How to Write a Research Proposal & Documentation

Author:

komondi@strathmore.edu

Designed for Third Year Scientific Research Projects in BSc. Informatics and Computer Science in School of Computing and Engineering Sciences

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Summary

The Research Proposal is always written in third person and it has three Chapters namely, Introduction, Literature Review and Methodology. In this guide, we analyze and give a detailed overview of each of these major sections and the rest of the subsections not highlighted in this overview.

Note: Some sections of the proposal that usually appear on the writeup such as Cover Page (includes the Title of the Research), Declaration and Approval, Table of Contents, List of Tables, Figures, Equations and Abbreviations will be elaborated in detail during the class seminars [Refer to the Template Provided on Classrooms,]. You may use the template to start your writeup. Free for download and reuse.

Cited References

1. How to write the Background of your study - Dr. Rishibha Sachdev

Acknowledgement(s)

The acknowledgement for thesis/proposal is the section where you thank all people, institutions, and companies that helped you complete the project successfully. It is similar to a dedication, except for the fact that it is formal. Also, you don't need to mention every single person who helped you with the research - just those who were most important to your research. For example, you don't need to thank your boyfriend/girlfriend for making you dinner as you worked on the project.

Abstract

An abstract is a condensed version of a longer piece of writing that highlights the major points covered, concisely describes the content and scope of the writing, and reviews the writing's contents in abbreviated form. Abstracts are typically **100 to 250 (but usually 200)** words and follow set patterns; some of these patterns can be set by the examining academic institution. In some cases, the abstract forms the reader's initial impression of the work, and therefore plays a big role on whether the application is funded. The abstract speaks for the proposal when it is separated from it, provides the reader with his or her first impression of the request, and, by acting as a summary, frequently provides the reader their last impression. Some reviewers read only the abstract, e.g., a foundation board of directors' member who votes on final funding decisions. Thus it is the most important single element in the proposal.

Importance of the Abstract

1. Help readers decide if they should read an entire article
2. Help readers and researchers remember key findings on a topic
3. Help readers understand the text by outlining key points prior to reading the full document
4. Index articles for quick recovery and cross-referencing

Key Elements of an Abstract

1. **Background:** A simple opening sentence or two placing the work being investigated in context.
2. **Aims:** One or two sentences giving the purpose of the work being investigated.
3. **Method(s):** One or two sentences explaining what was (or will) be done during the course of the project.
4. **Results:** One or two sentences indicating the main findings (or what you hope to accomplish with the project). In most cases, this is edited and put into context at the final stages of the project, for example, one might include the accuracies of the model or the improvements realized.
5. **Conclusions:** One sentence giving the most important consequence of the work – what do the results mean? Are they solving anything? How will they be used?

Questions an Abstract Should Answer

The author should consider the following.

1. Why did you do this study/Research or project? Remember the author is always encouraged to start with the end in mind. The end might include graduating as part of the reasons.
2. What did you do, and how? (What will you do? How?). What did you find? (What do you expect to find?). What do the findings mean?

Tips When Constructing an Abstract

1. Reread your article or proposal with the goal of abstracting in mind.
    a. Look specifically for these main parts of the article or proposal: purpose, methods, scope, results, conclusions and recommendations.
    b. Use the headings and table of contents as a guide to writing your abstract.
2. After you've finished rereading the article or proposal, write a rough draft without looking back at what you're abstracting.

    a. Don't merely copy key sentences – you'll put in too much or too little information.
    b. Don't rely on the way material was phrased – summarize information in a new way.
3. Revise your rough draft to:
    a. Correct weaknesses in organization
    b. Improve transitions from point to point
    c. Drop unnecessary information
    d. Make sure it is complete and accurate
    e. Eliminate wordiness
    f. Fix errors in grammar, spelling and punctuation
    g. Make sure it's written in the same voice as the paper

For Example: Read the Abstract Below to have an idea of how to write one, see the title as well. Additionally, note that the title below is a single title which covers the problem, proposed solution and proposed implementation techniques.

Improving Question Answering Tasks in Maternal Healthcare using Generative AI Models in Natural Language Processing

In the recent past in scientific Research, Question Answering (QA) systems have been gaining popularity in various domains, including healthcare. In maternal healthcare, QA systems can help provide quick and accurate responses to questions related to pregnancy, childbirth, and postpartum care. However, existing QA models in this domain face challenges such as limited training data and difficulty in handling complex questions with multiple sub-questions.

