

Unit 5. Scientific Report Writing

1. Research Proposal writing

2. Research Report writing

1. RESEARCH PROPOSAL WRITING

A **research proposal** is a document written by a researcher that provides a detailed description of the proposed program. It is like an outline of the entire research process that gives a reader a summary of the information discussed in a project. Research proposals are written for various reasons, such as requesting a budget (grant) for the research they describe, certification requirements for research (as from an institutional review board committee if the experiment is to be done on human beings or animals protected by animal rights laws), as a task in tertiary education (e.g., before performing research for a dissertation), or as a condition for employment at a research institution (which usually requires sponsor-approved research proposals). They may be considered as grey literature.

The **phrasing of research proposals** has many similarities to that of scientific articles. Research proposals are written in **future tense** and have different points of emphasis. Like scientific articles, research proposals have sections describing the research background, significance, methods and references. The method section of research proposals is far more detailed than those of scientific articles, allowing profound understanding of the price and risks of the study and the plans for reducing them. Instead of a section describing the results, research proposals have a section describing the hypotheses or the expected results. A typical research proposal includes an extensive but focused literature review. A research proposal may also include preliminary results.

In contrast to scientific articles, research proposals usually contain the **curriculum vitae** of the researchers. The curriculum vitae are required for proving that the personnel asking to conduct the research are

capable of doing so. For example, a research proposal for a study including injections would be expected to name at least one researcher qualified to inject human beings. Similarly, a research proposal in biology is not likely to receive funding when the entire staff consists of mathematicians only. In some academic institutes, a detailed resume of the thesis mentor is required on the research proposal in order to show that the mentor can help the student with the subject of the thesis. Research sponsors publish calls for research proposals, specifying the topics into which they fund research and their detailed format requirements. Those sponsors may be governmental, non profit or business research foundations. The following outline covers the primary components of a research proposal. Your proposal will be a variation on this basic theme.

Components of a research proposal:

Title page, Table content, Abstract/Summary

1. Introduction/Background

1.1. Statement of the problem

1.2. Hypotheses /questions

1.3. Significance of the study

1.4. Objective/aim of the study

2. Literature review

3. Research materials and methods

- Study area

- Study design

- Sample size

- Sampling methods
- Data collection
- Description of variables
- Data quality assurance
- Operational definitions
- Data analysis

4. Work plan

5. Anticipated outcome of the proposed research.

6. Budget

7. References

8. Appendices/annexures

1. **Title Page:** Most sponsoring agencies specify the format for the title page, and some provide special forms to summarize basic administrative and fiscal data for the project. Titles should be comprehensive enough to indicate the nature of the proposed work, but also be brief.
2. **Abstract:** The funder may use the abstract to make preliminary decisions about the proposal. An effective summary states the problem addressed by the applicant, identifies the solution, and specifies the objectives and methods of the project. This summary should also outline funding requirements and describe the applicant's expertise.
3. **Table of Contents:** Very brief proposals with few sections ordinarily do not need a table of contents; the guiding consideration in this is the reader's convenience. Long and detailed proposals may require, in addition to a table of contents, a list of illustrations (or figures) and a list of tables. If all of these are

included, they should follow the order mentioned, and each should be numbered with lower-case Roman numerals. The table of contents should list all major parts and divisions (including the abstract, even though it precedes the table of contents).

4. **Introduction** (including Statement of Problem, Purpose of Research, and Significance of Research): The introduction of a proposal should begin with a capsule statement of what is being proposed and then should proceed to introduce the subject to a stranger. It should give enough background to enable an informed layman to place your particular research problem in a context of common knowledge and should show how its solution will advance the field or be important for some other work. The statement describes the significance of the problem(s), referring to appropriate studies or statistics.
5. **Background** (including Literature Survey): Be sure to (1) make clear what the research problem is and exactly what has been accomplished; (2) to give evidence of your own competence in the field; and (3) to show why the previous work needs to be continued. The literature review should be selective and critical. Discussions of work done by others should therefore lead the reader to a clear impression of how you will be building upon what has already been done and how your work differs from theirs.
6. **Description of Proposed Research** (including Method or Approach): The comprehensive explanation of the proposed research is addressed not to laymen but to other specialists in your field. This section is the heart of the proposal and is the primary concern of the technical reviewers. Remember as you lay out the research design to (1) be realistic about what can be accomplished. (2) be explicit about any assumptions or hypotheses the research method rests upon. (3) be clear about the focus of the research. (4) be as detailed as possible about the schedule of the proposed work. (5) be specific about the means of evaluating the data or the conclusions. (6) be certain that the connection between the research objectives and the research method is evident. (7) spell out preliminary work developing an analytical method or laying groundwork as Phase 1. At the end of that phase you will be able to report that you have accomplished something and are ready to undertake Phase 2.

