A GUIDE TO THE PREPARATION OF RESEARCH PROPOSAL

Prof. H.P.M. Gunasena
Chairman
Coconut Research Board, Sri Lanka

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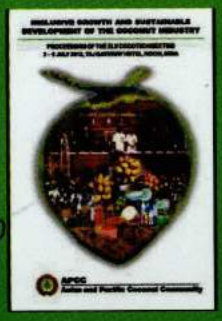

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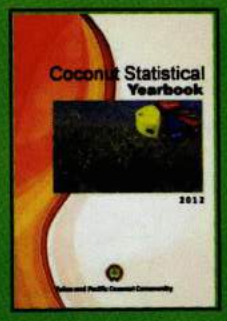

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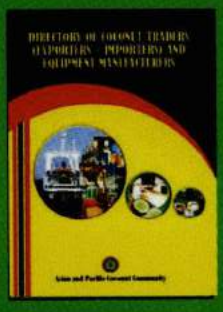

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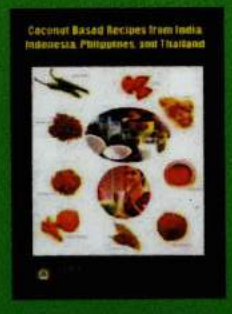

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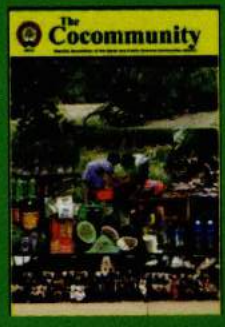

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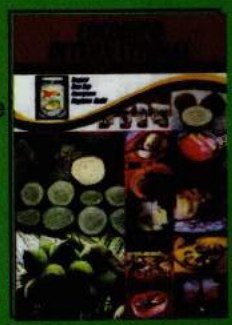

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Prof. H.P.M. Gunasena
Chairman
Coconut Research Board, Sri Lanka

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FOREWORD

Writing a good research proposal is an important skill that should be acquired by researchers in order to win the much needed financial support for their proposed research projects. A well written research proposal will likely be able to persuade and convince decision makers or funding agencies to provide necessary financial support. To achieve this goal, a good research proposal should contain such functions as a written representation of a programme/project, a request, an instrument of persuasion, a strong hypothesis, a well designed research methodology, a realistic research plan, budget and timetable, a promise of relevance and contribution to additional knowledge, and a commitment to provide answers or solutions to certain problems or technology gaps as well as to contribute to development action. All of these functions must be translated into a cohesive and a coherent research proposal.

Despite technical writing lessons provided during formal studies in the university, a comprehensive guide to the preparation of research proposal is considered to be important to be made available and accessible for those who are currently involved in research and development (R&D) work. The availability and accessibility of this book especially for coconut researchers is expected to pave the way for relevant research proposals to further develop the coconut industry.

With this end in view, Asian and Pacific Coconut Community (APCC) secretariat is happy to support the publication of A Guide to the Preparation of Research Proposal written by Prof. H.P.M. Gunasena, Chairman of Coconut Research Board, Sri Lanka. This book is written based on his vast experience and expertise both as a researcher and a university professor.

I would like to express my profound gratitude to Prof. H.P.M. Gunasena for his persistent effort to write this book and Mr. Muhartoyo, APCC Documentalist for the printing preparation process.

ROMULO N. ARANCON, JR.
Executive Director, APCC

PREFACE

The teaching of scientific writing and research proposal preparation is a new subject introduced to the university curriculum in recent years. Although this subject was considered less important in the past, currently it has assumed highest priority in all fields of science education in the universities. The neglect of this subject has created a problem to the students as they have not gained competence to write effectively making them less competitive in the job market. Also their on-job performance becomes less due to their inability to write well. This is generally true for all university students in non- English speaking countries.

Several ad hoc attempts have been made in the past to correct this situation by institutions involved in scientific research and universities. A number of seminars and workshops have been held on scientific/technical writing and research proposal preparation. The proceedings of some of these seminars and workshops have been documented, but they do not give adequate information and the impact has been less evident. Also, these 1-2 day seminars and workshops are instruction- type with less hands-on training. Normally, the training workshops in research proposal preparation should extend over 2-3 weeks and the participants should be able to complete a research proposal during that period.

As a result of this the research outputs of the national research system have been insignificant although substantial investments have been made for research and development activities. Evidently the researchers are reluctant to write their research findings due to lack of confidence in writing skills. These issues may have prompted the universities to introduce formal courses in scientific/technical writing and research proposal preparation.

The preparation of research proposals is a different activity altogether, but a through knowledge of scientific/technical writing is required to prepare proposals acceptable to the funding organizations. Many research proposals fail due to faulty writing, although the subject under discussion may be of considerable significance. Good writing can always make an impressive proposal to persuade funding organizations to part with some of their funds.

To my knowledge there are no book published locally on research proposal preparation which is a serious constraint to the academics and students of the universities as well as to the full- time researchers of the national research system. The intention of publishing this book is to fill this gap and help the researchers to prepare good proposals which could compete for funding.

To achieve the above objectives, the each section of the proposal from the title of the project to the designing of the budget described in this book has been expanded to include the principles of scientific/technical writing. Where appropriate, examples have been given to enable the reader to fully understand the content.

It is earnestly hoped that the book will be useful to the university academics, students and the scientific community to canvass funds for research and strengthen the research and development to vigorously promote the economic growth of our respective countries.

Prof. H.P.M. Gunasena
Chairman
Coconut Research Board, Lunuwila, Sri Lanka
August 2012

ACKNOWLEDGEMENTS

"In most of mankind gratitude is merely a secret hope of greater favours"
La Rochefoucauld, Francois De

This book began its life nearly twenty years ago when the author was assigned to teach a course in Technical Writing and Research Proposal Preparation at the Postgraduate Institute of Agriculture, University of Peradeniya. The inclusion of this new subject in the postgraduate curriculum was to cater specially to the postgraduate students pursuing M.Phil. and Ph.D. degrees which included an in-depth research component. However, this course has attracted many postgraduate students other than those pursuing research degrees. Therefore the course had to be designed to meet two specific objectives; firstly to develop knowledge and skills in technical/scientific writing, which university academics and professional researchers require most to achieve competence in writing journal articles and other scientific documents and secondly to develop competence in the preparation of research proposals.

In the long years of developing course materials, I have received valuable assistance from many academics of both local and foreign universities. It seems unfair to single out individuals from among the large number who helped, but I gratefully acknowledge their ideas that provoked me to develop a comprehensive postgraduate curriculum in technical writing and research proposal preparation, which culminated in the writing of this book. I owe my biggest editorial debt to Dr. EvarardJayamanne, Deputy Director (Research) of the Coconut Research Institute of Sri Lanka for loads of helpful suggestions and saw the book through the production. I am also greatly indebted to Prof. W.M.J.de Costa, and Prof. D.K.N.G. Pushpakumara, Senior Professors of Crop Science, Faculty of Agriculture, University of Peradeniya, and to Dr. Asoka Dissanayake, former Professor of Physiology, Faculty of Medicine, University of Kelaniya for an excellent review of the manuscript and valuable suggestions to improve the quality and content of this book. I could not have published this book without the constant encouragement and assistance provided by Dr. H.A.J. Gunathillaka, Director, Coconut Research Institute of Sri Lanka for which I am very grateful.

I also gratefully acknowledge the assistance received from Mr. P. A. Henry Nimal, Head, Technology Transfer Division and to Mr. M. A. Prasad Sanjeewa and Ms. D. Tharanga Dilani Danapala for meticulously typesetting the document and printing of this book.

Finally, the author is grateful to the Asian and Pacific Coconut Community for publishing this book.

1

INTRODUCTION

"The scientist does not study nature because it is useful; he studies it because he delights in it, and he delights in it because it is beautiful. If nature were not beautiful, it would not be worth knowing, and if nature were not worth knowing, life would not be worth living"

Jules Henri Poincaré

Research is for development; hence every country invests considerable amount of funds from their national budgets for research in various fields. The level of budgetary allocations by different countries for research and development varies depending on their level of economic development. The developed countries invest more on research while the less developed countries, due to budgetary constraints invest less. All the countries have established national research systems to foster research for development. The national research system includes the research institutions, universities, private sector, industry and non-governmental organizations. As the funds are not freely available for research, funding organizations have been established locally as well as globally to provide funds for research and development activities. These funds are allocated on a competitive basis considering local, national or international research and development priorities. Therefore, the researchers have opportunities to apply for these grants. Unfortunately, many researchers find it difficult to access these funds due to their inability in identifying significant problems, developing a strong hypothesis, use of proper methodologies and poor overall presentation of proposals. It is generally known that over 95% of research grant applications fail to achieve success due to many of the above reasons.