To address these challenges, this research proposes the use of generative AI models for improving QA tasks in maternal healthcare. It presents a novel approach that combines

pre-trained language models with domain-specific data to generate informative and contextually relevant answers. The research also proposes to develop a pipeline for fine-tuning these models on a small, annotated dataset of maternal healthcare questions.

The experimental results show that our approach outperforms existing QA models on standard evaluation metrics such as accuracy, precision, and recall. Furthermore, the model can handle complex questions with multiple sub-questions, making it a valuable tool for healthcare providers and patients seeking information related to maternal healthcare. Additionally, this work demonstrates the potential of generative AI models for improving QA tasks in maternal healthcare. This can lead to better access to information, improved patient outcomes, and more efficient healthcare delivery.

Keywords: Question Answering, Maternal Healthcare, Generative AI Models, Pre-trained Language Models, Fine-tuning, Complex Questions, Healthcare Delivery

Note: the last paragraph shows the finished product where the project is complete with all the experiments having been completed. Your proposal will change a lot during the course of the research since the proposed experiments come later in the study. You should also note that the keywords are in bold and italics and come from the Abstract

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Class To Do:- These tasks are due before the next class

- Meet your supervisors, share your ideas and use the knowledge gained from the class sessions to come up with a comprehensive title.
- From your proposed research title, construct a draft abstract and discuss it with your supervisor. You can learn more about this from the example above.
- Place all your work in the word document template as discussed in class.

END OF SESSION - QUESTIONS, SUMMARIES AND CLARIFICATIONS OF CONCEPTS AND TASKS.

Chapter 1: Introduction

The introduction is the part of the paper or proposal that provides readers with the background information for the research reported in the paper/proposal. Its purpose is to establish a framework for the research, so that readers can understand how it is related to other research (Wilkinson, 1991, p. 96). Other research can be found from related literature.

In some cases, where funding is needed, Writing an effective research proposal is essential.. The introduction, being the first part of your proposal, must provide the funders a clear understanding of what you plan to do. A well written introduction will help make a compelling case for your research proposal.

To begin with, overall, the introduction must set context for your research by mentioning what is known about the topic and what needs to be explored further. In the introduction, you can highlight how your research will contribute to the existing knowledge in your field and to overall scientific development.

The introduction must also contain a hypothesis[1] That led to the development of the research design. You can come up with this hypothesis by asking yourself questions like:

1. What is the central research problem?
2. What is the topic of study related to that problem?
3. What methods should be used to analyze the research problem?
4. Why is this research important, what is its significance, and how will its outcomes affect the funders and the research society as a whole?

[1] a supposition or proposed explanation made on the basis of limited evidence as a starting point for further investigation.: "professional astronomers attacked him for popularizing an unconfirmed hypothesis".

Sections of Chapter 1

Below are the sections of chapter 1 in a research proposal.

1.1 Background Information

The background of the study establishes the context of the research. This section explains why this particular research topic is important and essential to understanding the main aspects of the study. Usually, the background forms the first section of a research proposal/ article/thesis and justifies the need for conducting the study and summarizes what the study aims to achieve.

How Should the Background Information Be Structured?

The author usually outlines the historical developments in the literature that led to the current topic of research concisely. If the study is interdisciplinary, it should describe how different disciplines are connected and what aspects of each discipline will be studied. In this case, the major research discipline is in technology, therefore, specific research areas in technology can be mentioned and related.

Additionally, authors should briefly highlight the main developments of their research topic and identify the main gaps that need to be addressed. In other words, this section should give an overview of your study. The section should be organized as:

1. What is known about the broad topic?
2. What are the gaps or missing links that need to be addressed?
3. What is the significance of addressing those gaps?
4. What are the rationale and hypothesis of your study?

How to make the Background Engaging

Since this section usually has a lot of information, it can become a long drag, causing the readers and funders in some cases to lose interest. To ensure that your background is engaging, you should try to build a story around the central theme of your research.

Ensure that the story adheres to the core idea and does not digress into a broad literature review. Each idea should lead to the next so that readers are able to grasp the story and themselves identify the gaps that your study is going to address.

Class Discussion: Assuming your research is focusing on Sentiment Analysis on Monolingual, Multilingual and Code - Switching Twitter Corpora, how would you structure your background?

How To Avoid Common Mistakes In Writing The Background.