7. **Description of Relevant Institutional Resources:** In general this section details the resources available to the proposed project and, if possible, shows why the sponsor should select this University and this investigator for this particular research. Some relevant points may be the institution's demonstrated competence in the pertinent research area, its abundance of experts in related areas that may indirectly benefit the project, its supportive services that will directly benefit the project, and its unique or unusual research facilities or instruments available to the project.
8. **List of References:** The style of the bibliographical item itself depends on the disciplinary field. The main consideration is consistency; whatever style is chosen should be followed scrupulously throughout.
9. **Personnel:** This section usually consists of two parts: an explanation of the proposed personnel arrangements and the biographical data sheets for each of the main contributors to the project. The explanation should specify how many persons at what percentage of time and in what academic categories will be participating in the project. If the program is complex and involves people from other departments or colleges, the organization of the staff and the lines of responsibility should be made clear. Any student participation, paid or unpaid, should be mentioned, and the nature of the proposed contribution detailed. If any persons must be hired for the project, say so, and explain why, unless the need for persons not already available within the University is self-evident.
10. **Budget:** Sponsors customarily specify how budgets should be presented and what costs are allowable. The budget delineates the costs to be met by the funding source, including personnel, non-personnel, administrative, and overhead expenses. The budget also specifies items paid for by other funding sources. Includes justifications for requested expenditures

2. RESEARCH REPORT WRITING

Research report is considered a major component of the research study for the research task remains incomplete till the report has been presented and/or written. As a matter of fact even the most brilliant hypothesis, highly well designed and conducted research study, and the most striking generalizations and findings are of little value unless they are effectively communicated to others. The purpose of research is not well served unless the findings are made known to others. Research results must invariably enter the general store of knowledge. All this explains the significance of writing research report. There are people who do not consider writing of report as an integral part of the research process. But the general opinion is in favour of treating the presentation of research results or the writing of report as part and parcel of the research project. Writing of report is the last step in a research study and requires a set of skills somewhat different from those called for in respect of the earlier stages of research. This task should be accomplished by the researcher with utmost care; he may seek the assistance and guidance of experts for the purpose.

DIFFERENT STEPS IN WRITING REPORT

Research reports are the product of slow, painstaking, accurate inductive work. The usual steps involved in writing report are: (a) logical analysis of the subject-matter; (b) preparation of the final outline; (c) preparation of the rough draft; (d) rewriting and polishing; (e) preparation of the final bibliography; and (f) writing the final draft. Though all these steps are self explanatory, yet a brief mention of each one of these will be appropriate for better understanding.

Logical analysis of the subject matter: It is the first step which is primarily concerned with the development of a subject. There are two ways in which to develop a subject (a) logically and (b) chronologically. The logical development is made on the basis of mental connections and associations between the one thing and another by means of analysis. Logical treatment often consists in developing the material from the simple possible to the most complex structures. Chronological development is based on a connection or sequence in time or occurrence. The directions for doing or making something usually follow the chronological order.

Preparation of the final outline: It is the next step in writing the research report “Outlines are the framework upon which long written works are constructed. They are an aid to the logical organisation of the material and a reminder of the points to be stressed in the report.”

Preparation of the rough draft: This follows the logical analysis of the subject and the preparation of the final outline. Such a step is of utmost importance for the researcher now sits to write down what he has done in the context of his research study. He will write down the procedure adopted by him in collecting the material for his study along with various limitations faced by him, the technique of analysis adopted by him, the broad findings and generalizations and the various suggestions he wants to offer regarding the problem concerned.

Rewriting and polishing of the rough draft: This step happens to be most difficult part of all formal writing. Usually this step requires more time than the writing of the rough draft. The careful revision makes the difference between a mediocre and a good piece of writing. While rewriting and polishing, one should check the report for weaknesses in logical development or presentation. The researcher should also “see whether or not the material, as it is presented, has unity and cohesion; does the report stand upright and firm and exhibit a definite pattern, like a marble arch? Or does it resemble an old wall of mouldering cement and loose brick.” In addition the researcher should give due attention to the fact that in his rough draft he has been consistent or not. He should check the mechanics of writing—grammar, spelling and usage.

Preparation of the final bibliography: Next in order comes the task of the preparation of the final bibliography. The bibliography, which is generally appended to the research report, is a list of books in some way pertinent to the research which has been done. It should contain all those works which the researcher has consulted. The bibliography should be arranged alphabetically and may be divided into two parts; the first part may contain the names of books and pamphlets, and the second part may contain the names of magazine and newspaper articles. Generally, this pattern of bibliography is considered convenient and satisfactory from the point of view of reader, though it is not the only way of presenting bibliography. The entries in bibliography should be made adopting the following order:

For books and pamphlets the order may be as under:

1. Name of author, last name first.
2. Title, underlined to indicate italics.
3. Place, publisher, and date of publication.
4. Number of volumes.