Many postgraduate students and young researchers do not understand what a research proposal means and why it is important. This is because they have insufficient knowledge on research proposal preparation. Most of the universities, except a few do not offer courses in research proposal preparation. Having not acquired adequate knowledge, many researchers become disappointed when their research proposals fail to convince the funding organizations. The primary aim of funding organizations is to promote high quality research which is directed to solve specific problems, whether in developing or developed countries and to advance the knowledge in specific disciplines. Many funding organizations often report that the

proposals they receive are incomplete in various aspects. The projects are not clearly designed; hypotheses are not clear, objectives do not match with hypothesis, the methodologies are inadequate and the budgets are inflated in relation to the activities proposed. As a result of these deficiencies many proposals fail to attract funds, which discourage the potential researchers. Therefore, the objective of this document is to provide information and broad guidelines to help the researchers to prepare acceptable research proposals.

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DEFINITION OF A RESEARCH PROPOSAL

"Perfect as the wings of the bird may be, it will never enable the bird to fly, if unsupported by the air. Facts are the air of science. Without them a man of science can never rise"

A research proposal may be defined as a written plan for carrying out a scientific investigation on a given problem. It indicates a specific course of action as well as the inputs needed to solve the chosen problem. A research proposal is commonly prepared for submission to a funding organization for possible financial or technical assistance or both.

The research proposals are in essence mini research papers that have not reached the stage of actual practice (Stapleton *et al.*, 1995). If the proposal is accepted by the funding organization it will be implemented and final outputs will be published as a research paper.

A research proposal always involves two parties, the proponent of the proposal and the funding organization. The funding organization may accept, reject or modify the proposal to meet its needs. Therefore it must be remembered that a proposal is written for presentation to another party in order to gain its acceptance. Different funding organizations have well defined priorities and specific requirements for their research grant applications.

Therefore, a research proposal should perform some definite functions. These functions can be listed as follows:

- A written representation of a programme
- A request
- An instrument of persuasion
- A promise and a commitment
- A plan

3

COMPONENTS OF A RESEARCH PROPOSAL

"Science progresses best when observations force us to alter our preconceptions"

Vera Rubin

A research proposal has several components and they differ from each other depending on the requirements of the funding organizations. As the funding organizations require proponents to make use of their application forms, the proponent is not required to make his own application form. Sometimes researchers may ask as to what component of the proposal is most important. Naturally, all parts of the proposal will be important. However, if this question is posed to a funding organization, they may ask what contributes to the rejection of a proposal? In some studies it has been concluded that the rejection of a proposal is mainly due to either in the weakness in the approach to the problem or lack of sufficient confidence in the competence of the researcher.

Presented below is the common list of items of a research proposal.

3.1 Letter of Transmission

3.2 Title of the Research Proposal

3.3 Table of Contents

3.4 Abstract / Executive Summary / Summary

3.5 About the Submitting Institution/s

3.6 Introduction

3.7 Identification of the Research Problem

3.8 Formulation of Objectives, Goals and Strategies

3.9 Materials and Methods

3.10 Schedule of Activities

3.11 Expected Outputs

3.12 Dissemination of Research Outputs

3.13 Budget

3.14 Supporting Documents

3.15 Curriculum Vitae (CV) of Researchers

3.16 References

3.1 LETTER OF TRANSMISSION

The letter of transmission or the covering letter is a written request made by the proponent of a research proposal to a funding organization. This letter is submitted with the proposal. This letter is the first official contact between the proposer and the funding organization. Therefore, it should be written in all politeness on a letterhead of the proponent's institution, signed by the proposer and recommended and forwarded by the head of the institution.

Every proposal submitted to a funding organization should have a letter of transmission to enable follow-up correspondence between the parties. The correct corresponding mailing address and e-mail address should be given to avoid delays.

3.2 TITLE OF A RESEARCH PROPOSAL

The title of a research proposal is the most important item as it is the first read statement by the evaluators of funding organizations.

- It is the first statement of the proposal and indicates in summary form the content of the proposal
- It points to the specific problem to be studied and serves as a frame of reference for the study

To effectively perform these functions the titles should be brief and concise, and accurately descriptive of the objectives of the proposal. It should be written in such a manner that names of the variables to be investigated are included. If the number of variables is not more than three or four, they can be specifically included. However, if the number of variables is large, reference to them should not be by enumeration but by using appropriate collective terms or phrases such as "physical properties of soils,

instead of texture density, permeability or morphological characteristics of a plant instead of leaf, stem, flowers etc.

Short titles are more effective in conveying the essence of the proposal because they are easier to understand; hence they should be preferred to long titles. As Wong (www.meaning.ca) states that an effective, attractive and a catchy title not only picks the readers' interest, but also predisposes favourably towards the proposal. The maximum number of substantive words in the title should not exceed 20-25. A title that runs a single line is easier to read and understand than a title that runs over two or three lines.

Very often the titles of proposed studies are not indicative of what is proposed in the study. Therefore, the researcher should make an effort to make the title appropriately reflect the main theme of the proposed study.

3.3 TABLE OF CONTENTS

Every proposal should have a table of contents to enable the reader to easily find the topics listed in the proposal. The table of contents will indicate at a glance what topics are covered in the proposal. Although this may not be necessary for small proposals, for large proposals a well-defined table of contents with sub divisions of all important sections of the proposal should be prepared.

3.4 ABSTRACT/EXECUTIVE SUMMARY/SUMMARY

Every research proposal should have an Abstract, Executive Summary or Summary placed in a separate page at the beginning of the proposal. The funding organization in their research grant application will indicate whether they require an abstract, executive summary or a summary. It is a brief but a very concise summary of approximately 300 – 400 words. This enables the reader to understand the content of the proposal. This is the most read part of the proposal; hence it should be complete, concise, clear and cohesive. Most evaluators rely initially on the abstract/summary to get an overview of the proposal; hence it should stand on its own without the full proposal. It will include the nature of the problem to be investigated, rationale/justification of the study and expected outputs, description of the methods to

be employed, experimental design and layout, sampling procedures, instruments to be used, extent of its application and the significance of the study and its implications. This is the most important single element of the proposal.

3.5 ABOUT THE SUBMITTING INSTITUTION

Lead Institution: The name and address and contact numbers (telephone/fax and e mail) of the submitting institution should be given. A brief history of the institution, its organization and affiliation (whether government, university or private) availability of research personnel and technical staff, facilities, library and other resources which contribute to the proposed research must be mentioned. If the institution has demonstrated excellence in a particular area of research and it has up to date laboratory and field facilities that should be specifically stated as it may indirectly benefit the proposed research. If the institute is recognized either locally or globally for a specific type of research with a good track record the funding organizations are likely to consider proposals emanating from such prestigious institutions more favourably than those from institutions which are not well known. In fact, there are instances where the funding agencies contact prestigious institutions or individual researchers in those organizations when research grants are advertised.

Outside collaborating institutions: Most research proposals include outside institutions as partners. Some funding organizations encourage research partnerships between private sector and national research institutions and universities. This is a means to strengthen the national research system for more output of public good research. If support from outside institutions is sought where competency or specific resources become necessary to conduct the research project, it should be mentioned. Moreover, the name of the laboratory, and persons with whom such a contract to be made should be clearly stated. If international collaboration is planned as an interregional project letters of support from those institutions should be attached to the proposal as an appendix.

3.6 INTRODUCTION

An introduction is the formal beginning of the proposal and provides the background and a framework to the research problem. Introduction will provide background to the nature of the problem to be investigated, it will review the pertinent literature to

orient the reader and define the problem to be investigated (Day, 1979). A comprehensive literature review will identify the gaps in knowledge or controversial areas of literature in the selected subject. It will provide opportunities for the researcher to develop new models and concepts, to confirm or reject theories and present alternatives to beliefs and ideas that have not seen to work anywhere. It could be used to formulate questions that need further research and to develop a hypothesis for a research proposal.

An Introduction will help the researcher to develop an innovative proposal without duplication or in other words "reinventing the wheel". This will allow the researcher to develop a more effective and appropriate design for the study. A review will also introduce the researcher to new methodologies that he may not have been aware before. It will advance the knowledge of the researcher in that subject; he will establish competency and credibility, which will help to design the study and to interpret the results after completion of the study. In other words, the researcher will become competent to identify a problem for the proposed study.

If the problem is not stated clearly the evaluator will have no interest in the solution. If the problem has not been stated effectively and in a meaningful way with all supporting evidences from the literature, the evaluator will not be impressed. As Day (1979) states you should "hook" to gain the evaluators attention. Why did you choose that "subject" and why it is "important"?

The introduction of a research proposal serves four main functions. They are;

- Provides general background to the proposed study
- Present the problem to be investigated and how it was selected
- Elucidate the importance or significance of the study
- Identify who the beneficiaries of the results of the study are and how they will be benefitted. It is necessary to quantify the benefits by a reliable quantitative method such as cost : benefit analysis.

The final paragraph of the introduction will state the problem of the research proposal. This will enable the evaluators understand the actual benefits and provide an enhancing effect on the persuasive power of the proposal.

The most pertinent areas and the references should be incorporated into the introduction. However, in the case of postgraduate research, a thorough review of literature is expected by the supervisors and from that the most pertinent literature should be selected for the introduction of the proposal.