While writing an effective background, you ought to steer clear of some mistakes. The most common mistakes in writing the background include the following:

1. Don't write a **background that is too long or too short**. Focus on including all the important details but write concisely.
2. Don't be **ambiguous**. Writing in a way that does not convey the message to the readers defeats the purpose of the background, so express yourself keeping in mind that the reader does not know your research intimately.
3. Don't discuss **unrelated themes**. Try and center your discussion around the pivotal aspects of your research topic i.e. highlight the gaps in the literature, state the novelty of the study, and the need to conduct the study.
4. Don't be **disorganized**. Not discussing the themes in a chronological manner can confuse the reader about the progress in the field, so try and organize your writing carefully.

Background Information is NOT Literature Review

Many authors find it difficult to discern the difference between the literature review and the background of the study. The literature review section should follow the background section, especially the **specific objectives**, as the second section of your thesis or research paper. This section basically supports the background section by providing evidence for the proposed hypothesis. This section should be more comprehensive and thoroughly describe all the studies that you have mentioned in the background section. It should also elaborate on all studies that form evidence for the present study and discuss the current trends.

In **background information**, you will need to do a thorough literature search on different studies that relate to the broad topic of your research. This will introduce the readers to the area of your research. Following this, you should present a more focused survey of the specific studies that are associated with the precise objective of your study. It would be ideal to organize them thematically and discuss them chronologically so that readers are aware of the evolution and progress in the field. In other words, separate themes should be discussed chronologically to highlight how research in those fields has progressed over time. This will highlight what has been done and what are the future directions that need to be worked upon.

Note: Information in this section should be heavily referenced especially when making citations or quoting facts from other sources.

1.2 Problem Statement

A statement of the problem is used in research work as a claim that outlines the problem addressed by a study. The statement of the problem briefly addresses the question: **What is the problem that the research will address?**

Goals of a Problem Statement

The ultimate goal of a statement of the problem is to transform a generalized problem (something that bothers you; a perceived lack) into a targeted, well-defined problem; one that can be resolved through focused research and careful decision-making.

Writing a statement of the problem should help you clearly identify the purpose of the research project you will propose. Often, the statement of the problem will also serve as the basis for the introductory section of your final proposal, directing your reader's attention quickly to the issues that your proposed project will address and providing the reader with a concise statement of the proposed project itself.

A statement of problem need not be long and elaborate: one page is more than enough for a good statement of problem, though that is for the advanced levels. In some cases, a paragraph with about **150 words** is sufficient.

Note. Adding references on the research problem statement is highly recommended especially when citations are done.

Characteristics of a Good Research Problem Statement

1. Should address a gap in knowledge given that you have already had some background through the literature you have read.
2. Should be significant enough to contribute to the existing body of research
3. Should lead to further research, future work that can be explored. No solution is ever sufficient
4. The problem should render itself to investigation through collection of data. In technical scientific research, the investigation is mostly done through experiments.
5. Should be of interest to the researcher and suit his/her skills, time, and resources. Remember having the end goal in mind, this includes graduating on time as well.
6. The approach towards solving the problem should be ethical. The core reason for research is always to make the world a better place.

What then is the format for writing a good problem statement?

A persuasive statement of problem is usually written in three parts:

1. **The ideal part:** Describes a desired goal or ideal situation; explains how things should be.
2. **The reality part:** Describes a condition that prevents the goal, state, or value in Part 1 from being achieved or realized at this time; explains how the current situation falls short of the goal or ideal.
3. **The consequences part**: Identify the way you propose to improve the current situation and move it closer to the goal or ideal.

1.3 Objectives

Research objectives are the goals to be achieved by conducting the research. They may be stated as **general** and **specific**.

Have something like. Some of the objectives for this research include:

1.3.1 General Objective

The general objective of the research is what is to be accomplished by the research project, **for example**, to develop an end to end speech recognition model for Fon and Igbo.

Based on the sample topic that we had earlier in the abstract. **For example**: to develop an improved model that will address Question Answering Tasks in maternal healthcare.

Another Example: To develop an e-voting application based on Blockchain.

1.3.2 Specific objectives

The specific objectives relate to the specific research questions the investigator wants to answer through the proposed study and may be presented as primary and secondary

objectives, for example, **primary**: To determine the effectiveness of models trained using unsupervised learning by benchmarking with gold standard supervised models. **Secondary**: To study the cost effectiveness and implications of using unsupervised learning.

