below.

Department of Science and Technology

In the broad area of science and technology in India, the main funding agency is the Department of Science and Technology (DST), Government of India and the unit of the DST at the state level (State Councils for Science and Technology). The Department of Science and Technology supports research projects in many areas of science and engineering, especially those new and emerging areas from individual scientists, public institutions, and voluntary organizations under many schemes and programmes. The site also gives information on various international bilateral programmes. The following are some schemes as given in the website of DST. For more information and proforma for the submission of proposals, visit the website of DST (www.dst.gov.in).

Scientific and Engineering Research

- Mega Facilities for Basic Research
- Innovation in Science Pursuit for Inspired Research (INSPIRE) programme
- R&D Infrastructure (FIST, SAIFs, PURSE)
- Science and Technology of Yoga and Meditation (SATYAM)
- Programme for Science Students
- Swarnajayanti Fellowships
- National Science and Technology Management Information System (NSTMIS)
- Science and Engineering Research Board (SERB)
- Cognitive Science Research Initiative (CSRI)
- Impacting Research Innovation and Technology (IMPRINT)

- VAJRA (Visiting Advanced Joint Research) Faculty Scheme.

Technology Development

- Technology Development and Transfer
- National Good Laboratory Practice Compliance Monitoring Authority (NGCMA)
- Natural Resources Data Management System (NRDMS)
- Climate Change Programme
- Joint programme on Electric Mobility and Technology Foresighting
- Interdisciplinary Cyber Physical Systems (ICPS) Division.

S&T for Socio-economic Programme

- National Council for Science and Technology Communication (NCSTC)
- Science for Equity Empowerment and Development (SEED)
- National Science and Technology Entrepreneurship Development Board (NSTEDB)
- State Science and Technology Programme.

Women Scientists Programmes (WOS)

- Women Scientist Scheme-A (WOS-A): Research in Basic/Applied Science
- Women Scientist Scheme-B (WOS-B): S&T interventions for Societal Benefit
- Women Scientist Scheme-C (WOS-C): Internship in Intellectual Property Rights (IPRs) for the Self-Employment.

Technology Missions Division

- Water Technology Initiative Programme
- Clean Energy Research Initiative
- Nano Science and Technology Mission
- National Super Computing Mission

Science and Engineering Research Board (SERB)

In 2008, Government of India through an Act of Parliament approved the establishment of the Science and Engineering Research Board (SERB) as an autonomous research-funding agency free from bureaucratic controls. Most of the activities of the erstwhile Science and Engineering Research Council (SERC) under the Department of Science and Technology were handed over to the newly formed SERB. SERB supports research in frontier areas of science and engineering. The following are some schemes and programmes of SERB.

Core Research Grant (CRG)

The Core Research Grant (CRG) scheme provides core research support to active researchers to undertake research and development in frontier areas of science and

technology such as life sciences, physical sciences, chemical sciences, engineering sciences, earth and atmospheric sciences, and mathematical sciences (formerly, extramural research). This scheme encourages emerging and eminent scientists for individual centric, competitive mode of research funding. Although renamed, it is still extramural research, meaning the research undertaken by a scientist but outside the normal programme of a college, university, or research institution. There are no upper or lower limits for funding, but the budget is decided based on the actual requirement for its successful completion. The principal investigator should propose a realistic budget considering the infrastructure and resources available at the implementing institution.

Scheme for Funding High Risk-High Reward Research
The scheme for funding 'High Risk-High Reward Research' supports conceptually new and risky proposals, which may have a lasting influence on science and technology. The proposal must have bold research ideas, which may have wide ranging influence and the potential for new scientific and technological innovations. Formulation of new hypothesis or scientific breakthroughs is encouraged.

Scheme for Funding Industry Relevant R&D
The scheme is to utilize the expertise available in academic institutions and national laboratories in solving industry specific problems. All industries are eligible. More than one industry and more than one investigator from one Industry can be associated in a project.

Empowerment and Equity Opportunities for Excellence in Science
The scheme, Empowerment and Equity Opportunities for Excellence in Science (EMEQ), is aimed at providing research support to scientists belonging to the Scheduled Caste and Scheduled Tribe in undertaking research in newly emerging and frontier areas of science and engineering and thus to involve them in the National Science and Technology development process.