The literature reviews written by most researchers suffer from the following deficiencies (Wong, www.meaning.ca).

- Lack of organization and structure
- Lack of focus, unity and coherence
- Being repetitive and verbose
- Failing to cite influential references
- Failing to keep up with recent developments
- Failing to critically evaluate cited references
- Citing trivial and irrelevant references
- Depending too much on secondary sources

Therefore, it is important for the researcher to keep in mind the above in order to avoid pitfalls. These limitations will open avenues for proposal evaluators to question your scholarship and research competence leading to the rejection of a worthy proposal.

3.7 IDENTIFICATION OF A RESEARCH PROBLEM

"The scientist is a practical man and his are practical (i.e., practically attainable) aims. He does not seek the ultimate but the proximate. He does not speak of the last analysis but rather of the next approximation. His are not those beautiful structures so delicately designed that a single flaw may cause the collapse of the whole. The scientist builds slowly and with a gross but solid kind of masonry. If dissatisfied with any of his work, even if it be near the very foundations, he can replace that part without damage to the remainder. On the whole he is satisfied with his work, for while science may never be wholly right it certainly is never wholly wrong; and it seems to be improving from decade to decade"

G. N. Lewis.

The identification of a suitable problem that is worth investigating is the most difficult part of research proposal preparation. In fact most researchers consider this as the most difficult part of research proposal preparation. In the case of postgraduate students this is an intellectual exercise as those who successfully identify a significant research problem are considered to show the signs of a potential researcher. For professional researchers it is a challenge to select a significant problem. The problem and its significance are the two items the funding organizations consider when they evaluate research proposals. Therefore the selection of an important problem is of critical importance. The selection of an unimportant research problem can mean a lost chance for the proposal to get funding support.

There are several ways in which a research problem could be selected.

3.7.1 Priority of the funding organization: The primary objective of preparing a research proposal is to solicit interest and support of a funding organization. Therefore it is only logical to find out what the priority research areas of the organization are before embarking on a search for a specific problem to develop a research proposal. Most of the funding organizations indicate the broad areas for which research grants are awarded to direct the attention of the researchers to undertake research to solve those problems. Most of the international funding organizations such as United States Agency for International Development (USAID), Rockefeller Foundation, Japan International Cooperation Agency (JICA), International Development Research Centre (IDRC), Canadian International Development Agency (CIDA), Board on Science and Technology in International Development (BOSTID), International Fund for Agricultural Development (IFAD) and some of the local funding agencies indicate research priorities. Most of these funding organizations also make their priorities known to major research organizations and individuals. Sometimes they are published widely to notify the researchers. As this information is also available on their websites, the researcher should undertake a thorough web search before attempting to identify a problem. If the researcher knows what these areas are, then he can narrow down to a specific problem within the broad area which will be acceptable to the funding organization. This will make problem identification simple and easier. It will also give the researcher a greater chance for being considered favourably because the proposal can be made on a topic that falls within the sphere of interest of the prospective funding organization.

For instance in agricultural sciences breeding for optimizing yield of major cereals have been a priority research area of many funding organizations in the past. In the recent years increasing crop yields to meet the escalating food demand for increasing population has diverted their attention to the use of molecular techniques in breeding than conventional techniques. Therefore, it is important for the researchers to check on these priority areas before embarking on the preparation of a research proposal.

The local funding agencies, which are very few in most of the developing countries, also specify research priorities at different times. In Sri Lanka, there are three such institutions; the National Research Council, National Science Foundation and the Council for Agricultural Research Policy which provide funds for institutions under national research system. The national research system in Sri Lanka constitutes several research institutions that undertake research. These are Tea, Rubber, Coconut and Sugarcane research institutions which are specifically designated for research on those respective crops; Department of Agriculture conducts research mostly on annual field crops, fruits and vegetables and the Department of Export Agriculture on spices and allied crops. The livestock research is undertaken by the Veterinary Research Institute. Research on fisheries and aquatic resources is undertaken by National Aquatic Resources Agency. These institutions have developed their own research priorities and funds are allocated from the consolidated fund of the government or they may request funds from funding organizations. Their research priorities also differ from time to time based on national development priorities. The universities also undertake considerable amount of research, but they have not developed any priorities. The professional staffs of universities have their own interests and priorities and conduct research studies in their own respective fields of specialization. They may receive funds from the University Grants Commission or any other local or international funding organizations.

3.7.2 Area of specialization of proponent: It is always advisable to confine the area of research to the area of specialization of the researcher because it is the area in which he is most qualified and equipped to develop a research proposal. If the area selected is outside the proponent's capability, funding organization and even the home institution may question, which may cause embarrassment to the proponent. It is important to bear in mind that the funding organizations put a lot of weight on the researcher's technical competence when evaluating proposals for possible funding.

However, it has to be noted that the priorities of funding organizations may not cover the competencies of all proponents and this may prevent some researchers from applying for research grants. This can be overcome if the researchers can work as a

team which allows the competence of all the researchers to be pooled to develop and implement the proposed research.

3.7.3 Review of literature: The common approach used by most researchers is to undertake a thorough search of literature to identify a problem. A review of literature is a comprehensive account of what has been published on a topic by accredited scholars or researchers. Sometimes the reviews are limited to a certain time period. A review should not be a description of the literature available or a set of summaries, but a critical analysis of the available literature on a selected subject.

A comprehensive review of literature performs a number of functions:

- It provides a guide to a particular topic
- It provides an overview and acts as a stepping stone if you have limited time
- It helps to clarify the nature and importance of the problem to be studied
- It gives information that the proposal is not a duplication and is not attempting to reinvent the wheel
- It introduces the researchers to the methodologies or approaches that they may not have been aware before; thus helps the researchers in developing a more effective and appropriate design
- Depth and breadth of a review gives an indication of the extent of knowledge of the researcher in the specific subject area selected for the research which adds to his credibility.
- It shows the ability of the researcher to scan literature, using manual or computerized methods and to identify books and journals useful to the proposed research
- It shows the ability of the researcher for unbiased critical analysis of literature
- It will help in the interpretation of results when the study is completed

Therefore, it is important for the researcher to give due consideration to the review of literature to avoid mistakes that make the proposals unsuitable for funding. If the review is done hurriedly, it is likely that some of the important references that could give information or ideas may be omitted. If the review is too broad, it may lead to confusion, thus it is important to define the limit of the topic for the review. Therefore, comprehensive knowledge in the field will make the preparation easier and allow formulation of the hypothesis for the research.

comprehensive knowledge in the field will make the preparation easier and allow formulation of the hypothesis for the research.

3.7.4 Active participation in scientific meetings: The participation in scientific meetings such as seminars, conferences, symposia and workshops is an effective means to get the current information on research problems. The advantage of these meetings is that apart from providing up to date information, they also provide for exchange of views by participants. This will also provide opportunities to discuss individually your own problems and make contact with researchers in the same or related fields of interest.

3.7.5 Conducting field visits: Conducting field trips is another effective approach that can be used to identify problems for research. The researchers could get first-hand information on some topics from which research ideas may emanate. In the case of agricultural research, meetings with farmers during field trips could provide opportunities to identify problems, so to say from the horse's mouth at grass root level. Some of these problems may be the ones that the researcher may have never thought of before.

The problem identification is an intellectual process for researchers and particularly for postgraduate students. Therefore problem identification will take a considerable period of time. In the search of a problem one may end up with a number of potential topics rather than just one. At this stage, the researcher should undertake a further in-depth evaluation to arrive at a topic that could be used to prepare the proposal. In this process some criteria listed below could be used.

- **Proponent's interest in the problem**: It is always best to work on a problem that is of real interest to the researcher. If the researcher is keenly interested in the problem, such a research project is more likely to succeed.

- **Significance of the problem**: The significance of a particular research problem is a relative matter. Every country, region or organization identifies its own research gaps and priorities according to their own developmental needs. Some countries prepare long term national research plans. The problem should be of considerable importance that it will have application locally, regionally and internationally. The funding organizations invariably put a lot of emphasis on the significance of the problem and the expected

results when they evaluate proposals for possible financial support. Therefore the researcher should devote considerable thought on this aspect when deciding on which problem he should select. The researcher should ask himself the following questions to arrive at a satisfactory answer.

- Does the problem meet the scope, significance and topical requirements of the institution to which the proposal will be submitted?
- Will the findings be of practical value to policy and decision makers, extension workers, farmers and ordinary citizens?
- Will the solution to the problem advance knowledge in the field appreciably?
- What will be the breadth of application of findings in terms of range of coverage of individuals, years of applicability and areas of coverage?

- **Duration of the project**: This indicates the time required to complete a research project. This will depend on the time available to the researcher to devote to the project and the duration that the funding organization may consider when considering financial support. This will also depend on the type of research, for example laboratory studies could be completed in a comparatively short time than those involving forest trees or perennial crops such as coconut, tea or rubber. Usually, short duration projects are better for both the researcher and the funding organization. Therefore, it is preferable to select a problem that will take less time to study than one which will require a longer duration. Generally, long term studies are more costly to implement and many funding organizations are unwilling to commit funds for long duration projects. It is desirable to plan for a project with a duration of about 2-3 years.