Example: Kothari, C.R., Quantitative Techniques, New Delhi, Vikas Publishing House Pvt. Ltd., 1978.

For magazines and newspapers the order may be as under:

1. Name of the author, last name first.
2. Title of article, in quotation marks.
3. Name of periodical, underlined to indicate italics.
4. The volume or volume and number.
5. The date of the issue.
6. The pagination.

Example: Robert V. Roosa, "Coping with Short-term International Money Flows", The Banker, London, September, 1971, p. 995.

The above examples are just the samples for bibliography entries and may be used, but one should also remember that they are not the only acceptable forms. The only thing important is that, whatever method one selects, it must remain consistent.

Writing the final draft: This constitutes the last step. The final draft should be written in a concise and objective style and in simple language, avoiding vague expressions such as "it seems", "there may be", and

the like ones. While writing the final draft, the researcher must avoid abstract terminology and technical jargon. Illustrations and examples based on common experiences must be incorporated in the final draft as they happen to be most effective in communicating the research findings to others. A research report should not be dull, but must enthuse people and maintain interest and must show originality. It must be remembered that every report should be an attempt to solve some intellectual problem and must contribute to the solution of a problem and must add to the knowledge of both the researcher and the reader.

LAYOUT OF THE RESEARCH REPORT

Anybody, who is reading the research report, must necessarily be conveyed enough about the study so that he can place it in its general scientific context, judge the adequacy of its methods and thus form an opinion of how seriously the findings are to be taken. For this purpose there is the need of proper layout of the report. The layout of the report means as to what the research report should contain. A comprehensive layout of the research report should comprise (A) preliminary pages; (B) the main text; and (C) the end matter. Let us deal with them separately.

(A) Preliminary Pages

In its preliminary pages the report should carry a title and date, followed by acknowledgements in the form of 'Preface' or 'Foreword'. Then there should be a table of contents followed by list of tables and illustrations so that the decision-maker or anybody interested in reading the report can easily locate the required information in the report.

(B) Main Text

The main text provides the complete outline of the research report along with all details. Title of the research study is repeated at the top of the first page of the main text and then follows the other details on pages numbered consecutively, beginning with the second page. Each main section of the report should begin on a new page. The main text of the report should have the following sections: (i) Introduction; (ii)

Statement of findings and recommendations; (iii) The results; (iv) The implications drawn from the results; and (v) The summary.

(i) Introduction: The purpose of introduction is to introduce the research project to the readers. It should contain a clear statement of the objectives of research i.e., enough background should be given to make clear to the reader why the problem was considered worth investigating. A brief summary of other relevant research may also be stated so that the present study can be seen in that context. The hypotheses of study, if any, and the definitions of the major concepts employed in the study should be explicitly stated in the introduction of the report. The methodology adopted in conducting the study must be fully explained. The scientific reader would like to know in detail about such thing: How was the study carried out? What was its basic design? If the study was an experimental one, then what were the experimental manipulations? If the data were collected by means of questionnaires or interviews, then exactly what questions were asked (The questionnaire or interview schedule is usually given in an appendix)? If measurements were based on observation, then what instructions were given to the observers? Regarding the sample used in the study the reader should be told: Who were the subjects? How many were there? How were they selected? All these questions are crucial for estimating the probable limits of generalizability of the findings. The statistical analysis adopted must also be clearly stated. In addition to all this, the scope of the study should be stated and the boundary lines be demarcated. The various limitations, under which the research project was completed, must also be narrated.

(ii) Statement of findings and recommendations: After introduction, the research report must contain a statement of findings and recommendations in non-technical language so that it can be easily understood by all concerned. If the findings happen to be extensive, at this point they should be put in the summarised form.

(iii) Results: A detailed presentation of the findings of the study, with supporting data in the form of tables and charts together with a validation of results, is the next step in writing the main text

of the report. This generally comprises the main body of the report, extending over several chapters. The result section of the report should contain statistical summaries and reductions of the data rather than the raw data. All the results should be presented in logical sequence and splitted into readily identifiable sections. All relevant results must find a place in the report. But how one is to decide about what is relevant is the basic question. Quite often guidance comes primarily from the research problem and from the hypotheses, if any, with which the study was concerned. But ultimately the researcher must rely on his own judgement in deciding the outline of his report. "Nevertheless, it is still necessary that he states clearly the problem with which he was concerned, the procedure by which he worked on the problem, the conclusions at which he arrived, and the bases for his conclusions."