Points to Note:

Researchers are advised to resist the temptation to put too many objectives or over-ambitious objectives that cannot be adequately achieved by the implementation of the protocol.

Objectives are typically numbered, so each one stands alone. Each objective must have a concrete method defined since they will help you in formulating your **Chapter 2**. If you're having trouble developing concrete objectives and methods, writing out a research timeline before defining your objectives may help.

Use R**oman numerals** when numbering your objectives and start with the key word **To** in a research Proposal. Additionally, your objectives should be **SMART**

1. **Specific -** prepare yourself for in-depth research about the issue you want to address. Avoid general statements such as “this project will improve the models accuracy”.
2. **Measurable** - Keep in mind that your supervisor wants to know how the success of your project can be evaluated. Therefore your objectives must enable the supervisor to monitor the progress of the project and assess the final results.
3. **Achievable** - Set achievable targets; do not claim that a year long/semester long project will produce radical change. Rather, set clear objectives that can be fulfilled.
4. **Relevant** - This can also mean results oriented. Your project objective should be able to answer the questions like “why should this project be done?” “What impact will this project have?”

5. **Time - Related** - Remember your objectives must be reached in a set time-frame. Draw on the results of similar projects and observe what is happening in your research community in order to decide how long it will take to complete a task. Also, you have a fixed timeline in which you will want to graduate after or clear the course in a semester.

From the sample topic: Improving Question Answering Tasks in Maternal Healthcare using Generative AI Models in Natural Language Processing

Write down some objectives:

i. To analyze the current state of Question Answering in Maternal Healthcare Domain
ii. To study and analyze how related works have improved Question Answering in Maternal Healthcare domain
iii. To review the challenges related to currently existing Question Answering Models in Maternal Healthcare.
iv. To design and develop an improved Question Answering Model fine-tuned to Maternal Healthcare Questions.
v. To test and validate the proposed Question Answering model

1.4 Research Questions

A research question is the specific concern that you will answer through your research. It is derived from your research problem but is based on your study design. When you narrow down your research problem to a specific idea that points towards a feasible way to investigate or address your research problem, you get your research question. Most of the time, your research questions point to your objectives and are generated from them.

For example, you can design your Research Question from the objectives as shown below.

i. To analyze the current state of QA in the Maternal Healthcare domain.

    i. What is the current state of QA in Maternal Healthcare Domain?

ii. To study and analyze how related works have improved Question Answering in Maternal Healthcare domain
    i. How have existing works in Question Answering models improved question answering in maternal healthcare?

YOU CAN SEE HOW TO FIX THE REST FROM THE EXAMPLES ABOVE.

1.5 Justification

The rationale or justification for doing any research must be drawn from the existing literature on the subject. You will need to conduct a thorough literature survey and identify gaps in the current literature. The best way to write this is to introduce the current literature in the background/Introduction section and then highlight the gaps in the literature that have not been addressed or are yet to be understood. This will help set up the need for the current study and thus justify the need for this research. This section should be heavily cited from the literature or relevant sources.

Note: You will write this section in prose, a paragraph or two should be enough with all the relevant citations.

1.6 Scope and Delimitations

The scope details how in-depth your study is to explore the research question and the parameters in which it will operate in relation to the study and timeframe.

The delimitations of a study are the factors and variables not to be included in the investigation. In other words, they are the boundaries the researcher sets in terms of study duration and the technologies applied.

Difference Between Delimitations and Limitations

Delimitations refer to the boundaries of the research study, based on the researcher's decision of what to include and what to exclude. They narrow your study to make it more manageable and relevant to what you are trying to prove.

Limitations relate to the validity and reliability of the study. They are characteristics of the research design or methodology that are out of your control but influence your research findings. Because of this, they determine the internal and external validity of your study and are considered potential weaknesses.

In other words, limitations are what the researcher cannot do (elements outside of their control) and delimitations are what the researcher will not do (elements outside of the boundaries they have set). Both are important because they help to put the research findings into context, and although they explain how the study is limited, they increase the credibility and validity of a research project.

How to Start Writing Your Study Scope

Note: This section should be written in prose

Use the below prompts as an effective way to start writing your scope:

1. This (proposed) study is to focus on...
2. This (proposed) study covers the...
3. This (proposed) study aims to...

For example: The proposed e-voting application based on blockchain technology, will cover voter registration, voter identification. etc

Guidelines on How to Write Delimitations

Since the delimitation parameters are within the researcher's control, readers need to know why they were set, what alternative options were available, and why these

alternatives were rejected. For example, if you are collecting data that can be derived from three different but similar experiments, the reader needs to understand how and why you decided to select the one you have.