- **Availability of resources**: If the proponent's institution can provide most of the essential equipment and facilities, such research is likely to elicit more support from funding organizations than those that require the procurement of such resources. If the equipments are available at the home institution, the project cost will be considerably less and it will not be a big burden to the funding organization. As these are available in the institution the project implementation will be easier and quicker and the project can be completed

within the allocated period. If equipment has to be procured, it may take time for these to be delivered to the project sites before the project can be implemented. Some researchers often inflate the equipment budget to update their laboratories, but this could turn out to be a disadvantage.

3.8 FORMULATION OF OBJECTIVES, GOALS AND STRATEGIES

"Big goals create a fear of failure. Lack of goals guarantees it"

Anonymous

Once the research problem is identified the next task for the researcher is to formulate the objectives of the study. In other words, this is the part of the proposal where the researcher provides a definition of what he expects to achieve. Objectives are important because they have a direct bearing on what variables to be included in the study, the experimental design to be used, duration and the cost of the study. They will also be the basis for determining the accomplishments of the study when it is completed.

The term objectives imply the desired results or the goals that are to be achieved by the research project. When developing objectives it is necessary to adopt the **SMART**, which is a mnemonic used to set objectives often called key performance indicators. The objectives must be; **S**pecific, **M**easurable, **A**chievable, **R**ealistic and **T**imely.

Specific: Specific indicates that the objective is clear and specific, unambiguous and not a general one.

Measurable: Measurable indicates that there should be definite criteria to measure progress in attaining the objective.

Achievable: Achievable indicates that the objective is realistic and can be achieved. Sometimes researchers set overambitious objectives which are difficult to achieve.

Realistic: Realistic means that the objectives are based on facts than ideals

Timely: Timely indicates that the objectives are time –bound, giving a target date to achieve the objectives

General and Specific Objectives:

In research proposals the objectives are listed as General Objective and Specific Objectives.

General Objective:

This is broader in scope and indicates what is to be achieved by the research project. It is a long term development objective to which the project will contribute. For example, in a rice research programme on varietal evaluation or rate of fertilizer application, the general objective would be to increase national rice production to achieve self-sufficiency.

Specific Objectives:

These relate to the specific research questions for which the investigator is seeking answers through the proposed study. For example in the above rice varietal evaluation trial the specific objective would be to select the most outstanding variety in terms of growth and yield among those tested, in the case of rate of fertilizer application, to identify the optimum of fertilizer rate, that gives the highest yield.

Some researchers tend to include too many and over-ambitious objectives that cannot be easily achieved; this should be avoided. It will also increase the work load, duration and costs of the project. In a proposal there should be about 3-4 or even 5 specific objectives directly related to the proposed hypothesis.

3.9 MATERIALS AND METHODS

In this part of the proposal the proponent provides the plan of action in order to achieve the objectives of the study. This section should be written in detail, giving reasons for selecting a particular method over other available methods. The evaluator should get the impression that the best options have been selected, that are most efficient and cost effective. The guiding principle for writing the methods section is that it should contain sufficient information for the proposal evaluator to determine whether the methodology is sound (Wong, www.meaning.ca).

This section is important as you have to impress the proposal evaluators how you plan to tackle the research problem. A page limit to this section cannot be specified as it depends on the type of research planned. The guiding principle for writing this section is that the proponent should give sufficient detail that the methodology is sound. Most of the funding organizations find that the most common reason for proposal rejection is due to the lack of detail in the methodology (Sanchez, 2006). Some even argue that a good proposal should contain sufficient details that another qualified researcher can implement the project (Asya Al-Riyami, www. omjournal.org).

This section should include the following information.

- **Time and place of the study**: In field studies the time and place of the study should be explicitly stated. Time should indicate in terms of when the study will be started and when it is expected to be completed. The researcher should clearly indicate that the duration it will not go beyond the anticipated time necessary to bring the study to a successful completion.

- In regard to the place it is not enough that the place of the study is stated. A brief description of the place is necessary (e.g. In agriculture related studies , soil classification, soil properties such as texture, structure, water holding capacity and bulk density, N, P, and K content, soil pH, C:N ratio; climate data such as annual rainfall, maximum and minimum temperature, latitude, longitude etc.) and an explanation on why that place is selected for the study. However, it should be noted that the inclusion of these details will depend on the objectives of the proposed study, if the researcher is planning to use them in data analysis, interpretation of results and report writing.

  The detailed information about the methods will indicate to the evaluator whether the proposed investigation is a laboratory or a field study. In the case of laboratory studies information is necessarily limited, but in a field study detailed information will be required.

  Some important points regarding the place of study will include the following aspects.

  - Whether the place selected is representative of the places where the problem exists.

- Is the place readily accessible to the researchers? Far away places create difficulties for travel and increase transport costs and may be a waste of time for the researchers.
- Are there facilities or services near the place selected that can be availed of by the researchers? These may include research stations, universities, service centres, and townships that exist nearby.
- Is the place free of external factors that may cause disturbance during the implementation of the study? These may include areas subjected to frequent floods or droughts and wild animal damage in the case of agricultural experiments and areas where human conflicts exist with threat to the life of researchers and the properties.

This section has two components:

- **Materials**: The materials that will be used to conduct a study can be classified into two broad categories:
  - **Those upon which the observations will be made**

    The materials to be used, for example; seeds of crop varieties, seedling, trees, leaves, other plant parts, animals, soil, water, people etc, particularly those upon which observations are to be made should be adequately described. Depending on the nature of the materials, the description should be in terms of the number or volume, size, method of preparation and how that material was selected. If crop varieties/animal species are variables, their botanical/zoological names should be given. The proposer should give the complete updated scientific name (the full binomial name in Latin) when quoting plant or animal species with their authorities. Some examples are given below.

    Plants: Rice- *Oryza sativa* L., Maize- *Zea mays* L., Coconut- *Cocos nucifera* L., Jak fruit- *Artocarpus heterophyllus* Lam, Durian-*Durio zibethinus Murr*, Guava- *Psidium guajava* L.,

    Animals: Cattle- *Bos taurus bojanus,* Water Buffalo- *Bubalus bubalis* L. Sheep- *Ovis aries* L., Goat- Capra *aegagrus hircus* L., Rabbit- *Oryctolagus cuniculus* L. Poultry, Gallus *gallus domesticus* L.

In the case of agro-chemicals and fertilizers generic names should be given instead of trade names, which if necessary may be given within brackets.

- **Those used for measuring the variables**

  This section should state the proposed items such as equipment that are used for measuring the variables and justify their use. If well known methods are used, justification will be easier than when selecting those that are not widely known. Those such as the Kjeldhal for measuring nitrogen, flame photometry for measuring potassium, Walkley and Black method for estimating Carbon etc, are standard methods used by most researchers and need no description. If not widely known methods are used, details are required. Example: new equipment or a method or an improvement to an existing method developed by the researcher or a colleague in his home institution should be fully described, and backed by references.