Intensification of Research in High Priority Area (IRHPA)
The IRHPA programme supports proposals in high priority areas where multidisciplinary and multiinstitutional expertise is required. The board identifies priority areas in consultation with the stakeholders. Required facilities for implementing the project will be supported through this scheme.

In addition to the above schemes, SERB implements the following programmes as well:

- Ayurvedic Biology Programme
- Mathematical Research Impact-Centric Support (MATRICS) Scheme
- International travel support (ITS)
- Assistance to professional bodies and seminars/symposia
- Start-Up Research Grant (Young Scientists)
- Awards and Fellowships
- Partnership programmes.

For more information on the above schemes and updates, visit the home page of SERB (http://www.serb.gov.in/). Formats and guidelines can also be had from the website.

State Councils for Science and Technology

The decision to form state councils for science and technology was taken in 1971. Karnataka, Kerala, Uttar Pradesh, and West Bengal were the four pioneering states, who had established their State S&T Councils by the end of Fifth Five Year Plan. Subsequently, state science and technology councils have been established in all the States and Union Territories. Several states have also formed a separate department of science and technology. The chairpersons of the state councils are usually chief ministers of respective states or a renowned scientist. The Department of Science and Technology (DST), Government of India played a catalytic role by facilitating state governments in establishing and developing the State S&T Councils and by providing support for their technical secretariats.

In Kerala, the state council is called 'Kerala State Council for Science, Technology, and Environment (KSCSTE)'. Major programmes are under the heads: engineering and technology programmes, ecology and environment, science research schemes, rural technology programmes, biotechnology programmes, fellowships, student projects; seminars/symposia/workshop, travel grant, etc. Similar to Kerala, state councils for science and technology have been created in most other states. Search the websites of state councils for an update (see Annexure).

Indian Council of Agricultural Research (ICAR)

In agricultural research, the main government agency responsible for funding is the Indian Council of Agricultural Research (ICAR). The ICAR sponsors and supports different kinds of research schemes, which aim at filling critical gaps in the specific scientific fields or in the resolution of problems limiting production in agriculture and allied fields. Ad hoc schemes of ICAR were very popular among agricultural scientists until 2005. These were sanctioned for a period of three years utilizing fund from Agricultural Produce Cess funds. The government scraped the levy of cess on export of agricultural produce from the year 2005, necessitating the closure of ad hoc research schemes.

After the closure of ad hoc research schemes, Government of India established a national fund for supporting basic and strategic research through the ICAR system. As outlined by ICAR, the main objective of the scheme is to build capacity for basic, strategic, and cutting edge application research in agriculture, and address issues, which can be solved by intensive basic and strategic research jointly by a team of organizations/institutions. The fund was originally called 'National Fund for Basic, Strategic, and Frontier Application Research in Agriculture (NFBSFARA)', but renamed to 'National Agricultural Science Fund' (NASF) during the Twelfth Plan.

The funding programme promotes collaborative and multiinstitutional research based on innovative ideas of scientists for solving scientific and technological problems in agriculture. Scientists from all research institutions, universities, and private

sector in India are eligible to participate. Selection of projects under NASF is done in two stages; in the first stage, a concept note indicating the objectives, technical programme, critical gaps being addressed, details of the organization, project investigators, and estimated budget are to be submitted. Once the concept note is approved, the principal investigator has to submit full proposals for consideration. For more information, visit the site http://www.icar.org.in/nfbsfara/index.html.

The ICAR has launched another ambitious project, 'National Initiative on Climate Resilient Agriculture (NICRA)' in February 2011. A major objective of the project is to increase the resilience of Indian agriculture to climate change and climate variability through strategic research and technology demonstration. Just like NASF, selection of projects is done in two stages, first, the concept note, and later, full proposal, if the concept paper is approved. More details can be accessed from the site http://www.nicra-icar.in/.

From 2013 onwards, The Indian Council of Agricultural Research (ICAR) sponsors and supports short-term result-oriented Extramural Research Projects which aim at filling critical gaps in the scientific field or in resolution of problems limiting production and value addition in agriculture, animal husbandry, and fisheries. These projects can be submitted by ICAR Institutes, State Governments, Agricultural and other Universities, and public, quasi-public, and private institutions capable of undertaking research in the above areas.

Revolving Fund Scheme, Emeritus Scientist Scheme, National Professorship, National Fellowship, Junior and Senior Research Fellowships, etc., are some of the other schemes of ICAR providing grant for research.