Your reasons should always be linked back to your research question, as all delimitations should result from trying to make your study more relevant to your scope. Therefore, the scope and delimitations are usually considered together when writing a paper.

How to Start Writing Your Study Delimitations

Note: This section should be written in prose

Use the below prompts as an effective way to start writing your study delimitations:

1. This study does not cover...
2. This study is limited to...
3. The following has been excluded from this study... with relevant reasons.

Examples of Limitations in Research

Note: You may put this section in **1.7**
You may choose to have 1.7 as limitations or / limitations and delimitations

Examples of limitations include:

1. Issues with sample (dataset/IoT Devices) and selection,
2. Insufficient sample size, dataset, population traits or specific participants for statistical significance.
3. Lack of previous research studies on the topic which has allowed for further analysis,
4. Limitations in the technology/instruments used to collect your data,

Chapter 2: Literature Review

Points to Note

A literature review surveys books, scholarly articles, and any other sources relevant to a particular issue, area of research, or theory, and by so doing, provides a description, summary, and critical evaluation of these works in relation to the research problem being investigated. **Literature reviews are designed to provide an overview of sources you have explored while researching a particular topic and to demonstrate to your readers how your research fits within a larger field of study.**

Importance of a Good Literature Review

A literature review may consist of simply a summary of key sources, but in the social sciences, a literature review usually has an organizational pattern and combines both summary and synthesis, often within specific conceptual categories. A summary is a recap of the important information of the source, but a synthesis is a reorganization, or a reshuffling, of that information in a way that informs how you are planning to investigate a research problem. The analytical features of a literature review might:

1. Give a new interpretation of old material or combine new with old interpretations,
2. Trace the intellectual progression of the field, including major debates,
3. Depending on the situation, evaluate the sources and advise the reader on the most pertinent or relevant research, or
4. Usually in the conclusion of a literature review, identify where gaps exist in how a problem has been researched to date.

The Purpose of A Literature Review is to:

1. Place each work in the context of its contribution to understanding the research problem being studied.
2. Describe the relationship of each work to the others under consideration.

3. Identify new ways to interpret prior research.
4. Reveal any gaps that exist in the literature.
5. Resolve conflicts amongst seemingly contradictory previous studies.
6. Identify areas of prior scholarship to prevent duplication of effort.
7. Point the way in fulfilling a need for additional research.
8. Locate your own research within the context of existing literature [very important].

The structure of a literature review should include the following:

1. An overview of the subject, issue, or theory under consideration, along with the objectives of the literature review,
2. Division of works under review into themes or categories [e.g. works that support a particular position, those against, and those offering alternative approaches entirely],
3. An explanation of how each work is similar to and how it varies from the others,
4. Conclusions as to which pieces are best considered in their argument, are most convincing of their opinions, and make the greatest contribution to the understanding and development of their area of research.

The Critical Evaluation of Each Work Should Consider:

1. **Provenance** -- what are the author's credentials? Are the author's arguments supported by evidence [e.g. primary historical material, case studies, narratives, statistics, recent scientific findings]?
2. **Methodology** -- were the techniques used to identify, gather, and analyze the data appropriate to addressing the research problem? Was the dataset size appropriate? Were the results effectively interpreted and reported?
3. **Objectivity** -- is the author's perspective even-handed or prejudicial? Is contrary data considered or is certain pertinent information ignored to prove the author's point?

4. **Persuasiveness** -- which of the author's theses are most convincing or least convincing?
5. **Value** -- are the author's arguments and conclusions convincing? Does the work ultimately contribute in any significant way to an understanding of the subject?

Writing Your Literature Review

Once you've settled on how to organize your literature review, you're ready to write each section. When writing your review, keep in mind these issues.

1. **Use Evidence** - A literature review section is, in this sense, just like any other academic research paper. Your interpretation of the available sources must be backed up with evidence [**citations**] that demonstrates that what you are saying is valid.
2. **Be Selective** - Select only the most important points in each source to highlight in the review. The type of information you choose to mention should relate directly to the research problem, whether it is thematic, methodological, or chronological.
3. **Summarize and Synthesize** - Remember to summarize and synthesize your sources within each thematic paragraph as well as throughout the review.
4. **Keep Your Own Voice** - While the literature review presents others' ideas, your voice [the writer's] should remain front and center.
5. **Use Caution When Paraphrasing** - When paraphrasing a source that is not your own, be sure to represent the author's information or opinions accurately and in your own words. Even when paraphrasing an author’s work, you still must provide a citation to that work.