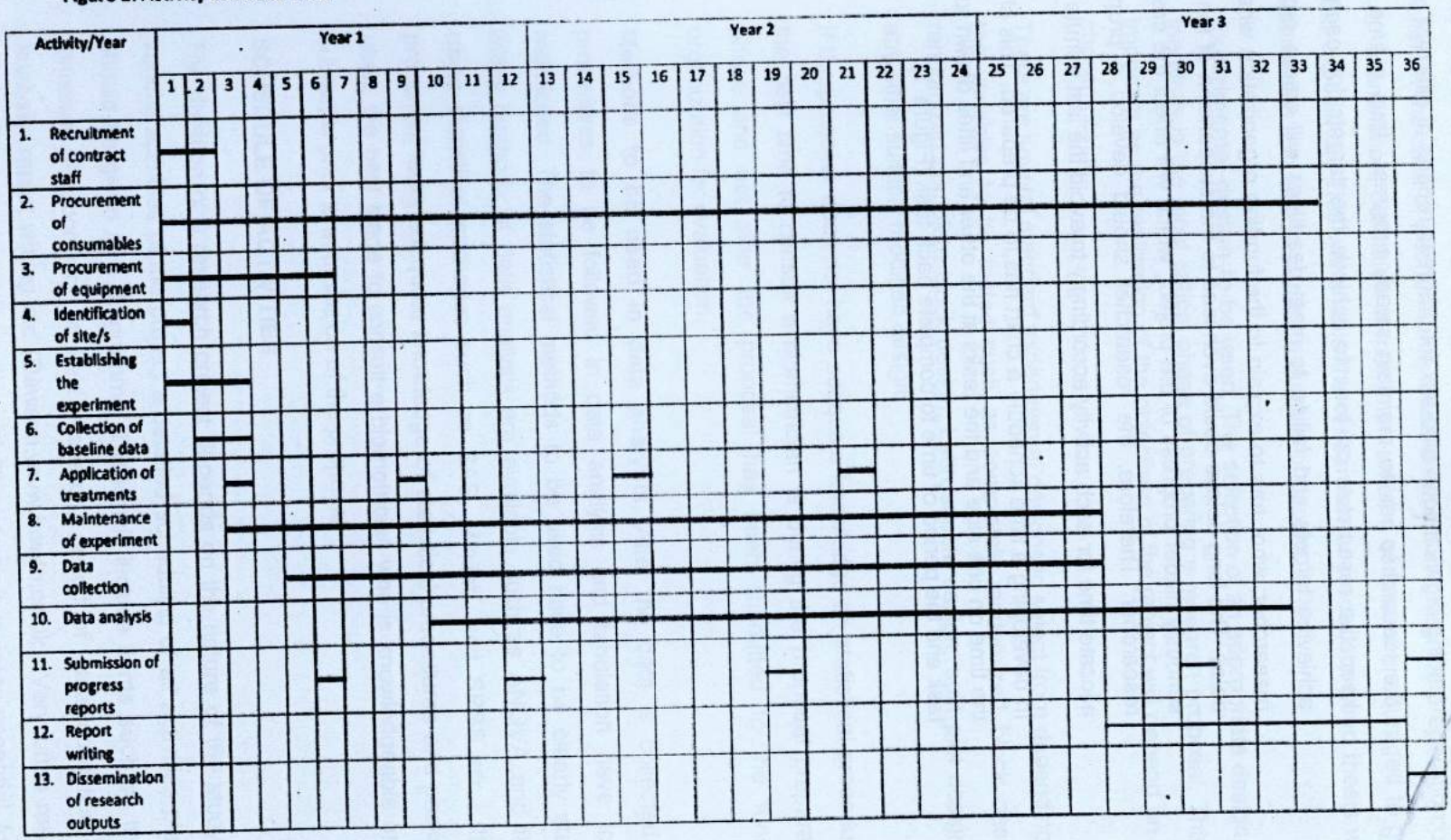
- **Variables to be examined and how they will be determined**

In any research proposal the variables to be examined should be described. These variables should be relevant and limited to the objectives of the study. Describe the experimental treatments, single or factorial and the basis for selecting the treatments.

- **There is also a need to provide:**
  - Information on what factors will be examined and how and when they will be selected, at random or not
  - Where appropriate , an illustration of the experimental layout or sample of forms or questionnaires to be used
  - An indication of how and when the data will be collected
  - Description of statistical methods to be used in the analysis of the data

The methods of data collection include the measurements/observations made on the selected variables. The data collection will vary according to the type of study. In all cases only the most important data to validate the hypothesis should be collected. These may be direct measurements on the materials used or from secondary sources as in the case of social science studies. The extent of data collection will

Figure 1: Activity Chart vs. Time



3.11 EXPECTED OUTPUTS

The expected outputs are indicated under the objectives of the proposal and they are the outputs the researcher has planned to achieve when the project was planned. The outputs must be significant; they are finite, measurable and definite. The failure for identifying clear outputs is a fault of many research proposals (Stapleton et al., 1995). If the outputs are not clearly worked out it will constrain any funding organization to consider such proposals.

3.12 DISSEMINATION OF RESEARCH OUTPUTS

Research is useful and worth the investment and time only if the results are used for the benefit of a majority of people of a country, enhance production capacity of an industry, or contribute to national development of a selected sector or advance the knowledge in a subject area appreciably. There is the need to decide what to do with your research outputs? How you plan to share your findings with other professionals, practitioners, policy makers and funding organizations. Therefore a clear time-bound plan for the dissemination of research outputs should be given in the proposal. This plan may include the following:

- Plan for publication of results of the project in local or international journals
- Other plans for presenting the results at local /international seminars and conferences
- Publish as monographs, book chapters, theses
- Identify the target group of beneficiaries
- Other institutions that could benefit from the results
- Any contacts with the industry that could benefit from the results
- How the project outputs could benefit the home institution and other related institutions
- How the outputs could contribute to national and international development

3.13 BUDGET

The budget is one of the most important components of the proposal; hence it should be carefully planned. The main objective of writing a proposal is to canvass funds from a funding organization and the main item that a funding organization scrutinizes is the budget.

If the proposal is to be submitted to a local funding agency, the budget estimates have to be prepared in local currency. If the proposal is to be submitted to an international funding organization, it is advisable to prepare the budget in the currency used by that country. It is common to prepare the budget of foreign funded proposals in US dollars.

The budget is a planning tool that specifies the expenditure allocation for various services listed in the proposal. It will include several items of expenditure required for implementing the research proposal. These will include personnel services, equipment maintenance and operating expenses such as travel, materials and other supplies, equipment and other items required to conduct the study. The most important to remember in preparing the budget is that it should be realistic. The budget should be based on the actual needs to conduct the study and should not be unduly inflated.

The funding organization normally provides a standard form for writing the proposal. This form invariably includes a format for preparing the budget. Sometimes these forms also indicate the limits of budget for different activities, for instance the budget for equipment may be limited to 30% of the total project budget and these should be adhered to. Although the style of preparing the budget may vary according to the funding organization, it generally covers the following items.

Major Items of a Budget

Personnel services: This section includes the salaries and allowances of personnel involved in the project directly such as research assistants, technical assistants and any other support staff needed for specific work. Their salaries and allowances should be worked out on the basis of time allocated to the project. If the principal investigator or team leader is to be paid an honorarium, that should be mentioned. It is common to employ postgraduate students in the research programme, if so their monthly stipends, registration, tuition, supervisory, examination, library, thesis preparation and any other fees levied by the universities should be included. The salaries should also include monthly provident fund payments as it is a statutory requirement. The salary scales of the staff of the research project should be determined on the basis of salary scales paid to professional staff of similar positions in research institutes. However, as these are temporary positions, higher salary scales should be prescribed to attract qualified and talented people and to retain their services until the completion of the project.

If the project plans to obtain the services of local or foreign consultants, their payments are generally higher and should be included in the budget. The salaries of consultants also depend on their specializations and in cases where foreign consultants are employed the payments will include a consultancy fee and a daily stipend, in addition to travel expenses. The salaries of all staff should be calculated only for the period they are actually going to work on the project. In case a consultant is required, the period should be mentioned. Similarly, if the services of a statistician are needed for data analysis, at the end of the project, his salary should be reflected in the budget for the final year of the project. The proposal should include the type of personnel required and justify their need.

Equipment and machinery: These are durable capital items and require large sums of money for procurement. They may include a vast array of items such as laboratory equipment and machinery, irrigation pumps, data processing equipment such as computers and printers, photo copiers etc. For long duration projects which involve extensive field work entailing travel, vehicles may be requested. Sometimes the laboratories and experimental fields may have to be redesigned to meet specific requirements of the project. It is necessary for the researcher to limit these items to those needed for the successful completion of the project in hand and not for upgrading the facilities of the laboratories. Each item of expensive equipment should be fully justified such that without them the project will find it difficult to succeed. A complete description of the equipment is required such as type, model, quantity etc. To convince the funding agency, it is wise for the researcher to obtain the exact costs of equipment from the agents before preparing the budget.

Most funding organizations expect the host institution to meet a part of the equipment needs. If the host institution is well equipped with laboratory or field equipment, funding organizations are likely to consider those proposals more favourably. Therefore, indicate the major equipment and facilities relevant to the project available in the home institution.

Supplies: These items include the consumables such as chemicals, glassware, communication expenses, stationery and office supplies. These items are used during the process of research.

Travel and subsistence: These include transport costs of personnel and materials to and from work sites etc. If project vehicles are not available, they have to be hired at daily or monthly basis at local rates. Normally, the local funding agencies do not provide funds for the procurement of vehicles. However, large projects funded by international funding organizations may consider vehicles, if a strong justification could be made. The researchers will require a daily subsistence allowance while travelling. These rates are generally similar to the rates stipulated by the government. However, considering that these are very low, higher rates could be suggested giving reasons.

In many projects, provision is made for overseas travel for researchers for various purposes. These may be for them to participate in workshops and conferences which are related to project work, to present the findings of the project at international conferences and to update their knowledge etc. When postgraduate students are employed as research assistants, some projects provide travel and subsistence for short to medium periods to provide specialized training related to the project in a selected research institute or a university. If foreign consultancies are planned, provision should be made for their travel under this category of expenditure. These consultancies may be for one or two missions depending on the needs of the project. In overseas travel, the location of travel should be indicated and travel funds based on quotations obtained from a travel agency. As these items cannot be included in mid way of the project it is important for the researcher to identify these and make a full justification.

Publications, seminars and workshops: The research projects culminate in new information which should be documented and disseminated through various means. These will include journal articles, oral presentations at

seminars and conferences and special publications. If these are planned provision should be made in the budget.

Miscellaneous: The provision has to be made in the budget under this category to meet unexpected expenses due to increase in prices of supplies and services. Sometimes an unexpected item may be needed and such items could be procured under miscellaneous. However, do not include large amounts under this category for vague purposes. Generally, a provision of 10% of the total budget is reserved for miscellaneous expenses.