Department of Biotechnology

The Department of Biotechnology (DBT) was set up under the Ministry of Science and Technology in 1986 to give a new momentum to the growth and development of modern biology and biotechnology in India. The department provides the following categories of support to scientists working in the fields of biology- and biotechnology-related fields.

- Research and development projects, creation of infrastructural facilities, centres of excellence in the identified areas and demonstration projects
- Biotechnology-based programmes for SC/ST population
- Biotechnology-based programmes for women and rural development
- Bioinformatics
- Human resource development in biotechnology
- Financial assistance for holding seminar/symposium/conference/workshop on thrust areas of biotechnology
- Travel support.

DBT calls for proposals in specified areas. DBT has facilitated online submission at http://dbtepromis.nic.in or http://dbtepromis.gov.in. Sometimes, hard copies of the project document in the prescribed proforma should also be submitted. DBT will receive only online submission for proposals for conference, travel, exhibition, and popular lectures. The URL is http://dbtctep.gov.in for online submission. For an

update on call for papers and other details of DBT funded projects, visit http://dbtindia.nic.in or http://dbtindia.gov.in.

Indian Council of Medical Research

The Indian Council of Medical Research (ICMR), with its headquarters at New Delhi, is the apex organization in India for the formulation, coordination, and promotion of research in biomedical sciences. The ICMR gets funds from the Government of India through the Department of Health Research under the Ministry of Health and Family Welfare. For strengthening biomedical research in India, the first attempt was made in 1911 by the formation of the Indian Research Fund Association (IRFA). Later on, Government of India made several changes in the organization and activities of the IRFA. In 1949, it was renamed as the Indian Council of Medical Research (ICMR) intensifying its scope and functions.

The ICMR undertakes several activities related to biomedical research. It promotes both intramural research and extramural research. The intramural research is through 32 research centres in different parts of the country. The ICMR supports extramural research activities through (1) creating Centres for Advanced Research in different research areas in selected departments of medical colleges, universities, and other non-ICMR research institutes; (2) setting up task force groups for various studies; and (3) open-ended research, sanctioned based on applications for grant-in-aid from scientists of medical colleges, universities, and other non-ICMR research institutes.

The ICMR also promotes human resource development in biomedical research by awarding research fellowships, short-term visiting fellowships, short-term research studentships, training programmes, seminars, symposium, and workshops. The Council has a scheme to offer 'Emeritus Scientist' positions for retired medical scientists and teachers so that they can continue research on specific biomedical topics. The Council also gives awards and prizes to Indian scientists considering their contributions to biomedical research. For more information, visit the site http://www.icmr.nic.in.

Other Indian Funding Agencies

There are many other agencies giving grants in specified areas. For instance, the University Grants Commission (UGC) provides grant for many research-oriented projects under various heads. In India, the Council for Advancement of People's Action and Rural Technology (CAPART) acts as the major funding agency for voluntary organizations in rural areas. A list of major agencies providing grant support to research in science and technology in India is given in Annexure along with their web addresses. The list is not exhaustive.

Occasionally, certain funding agencies may declare special schemes for research funding, for example, NATP (National Agricultural Technology Project), NAIP (National Agricultural Innovation Project), National Horticultural Mission, and Technology mission on various commodities. These will be operational for a short period only. Scientists should be alert to grab the opportunity. While application forms and processes may be different for different funding agencies, the concepts are similar in that scientists must compete for funds before peer review panels.

Annexure

Agencies providing grant support to research in science and technology.

