Chapter 5

Writing a research project proposal

> Imagination is more important than knowledge. For knowledge is limited to all that we now know and understand, while imagination embraces the entire world, and all there ever will be to know and understand.
>
> Albert Einstein (1879–1955)

Proposals in engineering and the technical sciences require not just knowledge of the field but also imagination to apply that knowledge to solve problems. This chapter aims to help you write a proposal for a research project. A research proposal is a standard requirement for acceptance into most postgraduate programmes. (However, if you are applying for a specific pre-defined research project in an engineering undergraduate programme, you may not need to submit a project proposal.)

In a good research proposal, you will need to demonstrate that you are

1. Capable of independent and critical thinking and analysis
2. Capable of communicating your ideas clearly

PURPOSE OF A RESEARCH PROPOSAL

The proposal is intended to show your supervisor that you have a clear idea of previous work in your chosen area of research, the research problem and the methods you plan to use to solve the problem.

STRUCTURE OF A RESEARCH PROPOSAL

The structure and length of your research proposal will vary depending on the requirements of your institution or department so the first step is to find out departmental guidelines and requirements.

Examples of requirements for a research proposal are the guides provided by the University of Edinburgh (*How to write a good postgraduate research proposal*, 2010), and the University of Melbourne (*How to write a research proposal: A guide for science and engineering students, n.d.*). Typically, a research proposal comprises the following elements:

Title: A well-crafted title is essential for two reasons. First, it acts as the gateway to the content of your research proposal and, therefore, should tell the reader immediately what the proposal is about. Second, it is the first part of your research proposal that is read by the reviewer or research committee, and it is essential that you make a positive first impression.

Obviously, the title you come up with at this stage is only a working title. It is unlikely to be the final title of your completed research project as this will often depend on your results. Here are three guidelines for writing an effective title:

1. Indicate clearly the content and focus of the research project.
2. Make it clear and concise. The primary function of a title is to provide a precise summary of the paper's content so avoid unnecessary details. A good title should be no more than 15 to 20 words.
3. Make it descriptive; include keywords that describe the proposal.

A common practice is to start with the main overall topic and use a colon to separate the topic from the focus as in the following example:

Storm water harvesting: managing the hazards of surface water pollution by run-off.

Abstract (for longer proposals): In the abstract, summarise the gist of your proposed research project in a paragraph of about 150–200 words. State the purpose and motivation for the study, a statement of the problem, the data collection methodology and analysis, and the significant results and implications of the research proposed.

Introduction: This section provides background information for the research (i.e. the problem being addressed). Information relating to your research question(s) or hypothesis/hypotheses is typically organised from general to specific.

The background information is provided in the form of a literature review that helps you set the context for your research to help the reader understand the research questions and objectives. Choose key research papers and explain clearly how your research will either fill a knowledge gap or follow from previous research (refer to *Chapter 13—Writing the Introduction and Literature Review* for practical information on how to conduct and write a literature review).

Possible format for an Introduction:

- Introduce the area of research
- Review key research papers
- Identify any gap in knowledge or questions that needs to be answered
- Your hypotheses or research objectives
- Scope of your research project

Research Problem: State the primary problem you are trying to solve. It may be a research question(s) or hypothesis/hypotheses stated in a few concise sentences that express clearly the focus of your project and its scope.

Methodology: Include a description and rationale for the methods of data collection and analysis, and the materials used. Provide just enough information for the experiments and data collection to be replicated by someone else, and nothing more.

Typically, this section uses subheadings (i.e. *Subjects, Instrumentation, Data Collection, Methods of Analysis etc.*) and is written using the future tense, for example, 'The research will initially examine water treatment processes in …'

In deciding on the subheadings to use, think of the kind of research you are proposing:

- *Experimental*—equipment, materials, method
- *Modelling*—assumptions, mathematical tools, method
- *Computational*—inputs, computational tools, method

Timetable/Schedule: List the stages of the research project in timeline or tabular format and the deadlines for completion of these stages or tasks.

Report/Thesis Organisation (if applicable): Outline the proposed chapters of the report or thesis and describe the content of each chapter in a few sentences.

Significance and Contribution of the Study: Conclude the proposal with a paragraph on the importance of your research and state how it will contribute to knowledge and understanding of certain issues. Relate the expected outcomes of your research to the objectives stated in the Introduction, so that the significance of your study and the contribution to knowledge is apparent. However, do not exaggerate the importance of the contribution your study will make.

List of References: List all the sources cited in your research proposal by using a referencing format appropriate to your institution or department. Do not list references that are not referred to in your proposal.

An example of a research project proposal is shown in Writing Guidelines 5.1.

Writing Guidelines 5.1 A sample research project proposal

Abstract/Summary (optional)

See Chapter 17: Abstract

Background/Literature Review

See Chapter 13: *Writing the Introduction and Literature Review*

Various aspects of civil engineering require information that is not only accurate, but also up-to-date. In geotechnical engineering, for example, it is important to have detailed knowledge of the soil conditions and terrain. While the soils can be investigated through point sampling, studying the macro features of a terrain would be more challenging as the area of study would be much larger. Conventional methods of point sampling and mapping to a large area would be very expensive and time consuming. The recent advances and availability of satellite platforms such as World-View, QuickBird, IKONOS, LANDSAT, AQUA, TERRA and locally owned XSAT for civilian usage have now allowed quantitative and qualitative evaluations of any large area via satellite imagery.