Contribution of the host institution: The funding agencies normally expect a counterpart contribution from the host institution and this should be shown in the budget converted into monetary terms. The availability of these resources makes the funding agencies consider the proposal favourably, not only due to the reduction of costs, but it demonstrates the capacity of the institution as a strong resource base to conduct the proposed research. It also indicates the interest of the host institution and internal consistency. The contribution from the host institution may include the following:

- Personnel in terms of research assistants, technical assistants, support staff, field workers clerical support etc
- Major equipment and services
- Laboratory and field facilities
- Transport
- Access to Internet
- Office space and accommodation for local/foreign consultants, postgraduate students
- Other resources and services that are available in the institution or accessible from outside

Institutions at no extra cost

A general format of a budget is given in Tables 1 and the contribution of the host institute in Table 2.

Table 1: General Format of a Budget (Rs./US $)

Item	Year 1	Year 2	Year 3	Total
1. Personnel Research assistants Technical assistants Supporting staff Postgraduate students Other				
Sub Total				
2. Equipment- List each equipment separately				
Sub Total				
3. Consumables Laboratory and office supplies, communication, experimental materials such as seed, chemicals and glassware				
Sub Total				
4. Travel & subsistence- Local /overseas travel, Travel of consultants				
Sub Total				
5. Dissemination of research outputs publications, seminars and workshops, monographs etc				
Sub Total				
6. Miscellaneous				
TOTAL				

Table 2: Contributions of the Host Institution (Rs./US $)

	Year 1	Year 2	Year 3	Total
1. Personnel, salaries and allowances				
2. Major equipment & services				
3. Laboratory and field facilities				
4. Office space/communication equipment				
5. Transport				
6. Access to internet, e-mail etc.				
7. Other resources and services				
Total				

3.14 SUPPORTING DOCUMENTS

These documents are attached as appendices of the proposal. The appendices provide documentary evidence in support of the proposal. These may include the recommendation letters from the head of the institution and head of the department, consent forms from the collaborating institutions, cover letters sent to appropriate stakeholders, survey questionnaires, ethical clearance certificates etc. In foreign grant applications, an official letter of endorsement from the Sri Lankan line ministry and the Department of External Resources of the Ministry of Finance and Planning is also a mandatory requirement.

3.15 CURRICULUM VITAE (CV) OF PROPOSERS

Curriculum Vitae (CV) of the principal investigators should be attached to the proposal as an appendix. There is no standard format to write a CV and the proposer has to develop his own format to suit the objectives of the proposal.

CV is an overview of your life's accomplishments. CV should be simple and concise and tailor-made to suit the needs of the proposal. CV should be used as an instrument of persuasion against other competitors; hence the key achievements should be clearly indicated. A well-structured CV displays the professionalism of the proposer and can make a better impression on the evaluators. Therefore, the CV should be of good quality, clear, professional and up to date.

The CV should include your name, designation, contact information (address, telephone number, e mails etc.) academic and professional qualifications, research and other publications, achievements such as scholarships and awards, patents and membership in recognized professional associations and scientific societies etc. An impressive statement on your abilities as a researcher, a research manager, team leader, organization ability, technical skills in planning and implementing projects, cost management etc should be included. CV of an active academician or a researcher could be very lengthy running into several pages but in the case of a research proposal it should be summarized not to exceed a single typed page. Your CV should reflect specifically on your abilities as a researcher and publishing scholarly achievements in the proposed research. To show that the proposer is an active researcher in the proposed field, the best and most relevant publications in the past 3- 5 years may be listed.

3.16 REFERENCES

In biological or social sciences many of the concepts and ideas are derived from others work. These have to be properly acknowledged so that:

- Anyone interested in them can track them down
- Researcher will get a broad knowledge on the subject
- Researcher's supervisor /tutor/research director/research proposal evaluator will know that you have read plenty of literature and up to date in knowledge in the proposed subject
- Researcher will not be accused of academic theft or plagiarism

In a research proposal only the most significant, published references should be included. Although the number of references for listing varies, they should not be excessive. In a research proposal about 20 references may be adequate.

In writing the references either the **Harvard style** or **Vancouver style** could be used. In biological sciences it is common to use the former while in social sciences the

latter is used. In web based searches, date of access of the cited website should be given, Example: www. Omjournal.org. accessed on 19th April 2012.

Harvard style is generally referred to as the name and year system. In this system the author's name and the year is included on the text and the full reference is given in the list of references in alphabetical order. This system is preferred by biological scientists as it could be followed easily according to the alphabetical order. It also has the advantage that as the references are unnumbered, more references could be added or deleted easily. Also, the reader can see the names of the author and the year in the text itself. The disadvantages of this system are that the reader has to jump over several lines of parenthesis before picking up the text and increased printing cost.

In **Vancouver style** a reference is given a running number as they occur in the text and the full reference is found in the list in numerical order. This system has the advantage that as the names of authors does not appear in the text, it is convenient for the reader to read without any interruption. It also saves printing cost unlike in the previous system.

The references in journal articles, books, a chapter in a book, proceedings of workshops and conferences, published reports, unpublished theses, multi-media, non-Internet and Internet sources etc, are written differently and the standard procedures should be followed (Day, 1979; Cross and Towle, 1996; Li and Crane, 1995). Unpublished reports and personal communications should not be included in the proposal as there is no way for the reader to check matters for further information.

An examples of references based on the **Harvard style** is given below.

Journal article: Perera, E.J and Ratnayake, K.B. (2011). A new virus disease in banana. Journal of Phytopathology 23(1): 23 – 32.

Book: Bradford, C. (2007). Industrial Relations. 3rd Ed. John Wiley & Sons,

Moxley M. Joseph. (1992). Publish, Don't Perish. Praeger Publishers, Westport, Connecticut.

Chapter in Book: Gunasena, H.P.M. and Pushpakumara, D.K.N.G. (2007). Tamarind.*In* D.K.N.G. Pushpakumara, H.P.M. Gunasena and V.P. Singh. Eds. Underutilized fruit trees in Sri Lanka (1), 352-387. Digital Teleprints (Pvt) Limited, Kandy, Sri Lanka

Proceedings of workshops/conferences: Tennakoon, N.A. (2011): Soil fertility and water management through coconut based agroforestry systems. Proceedings of a symposium on increasing coconut land productivity through agroforestry interventions. Coconut Research Institute, Lunuwila, Sri Lanka, 15th March 2011. Eds: D.K.N.G.Pushpakumara, H.P.M.Gunasena, H.A.J.Gunathillake and V.P.Singh. pp 45-56

Internet sources: Diana Taylor. A literature review: A few points on conducting it. www.writing.utotoronto.cal. Accessed on 30th April 2012

Use of Abbreviations: The researcher should use accepted abbreviations in writing references according to the British Standards (BS 5605, 1978). A few examples of abbreviations are given below.

Word	Abbreviation	Unit	Abbreviation
Abstract	Abstr.	Gram	g
Agronomy	Agron.	Kilogram	kg
Biology	Biol.	Tonne	t
Biochemical	Biochem.	Metre	m
Bulletin	Bull.	Minute	min
Chemistry	Chem.	Hour	h
Economics	Econ.	Week	wk
Ecology	Ecol.	Horsepower	hp
Edition	Ed.	Year	yr
Experimental	Exp.	Month	m
Neurology	Neurol.	Litre	l
Institute	Inst.	Mililitre	ml
Pathology	Pathol.	Melting point	mp
Science	Sci.	Milliequivalent	meq
Symposium	Symp.	Hectare	ha
Tropical	Trop.	Second	s
Technical	Tech.	Kilometre	km
Transactions	Trans.	Milimetre	mm
Virology	Virol.	Centimetre	cm
Zoology	Zool.	Watt	W

4

ETHICAL ISSUES IN RESEARCH

"Science is what you know; philosophy is what you don't know"

Bertrand Russell

Ethics are the ***Golden Rules*** that distinguish between the right and wrong. The principles on research ethics have been long established for a variety of topics in scientific research. These include the design of research projects, various aspects of academic scandal, including scientific misconduct such as fraud, fabrication of data, plagiarism etc. Therefore, different professional associations, government agencies and universities have adopted specific codes, rules and policies relating to research ethics. The National Science and Technology Commission (NASTEC) has published a document, A Guidebook on Research Ethics in 2004. This document defines the responsibilities, commitments, and obligations of individual scientists as well as laboratory ethics to guide the researchers to enable them to maintain high professional standards in order to safeguard their own reputation, reputation of the institutions to which they belong and credibility of the profession. It includes many aspects of research ethics such as obligation of researchers, adherence to policies, obligation of researcher to the institution, commitment to competence and credibility, responsibility to colleagues and peers, peer review, mentoring, training and supervisory relationships, conflict of interests and exploitation of resources, research data management, authorship and publication practices, allocation of credit, public speaking, laboratory ethics, care and use of animals for research, care and use of humans for research, commitment to indigenous populations and other identifiable groups and environmental health and safety. The National Science Foundation (NSF) has established a National Committee of Ethics in Science and Technology to advise the NSF grantees on research ethics. Similarly the Faculties of Medicine of the national university system, have developed a code of ethics for their professionals. However, in the developing countries, although codes of ethics exist, they are not given enough publicity, promoted or implemented resulting in erosion of research standards (NASTEC, 2004).