(iv) Implications of the results: Toward the end of the main text, the researcher should again put down the results of his research clearly and precisely. He should, state the implications that flow from the results of the study, for the general reader is interested in the implications for understanding the human behaviour. Such implications may have three aspects as stated below:

(a) A statement of the inferences drawn from the present study which may be expected to apply in similar circumstances. (b) The conditions of the present study which may limit the extent of legitimate generalizations of the inferences drawn from the study. (c) The relevant questions that still remain unanswered or new questions raised by the study along with suggestions for the kind of research that would provide answers for them. It is considered a good practice to finish the report with a short conclusion which summarises and recapitulates the main points of the study. The conclusion drawn from the study should be clearly related to the hypotheses that were stated in the introductory section. At the same time, a forecast of the probable future of the subject and an indication of the kind of research which needs to be done in that particular field is useful and desirable.

(v) Summary: It has become customary to conclude the research report with a very brief summary, resting in brief the research problem, the methodology, the major findings and the major conclusions drawn from the research results.

(C) End Matter

At the end of the report, appendices should be enlisted in respect of all technical data such as questionnaires, sample information, mathematical derivations and the like ones. Bibliography of sources consulted should also be given. Index (an alphabetical listing of names, places and topics along with the numbers of the pages in a book or report on which they are mentioned or discussed) should invariably be given at the end of the report. The value of index lies in the fact that it works as a guide to the reader for the contents in the report.

ORAL PRESENTATION

At times oral presentation of the results of the study is considered effective, particularly in cases where policy recommendations are indicated by project results. The merit of this approach lies in the fact that it provides an opportunity for give-and-take decisions which generally lead to a better understanding of the findings and their implications. But the main demerit of this sort of presentation is the lack of any permanent record concerning the research details and it may be just possible that the findings may fade away from people's memory even before an action is taken. In order to overcome this difficulty, a written report may be circulated before the oral presentation and referred to frequently during the discussion. Oral presentation is effective when supplemented by various visual devices. Use of slides, wall charts and blackboards is quite helpful in contributing to clarity and in reducing the boredom, if any. Distributing a board outline, with a few important tables and charts concerning the research results, makes the listeners attentive who have a ready outline on which to focus their thinking. This very often happens in academic institutions where the researcher discusses his research findings and policy implications with others either in a seminar or in a group discussion.

Thus, research results can be reported in more than one ways, but the usual practice adopted, in academic institutions particularly, is that of writing the Technical Report and then preparing several research papers to be discussed at various forums in one form or the other. But in practical field and with problems having policy implications, the technique followed is that of writing a popular report. Researches done on governmental account or on behalf of some major public or private organisations are usually presented in the form of technical reports.

PRECAUTIONS FOR WRITING RESEARCH REPORTS

Research report is a channel of communicating the research findings to the readers of the report. A good research report is one which does this task efficiently and effectively. As such it must be prepared keeping the following precautions in view:

1. While determining the length of the report (since research reports vary greatly in length), one should keep in view the fact that it should be long enough to cover the subject but short enough to maintain interest. In fact, report-writing should not be a means to learning more and more about less and less.
2. A research report should not, if this can be avoided, be dull; it should be such as to sustain reader's interest.
3. Abstract terminology and technical jargon should be avoided in a research report. The report should be able to convey the matter as simply as possible. This, in other words, means that report should be written in an objective style in simple language, avoiding expressions such as "it seems," "there may be" and the like.
4. Readers are often interested in acquiring a quick knowledge of the main findings and as such the report must provide a ready availability of the findings. For this purpose, charts, graphs and the

statistical tables may be used for the various results in the main report in addition to the summary of important findings.

5. The layout of the report should be well thought out and must be appropriate and in accordance with the objective of the research problem.
6. The reports should be free from grammatical mistakes and must be prepared strictly in accordance with the techniques of composition of report-writing such as the use of quotations, footnotes, documentation, proper punctuation and use of abbreviations in footnotes and the like.
7. The report must present the logical analysis of the subject matter. It must reflect a structure wherein the different pieces of analysis relating to the research problem fit well.
8. A research report should show originality and should necessarily be an attempt to solve some intellectual problem. It must contribute to the solution of a problem and must add to the store of knowledge.
9. Towards the end, the report must also state the policy implications relating to the problem under consideration. It is usually considered desirable if the report makes a forecast of the probable future of the subject concerned and indicates the kinds of research still needs to be done in that particular field.
10. Appendices should be enlisted in respect of all the technical data in the report.
11. Bibliography of sources consulted is a must for a good report and must necessarily be given.
12. Index is also considered an essential part of a good report and as such must be prepared and appended at the end.
13. Report must be attractive in appearance, neat and clean, whether typed or printed.
14. Calculated confidence limits must be mentioned and the various constraints experienced in conducting the research study may also be stated in the report.

15. Objective of the study, the nature of the problem, the methods employed and the analysis techniques adopted must all be clearly stated in the beginning of the report in the form of introduction.

In spite of all that has been stated above, one should always keep in view the fact report-writing is an art which is learnt by practice and experience, rather than by mere doctination.