Funding agency with website address	Mailing address
Department of Science and Technology (DST) (www.dst.gov.in)	Department of Science and Technology, Technology Bhavan, New Mehrauli Road, New Delhi-110016
Science and Engineering Research Board (SERB) (www.serb.gov.in)	The Secretary, Science and Engineering Research Board, 5 and 5A, Lower Ground Floor, Vasant Square Mall, Sector-B, Pocket-5 Vasant Kunj, New Delhi-110070
Indian Council of Agricultural Research (ICAR) (www.icar.org.in)	Indian Council of Agricultural Research, Krishi Bhavan, New Delhi 110114
Department of Biotechnology (DBT) (www.dbtindia.nic.in)	Department of Biotechnology, CGO Complex, Lodhi Road, Block No. 2, Floor 7, New Delhi-110003
University Grants Commission (UGC) (www.ugc.ac.in)	University Grant Commission (UGC), Bahadur Shah Zafar Marg, New Delhi-110002
Indian Council of Medical Research (ICMR) (www.icmr.nic.in)	P.O. Box No. 4911, Ansari Nagar, New Delhi-110029
Ministry of Health and Family Welfare (www.mohfw.nic.in)	Ministry of Health & Family Welfare, Nirman Bhavan, Maulana Azad Road, New Delhi-110011
Department of Health Research (www.dhr.gov.in)	Department of Health Research, Ministry of Health & Family Welfare, Nirman Bhavan, Maulana Azad Road, New Delhi-110011
Indian Council of Forestry Research and Education (ICFRE) (www.icfre.org)	Indian Council of Forestry Research and Education, P.O., New Forest, Dehradun-248006 (Uttarakhand)
Indian Council of Social Science Research (ICSSR) (www.icssr.org)	Director (Research Projects), Indian Council of Social Science Research, (P.O. Box No. 10528), Aruna Asaf ali Marg, JNU Institutional Area, New Delhi-110067
Indian Council of History Research (ICHR) (www.ichrindia.org)	Indian Council of Historical Research, 35 Ferozeshah Road, New Delhi-110001
Department of Atomic Energy (www.dae.gov.in)	Anushakti Bhavan, C.S.M. Marg, Mumbai-400001
Department of Higher Education (https://mhrd.gov.in/higher_ education)	Department of Higher Education, Ministry of Human Resource and Development, Shastri Bhavan, New Delhi-110001
Ministry of Environment, Forests, and Climate Change (www.moef.nic.in)	Ministry of Environment, Forests, and Climate Change Indira Paryavaran Bhavan, Jorbagh Road, New Delhi-110003

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Funding agency with website address	Mailing address
Ministry of Earth Sciences (www.moes.gov.in)	Ministry of Earth Sciences Prithvi Bhavan, Opp. India Habitat Centre, Lodhi Road, New Delhi-110003
Department of Chemicals and Petrochemicals (www.chemicals.nic.in)	Department of Chemicals and Petrochemicals, Ministry of Chemicals & Fertilizers, Janpath Bhawan, (3rd Floor, B-Wing), Janpath, New Delhi-110001
Department of Scientific and Industrial Research (www.dsir.nic.in)	Department of Scientific and Industrial Research, Ministry of Science & Technology, Technology Bhavan, New Mehrauli Road, New Delhi-110016
Ministry of Non-conventional Energy Sources (www.vigyanprasar.gov.in)	The Secretary, Ministry of Non-Conventional Energy Sources, Block No. 14, CGO Complex, Lodhi Road, New Delhi-110003
Council for Advancement of People's Action and Rural Technology (CAPART) (www.capart.nic.in)	Council for Advancement of People's Action and Rural Technology (CAPART), India Habitat Centre, Zone-V-A, 2nd Floor, Lodhi Road, New Delhi-110003
Council of Scientific and Industrial Research (CSIR) (www.csir.res.in)	Head, HRD Division, CSIR, CSIR Complex, NPL Campus, Pusa, New Delhi-110012
Defence Research and Development Organization (DRDO) (www.drdo.gov.in)	Defence Research & Development Organization, Ministry of Defence, DRDO Bhavan, DHQ PO, New Delhi-110011
Oil India Limited (OIL) (www.oil-india.com)	The General Manager, (R&D), Oil India Limited, Duliajan-786602
National Medicinal Plant Board (www.nmpb.nic.in)	The Chief Executive Officer, National Medicinal Plant Board, Chandralok Building, 36 Janpath, New Delhi-110001
Ministry of Food Processing Industries (www.mofpi.nic.in)	Ministry of Food processing Industries, Panchaseel Bhavan, August Kranti Marg, New Delhi-110049
National Horticulture Board (www.nhb.gov.in)	National Horticultural Board, Ministry of Agriculture, Govt. of India, 85, Institutional Area, Sector-18, Gurgaon-122015
Website addresses of some state councils on science and technology	Andhra Pradesh (www.apcost.gov.in); Gujarat (http://dst.gujarat.gov.in/gcst.htm); Haryana (www.dstharyana.org); Karnataka (www.kscst.org.in); Kerala (www.kscste.kerala.gov.in); Punjab (www.pscst.com); Tamil Nadu (www.tanscst.org); UP (www.cstup.gov.in); West Bengal (www.dstwb-counsil.gov.in)

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