The ethical issues in research begin with the preparation of research proposal and persist throughout its implementation up to publication of results and authorship. Another issue is the conflict of interest. The researchers should avoid real or perceived conflicts of interest and minimize bias, flawed judgement, harm or

exploitation (Brock, et al., 2002). In research involving biological diversity and access to genetic resources where transfer out of the country of any genetic materials or metabolites and other extracts of organisms to foreign nationals or institutions are planned, the code of ethics is applicable and should be strictly followed. In research which is likely to have environmental impacts resulting from the experimental methods used or outcomes of such experiments approval from the national authorities should be obtained. As in Sri Lanka, the subject of environment and biological diversity in most countries is listed under the Ministry of Forestry and Environment.

Research ethics are most developed as a concept in medical sciences (www.wikipedia.org). Ethical issues apply to all types of research in health research (Fathalla and Fathalla, 2004). Ethical consideration when human subjects are involved in research should be fully discussed. In the case of medical research, the proposal should describe the measures that will be taken to ensure that the research is carried out in accordance with the World Medical Association Declaration of Helsinki on Ethical Principles for Medical Research Involving Human Subjects (www.wma.net). Under this declaration the researcher should answer the following questions:

- Is the research adequate to provide answers to the research question? It is unethical to expose subjects to research that will have no value.
- Is the method of selection of research subjects justified? The use of vulnerable subjects such as minors, prisoners and those with mental disability need special justification.
- Are the interventions justified in terms of risk : benefit ratio? Risks are not limited to physical harm; psychological and social risks must also be considered.
- For observations made, whether measures have been taken to ensure confidentiality?

To clarify and overcome any ethical issues, the researcher should submit the proposal to an appropriate ethics committee for approval, before it is submitted to the funding organization (Asya Al-Riyami.www. omjournal.org). In the medical faculties of Sri Lanka, researcher is required to fill an application form when submitting research proposal on ethical issues for consideration by the Scientific and Ethical Review Committee. An ethical clearance certificate from an appropriate department/institution in the country should be submitted with the application form.

5

EVALUATION PROCEDURE OF RESEARCH GRANT APPLICATIONS

"Science is facts; just as houses are made of stone, so is science made of facts; but a pile of stones are not a house, and a collection of facts is not necessarily science"

Jules Henri Poincaré

When research grant applications are received by a funding organization, a set procedure is followed to evaluate those applications. The purpose of evaluation is to ensure the highest standards of excellence in research and accountability in the use of limited funds. The funding organizations vary in how explicitly they make these criteria and how detailed they are. However, each funding organization will identify the minimum criteria that are used for evaluation of research proposals. These criteria are also kept broad as each funding organization may cover a range of possible topics.

In the first stage the funding organization will review the proposal for conformity with the guidelines of the organization. The applications that fall outside the purview of the funding organization or those that are incomplete will be returned to the applicant.

Those applications that pass the first stage will be subjected to intrinsic technical review for which different funding agencies use various mechanisms. Some funding agencies review the applications using two experts in the proposed area of research. Some agencies use a panel of experts, while others use a committee of researchers. In the case of the National Science Foundation of Sri Lanka, proposals are reviewed by the relevant research panels, while the Sri Lanka Council for Agricultural Research Policy uses its national research committee for the evaluation of research proposals. In the universities, the proposals are reviewed by the research committees of respective faculties or by the university research committee. In plantation crop research institutes, tea, rubber and coconut, their research committees constitute outside experts to evaluate the proposals. In most of the situations, the researcher has to verbally present the proposed research activity to the committee. The evaluators are expected to assess the proposals in respect of

their efficiency and usefulness and suggest ways in which the proposal can be improved (Cooray, 1992). In the review process many proposals gets rejected and in case where a proposal is accepted, the reviewers may suggest ways to improve the content of the proposal.

CRITERIA USED FOR EVALUATING PROPOSALS BY DIFFERENT FUNDING ORGANIZATIONS

The funding agencies provide the general criteria for evaluation in their Guidelines for Applicants or Grant Proposal Guides. The proposers are advised to read the evaluation procedures in order to meet those criteria when preparing the proposals.

The evaluation criteria used by a few selected funding local and international organizations illustrate the procedures followed in evaluation of research proposals.

LOCAL FUNDING ORGANIZATIONS:

National Research Council of Sri Lanka

In the evaluation of research grant applications, among others emphasis is on the relevance of the study to national development and/or its contribution to science and technology capacity strengthening in the country (see. NRC guidelines for applicants www.nrc.gov.lk).

Sri Lanka Council for Agricultural Research Policy

Sri Lanka Council for Agricultural Research Policy has provided guidelines for the evaluation of research proposals by the respective subject committees (Anon, 2012). Some of the important criteria are listed below:

Current status of the relevance of research and justification, impact of research outputs, innovativeness, clarity of objectives, experimental methodology, capability of the research team in terms of qualifications and experience, availability of physical resources, budget etc. (www.carp.gov.lk)

National Science Foundation of Sri Lanka

The applications are reviewed by two reviewers and a technical report is also submitted by the scientific officer of the foundation. The panel may invite the

applicant to make a presentation on the proposed research. (See - Guidelines for completion of application forms (www.nsf.ac.lk)

INTERNATIONAL FUNDING ORGANIZATIONS:

The National Science Foundation, USA

The National Science Foundation, USA asks reviewers to comment on four aspects of the proposal:

a) Researcher performance competence

b) Intrinsic merit of the research

c) Utility or relevance of the research

d) Effect on infrastructure in science and engineering.

More recently the National Research Foundation has further emphasised on the importance of the following criteria in the evaluation of research proposals (Hanson. www.nsf.gov.pubs/2004).

1. Intellectual merit

a) What is the Intellectual merit and quality of the proposed activity?

b) How important is the proposed activity to advance knowledge and understanding within its own field or across different fields? How qualified is the proposer (individual or team) to conduct the project?

c) To what extent does the proposed activity suggest and explore creative and original concepts? How well conceived and organized is the proposed activity?

d) Is there sufficient access to resources?

2. Broader Impacts

a) What are the broader impacts of the proposed activity?

b) How does the activity advance discovery and understanding while promoting teaching, training and learning?

c) How well does the proposed activity broaden the participation of unrepresented groups (e.g. gender, ethnicity, disability, geographic etc)?

d) To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships?

e) Will the results be disseminated broadly to enhance scientific and technical understanding?

f) What may be the benefits of the proposed activity to society?

International Foundation of Science (IFS), Sweden

a) Applicant's qualifications and feasibility of the project

- Applicant's training and experience
- Available and requested resources
- Realistic goals and time plan

b) Scientific quality

- A well formulated hypothesis based upon up to date knowledge on the problem
- Statistically sound design of experiments or plan of trials and observations
- Relevant methods of sampling, laboratory work, measurements etc.

c) Relevance of results to:

- Applicability to development
- Scientific knowledge
- National priorities

6

ATTRIBUTES OF A GOOD RESEARCH PROPOSAL

A research proposal will have some attributes that contribute to its acceptance by a funding organization. If the researcher is aware of these attributes, it will help him to prepare a better proposal. Some of the good attributes of a research proposal are given below:

- Subject within the interest of the funding agency and the home institution. In the case of a postgraduate student relevance to the student's course will be of importance
- Comprehensive and thorough background research and review of literature has been undertaken
- Clear definition of the problem
- Research is innovative and unique, or offers new insight for development
- Clear and tactical plan to solve the problem, best alternative methods used. Good match between the issues to be addressed and the approach being adopted
- Can be completed in good time
- Time table, resources and budgets are well justified, cost-effective
- No duplication and re-invention of the wheel
- Strong home institution support
- Useful policy and practice implications
- Neatly prepared well-structured and complete in all aspects. Sloppily prepared proposals will not interest the attention of the funding organizations, also does not speak well of the proposer.

7

WHY RESEARCH PROPOSALS FAIL?