Satellite imagery has been utilised in various disciplines, including the estimation of evapotranspiration (El Tahir et al., 2012) as well as the mapping and quantification of land area and cover types (Kamaruzaman and Hasmadi, 2009). These applications use satellite images that were captured over longer time intervals. Applications in geotechnical engineering require satellite images to be acquired over shorter time intervals. This is currently being realised with the launching of micro- and nano-satellites where images can be acquired at time intervals of days rather than weeks or months (Nakasuka, 2013). This provides the opportunity to apply satellite imagery to more rapid change events like flooding, landslides, earthquakes and so on.

Research Objective

The objective of this research is to use satellite imagery to show correlation among different variables for landslides. These variables include soil water content, temperature distribution, precipitation, land cover and topography.

Methodology

See Chapter 7: *Research Methodology and Research Methods*; Chapter 14: *Writing the Materials and Methods Section*

Satellite images containing landslide sites with ground truth data will be collated. Information on the different variables will also be obtained from satellite data. It is envisaged that the data will be obtained from several satellites. The information obtained will be put into a database for analysis and establishment of correlations. In addition, deterministic analysis for individual landslides will be conducted to understand the underlying mechanism of the landslide.

(*Continued*)

Writing Guidelines 5.1 (*Continued*) A sample research project proposal

Timetable/Schedule

The collation of information will take about 2–3 years. However, the information collated by the end of the first year will suffice for the start of data analysis. It is expected that the development of correlations will take a further 2 years. Overall, the project is expected to be completed within 4 years.

See Chapter 6: *Planning a Research Project*

Conclusion

With a better understanding of the variables contributing to landslides, it is possible to develop an early warning system for landslide prone areas, more *reliable* landslide risk maps as well as *more effective* policies for sustainable development of hilly terrain.

Resources

The university has already the software and hardware for the processing of satellite images. As far as possible, the project will endeavour to use satellite data that are publicly available. However, the project may require the purchase of additional high-resolution satellite images and satellite data for in-depth study of some of the landslides.

References

El Haj El Tahir, M., Wenzhong W., Xu C. Y., Youjing, Z., & Singh V. P. (2012). Comparison of methods for estimation of regional actual evapotranspiration in data scarce regions: The Blue Nile, eastern Sudan. *Journal of Hydrologic Engineering* 17: 578–589.

Kamaruzaman Hj, J., & Mohd Hasmadi, I. (2009). Mapping and quantification of land area and cover types with Landsat™ in Carey Island, Selangor, Malaysia. *Modern Applied Science* 3(1): 42–50.

Nakasuka, S. (2013). Current Status and Future Vision of Hodoyoshi Microsatellites—Systems for Quick and Affordable Space Utilizations. Proceedings of the 5th Nano-Satellite Symposium, November 20–22, 2013, Tokyo, Japan.

Source: Lim, B. J. M., *PhD project proposal* (unpublished), Nanyang Technological University, Singapore, 2013.

OTHER CONSIDERATIONS

1. *Resources:* When writing a research project proposal, you will need to consider the resources (equipment, test materials etc.) available for your project. If not, you will need to consider the possibilities of acquiring such resources during your project.
2. *Ethical Considerations:* Research done in a university setting usually requires Institutional Research Board (IRB) approval. This means that your research has to be approved by an ethics committee to make sure

you comply with the rules and expectations with which the research should be conducted. Project proposals must therefore include potential issues raised by the conduct of the research and how these will be addressed should they occur. This is particularly important if your research is deemed 'high-risk', that is if it involves people, animals, or sensitive materials. Find out what the ethical approval system is in your prospective institution. Your supervisor will be able to provide you with this information.

TIPS ON WRITING STYLE AND LANGUAGE IN A RESEARCH PROPOSAL

1. Follow the three C's rule:
   Clear: Is what you have written intelligible and are your ideas clearly articulated?
   Concise: Have you written your proposal in a succinct and focused way?
   Coherent: Are the sections of your proposal clearly linked so that it is clear to the reader what you want to do, why you want to do it and how you will do it?
2. Revise and edit your writing thoroughly:
   Poor grammar and inappropriate style distract your reader and compromise your credibility as a researcher. Use spell check and grammar check applications. (Refer to *Chapter 10—Grammar, Punctuation and Word Usage Guide* and *Chapter 20—Revising and Editing* for help with grammar and revising.)
3. Use transitions:
   Signal to the reader as you move through your text by using transition words and expressions such as *however, following this, in contrast, consequently* and so on.
4. Avoid overly hesitant or tentative language:
   Sound confident and sure about the work that you are proposing to do. So avoid excessive use of expressions such as *it seems that…, it is hoped that…, it might be possible…, perhaps* and so on.

CHECKLIST FOR WRITING A RESEARCH PROPOSAL

Does your proposal include

- ☐ A critical discussion of previous research in your area?
- ☐ A clear statement of your hypothesis/hypotheses or objective(s)?
- ☐ The methodology for your research and the expected stages?
- ☐ Facilities, resources, laboratory equipment needed?

INTERESTING FACTS

Writing research project proposals is a normal activity in academia. Such research project proposals are often for research grant applications. However, the success rate of obtaining a grant is about 20% (American Society for Engineering Education, n.d.), that is one successful application in five applications. The success rate for the individual may be as low as one successful research project proposal for every 10 or 20 written research project proposals.

REFERENCES

American Society for Engineering Education (n.d.). *Tips for a winning research proposal*. Retrieved from: http://www.asee-prism.org/tips-for-a-winning-research-proposal/.

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The University of Melbourne. (n.d). *How to write a research proposal: A guide for science and engineering students*. Retrieved from: http://services.unimelb.edu.au/__data/assets/pdf_file/0006/471273/Writing_a_research_proposal_Science_Engineering_Update_051112.pdf.