"It would be possible to describe everything scientifically, but it would make no sense; it would be without meaning, as if you described a Beethoven symphony as a variation of wave

Albert Einstein

Not all research grant applications will be accepted by funding organizations. The funding organizations will make a limited number of awards annually, depending on the availability of funds and various other criteria. It is common knowledge that over 95% of the applications fail to receive grants due to various shortcomings of the proposal. If the researcher is aware of the reasons why research proposal fail, then he/she will be in a better position to prepare a successful proposal. Some of the reasons for the failure of research proposals are given below:

- Lack of details and clarity on scientific hypothesis, insufficient evidence, is doubtful or unsound
- Aims and objectives are unclear and vague
- Lack of details on methodologies used, insufficient information on data collection and methods of data analysis
- Problem is not significantly important or only marginally important
- Not truly new or innovative
- Limited to only baseline data collection
- Time table is inappropriate or unrealistic
- *Overall plan is too ambitious and cannot* be achieved on the time scale
- Unrealistically broad and lacking in focus, too theoretical
- Repetitive of similar work elsewhere which indicates lack of background research
- Not relevant to national, regional or international development
- Does not fall within priorities of the funding agency
- Exceeds normal funding level, budgets are inflated and the budget is not carefully thought out
- Too many citation lapses and incorrect references
- Not citing land mark studies
- Too much details on minor issues and not enough details on major issues
- Proposal is too long or too short
- Not demonstrating the potential impact of the research
- Poor writing and presentation
- Investigator's previously published work in this field does not inspire confidence
- Investigator proposes to rely heavily on insufficiently experienced co-investigators
- Statistical aspects of the proposal have not been given sufficient consideration
- Investigators other responsibilities would prevent devotion of sufficient time and attention to this research
- Institutional set up is unfavourable

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FORMAT OF A RESEARCH GRANT APPLICATION FORM

All the funding organizations provide a research grant application form to be completed by the prospective applicants. Depending on the level of funding the format varies; those that provide large grants have very detailed application forms. The general format of an application form is given below:

1. Title of Project:

2. Name of Principal Investigator:

2.1 Designation:

2.2 Field of Specialization:

2.3 Highest Academic /Professional Qualifications:

2.4 Date and Place of obtaining Qualifications:

2.5 Official Address:

2.6 Telephone /e-mail address:

3. Names of Co-investigators:

3.1 Designation:

3.2 Field of Specialization:

3.3 Highest Academic /Professional Qualifications:

3.4 Date and Place of obtaining Qualifications:

3.5 Official Address:

3.6 Telephone /e-mail address:

4. Duration:

4.1 Planned Starting Date:

4.2 Planned Completion Date:

5. Project Description:

5.1 Background and Justification

6. Relevance to National/Regional/International Development:

7. Objectives:

8. Methodologies/Materials and Methods:

9. Expected Outcomes of the Project:

10. Dissemination of Project Outputs;

11. Curriculum Vitae of Investigators:

12. Ethical Clearance:

13. Budget:

13.1 Summary of Budget:

13.2 Detailed Budget:

13.3 Costs Borne by the Proposer's Institution:

14. Other Funding Organizations from which the Applicant or Co- Investigators have Received or Applied for Funds for the Same Grant:

14.1 Title of the Project:

14.2 Name of Investigator/s:

14.3 Amount of Financial Support:

14.4 Funding Organization:

14.5 Start Date of Project:

14.6 Completion Date of Project:

15. References:

16. Appendices:

Signature of the Principle Investigator

Date

Certification of the Head of the Institution

Name Designation

Signature

Date

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RESEARCH FUNDING ORGANIZATIONS

Several national and international organizations provide grants for research in different fields. The level of funding differs, while some organizations provide small grants there are many international agencies which provide large grants.

LOCAL FUNDING ORGANIZATIONS:

There are three leading organizations which support research in Sri Lanka. Besides, small funds are also provided by the University Grants Commission (UGC) to support staff research of the universities. The national funding organizations listed below provide funds for research in various disciplines.

- Sri Lanka Council for Agricultural Research Policy (CARP), 47/5, Maitland Place ,Colombo 7

  (www.carp.gov.lk)

- National Research Council (NRC), 380/72, BauddhalokaMawatha, Colombo 7 (www.nrc.gov.lk)

- National Science Foundation (NSF), 47, Maitland Place , Colombo 7(www.nsf.ac.lk)

INTERNATIONAL FUNDING ORGANIZATIONS

- Asian Development Bank, Manila The Philippines
- Canadian International Development Agency (CIDA) www.cida.gc.ca
- Department for International Development, (DFID), Palace Street, London SW1E 5HE, UK. www.dfid.gov.uk
- European Union, Avenue Marnix 17, 2nd Floor, 1000 Brussels, Belgium. www.europa. eu
- Food and Agricultural Organization of the United Nations (FAO), Viale delleTerme di Caracalla, 00153, Rome, Italy .www.fao.org

- Ford Foundation, 320, East, 43rd street New York NY 10017, USA. www.fordfoundation.org
- German Technical Cooperation (GTZ). Germany.
- International Foundation for Science (IFS), Karlvagen 108, 5th Floor, SE-115 26, Stockholm, Sweden www.ifs.se
- International Development Research Centre, (IDRC), P.O. Box 8500, Ottawa, Ontario, Canada KIG 3H9. www.idrc.ca
- International Fund for Agriculture Development (IFAD), FAO, Rome Italy. www.ifad.org
- International Research Centres under the Consultative Group on International Agricultural Research* (CGIAR), (International Rice Research Institute, Los Banos, Laguna, The Philippines, World Agroforestry Centre,(ICRAF), Kenya, World Fish Centre (Penang, Malaysia, International Potato Research Centre (CIP), Peru, International Institute for Tropical Agriculture, (IITA), Nigeria, International Centre for Research in Semiarid Crops (ICRISAT), Hyderabad, India, Centre for International Forestry Research (CIFOR), Bogor 16115, Malaysia, International Centre for Tropical Agriculture (CIAT), ApartadoAéreo 6713, Cali, Colombia www.ciat.cgiar.org, Biodiversity International, Montpellier, France

  International Water Management Institute (IWMI), Colombo, Sri Lanka)
- Japanese International Cooperation Agency (JICA), Nibancho Centre Building 5-25,Niban- Cho Chiyoda –ku Tokyo 102-8012, Japan.www.jica.go.jp
- Rockefeller Foundation, 420 Fifth Avenue, New York NY 10018, USA. www.rockerfellorfoundation.org
- The Board of Science and Technology, (BOSTID), of the National Research Council, The National Academies, 500 Fifth Street, Washington DC 20001, USA. www.nationalacademies.org
- The National Science Foundation, 4201 Wilson Boulevard Arlington, Virginia 22230, USA. www.nsf.gov.pubs.

- The World Bank,1818, H Street Washington DC 20433,USA, www.worldbank.org
- TWAS, The Third World Academy of Sciences for the Developing World, ICPT Campus, StradaCostiera 11,34151 Trieste, Italy. www.twas.icpt.it
- Swedish Agency for Research Collaboration in Developing Countries (SAREC), Stockholm, Sweden

* CGIAR institutions provide some financial support for researchers in developing countries.

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About the Author

Prof. H.RM. Gunasena, Emeritus Professor, University of Peradeniya is the current Chairman of the Coconut Research Board, Sri Lanka. He holds a BSc. Agnc. (Hons) degree from the University of Peradeniya and Ph.D. degree from University of Reading, UK. In recognition of his services to the field of agricultural education, he was awarded D.Sc. degrees from the Universities of Rajarata, Sabaragamuwa and Wayamba.

Prof. Gunasena was the Head, Department of Crop Science, Dean of the Faculty of Agriculture, and the Director of the Postgraduate Institute of Agriculture of the University of Peradeniya. He was the Executive Director, Sri Lanka Council for Agricultural Research Policy. He was also the Advisor to the Minister of Agriculture. He has served as a member of the University Grants Commission, National Science and Technology Commission and the University Councils of Peradeniya, Wayamba, Rajarata, and Open University of Sri Lanka.

Prof. Gunasena has contributed immensely to local and international agricultural research. He has to his credit over 270 research publications and scientific communications related to agricultural education and research. He has also published 25 **books,** some of which are being used as text books in universities. Prof. Gunasena has edited 63 proceeding of workshops and contributed to chapters in several text books. He is also the Editor-in-Chief of the Sri Lankan Journal of Agricultural Sciences for the past 30 years

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Prof. Gunasena has won many international meritorious awards during his career. He was a Senior Fellow of the East-West Centre in Hawaii and Senior Research Fellow of the International Centre for Research in Agroforestry He was also the recipient of a Senior Travelling Fellowship of the Association of Commonwealth Universities. He also won a Gold Medal for his contribution to the development of Agriculture in the Asian Region, awarded by the Asian Agricultural Research Fund.

He was a member of the Global Fund (GFAR) for Agricultural Research, Rome, Director of the Global Horticulture initiative and Chairman, Asia-Pacific Association of Agricultural Research Institutions (APPARI) and Chairman, Asian Centre for Underutilized Crops (ACUC).He was also a member of the Tea and Rubber Research Boards, Hector Kobbekaduwa Agrarian Research and Training Institute, National Institute of Social Development, National Institute of Plantation Management and the National Institute of Fisheries and Nautical Engineering.

Prof. Gunasena has also completed 52 consultancies for several international research centres and Development organizations. Among these the major consultancies were the External review of the World Agroforestry Centre, Nairobi, Kenya, and the UNDP consultancy on Reforming Agricultural Education in Pakistan.

Prof. Gunasena is the teacher-in charge of the Scientific Writing and Proposal Preparation at the Postgraduate Institute of Agriculture for more than 17 years.