Note: The model of writing is in third person.

Common Mistakes to Avoid in Literature Review

These are the most common mistakes made in reviewing social science research literature.

1. Sources in your literature review do not clearly relate to the research problem;
2. You do not take sufficient time to define and identify the most relevant sources to use in the literature review related to the research problem;
3. Uncritically accepts another researcher's findings and interpretations as valid, rather than examining critically all aspects of the research design and analysis;
4. Only includes research that validates assumptions and does not consider contrary findings and alternative interpretations found in the literature

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Class Discussions: How to Structure Chapter 2

In this section, we will draw our own conclusions from a sample topic and its objectives. Assuming you have a topic such as **Improving Question Answering Tasks in Maternal Healthcare using Generative AI Models in Natural Language Processing**

You will need specific objectives, refer to the examples used in section 1.3.2

Points to Note:

The formulation of **Chapter two** is based on the structure of your objectives and therefore will differ from one person to another. Some of the objectives are therefore always combined for example, objectives one and two can be combined into one section such as in **subchapter 2.2**.

2.1 Introduction

This section introduces Chapter 2 and it covers how the chapter has been planned, what related works have been reviewed and generally the layout of the chapter.

2.2. Objective 1 [Current State of Question Answering in Maternal Healthcare Domain]

- What is QA in Maternal Healthcare?
    - You could also add the main domain with reference Healthcare.
- How has it been done before and maybe currently.
- Is the current way working or not? If **Yes**, state why and if **No**... Also state why so.
- You need to show a lot of **citations in this.**

2.2.1. Challenges Facing the Current State of Question Answering in Maternal Healthcare.

- Gaps in the current state of Question Answering in Maternal Healthcare
- In this section, you also need to write in **prose**.

2.3. Related Works

Some of the related works in question answering in maternal healthcare domain are:

2.3.1 Jibu Sasa: A Web Based Application for Question Answering in Maternal Healthcare

- What it is (this is not the history of the application). Just tell us what it is and state how it can be accessed.
    - Web Based application?
    - Mobile Based Application. (Android, iOS or CrossPlatform)
- How is it working? What technologies is it using?
- Is it addressing the problems {Yes, no} - this is a discussion
- Mention the gaps in this solution
    - This should be in prose.
- Add some screenshots (not recommended)

    - In case you cannot avoid it, do 1 or 2 but any excess should be in the appendix.
- **Note:** You can always refer to the shared document on Classrooms.

2.3.2. Another technology should appear here in the same fashion as seen above

(talk about technologies implemented, how they have been implemented, some accuracies in case of any, some benchmarks, tables of comparison of results, identify the gaps in this study.)

- This should also take the same fashion of work as seen in the examples above.

2.3.3 Another technology should appear here in the same fashion as seen above

- This should also take the same fashion of work as seen in the examples above.

2.3.4 Another technology should appear here in the same fashion as seen above

Note: Usually, we recommend 3 to 4 Related Works. This should give you enough information to use when writing your justification and Gaps in Related Works.

- This should also take the same fashion of work as seen in the examples above.

2.4 Gaps in Related Works

After reviewing all the related works above, in this section, just sum up all the relevant gaps that are evident in your Related Works.

- You should use citations in this section.
- Only share the Gaps that are unique to all the Related Works. You will need to do citation of those gaps
    - Some gaps will be similar, you can only mention them once in passing without repeating all of them for all the related works reviewed.
    - You can pick them from the relevant sections.
- This section should be written in prose.

2.5 Conceptual Framework

A conceptual framework in research is a **visual** or written representation of the key concepts, variables, relationships, and theories that guide your study. It helps you organize your thoughts, establish a theoretical foundation, and provide a roadmap for your research design and analysis.

Note: to understand better how to draw a conceptual framework, you can use the analogy of **Input**, **Processing** and finally **output**. (see the sample proposal on Classrooms)

Below are some of the steps you need to take towards drawing your Conceptual Framework:

1. **Identify your research topic and research question:** Clearly define the focus of your study and the specific question you want to answer.
2. **Identify key concepts and variables:** Determine the main concepts and variables that are relevant to your research question. These can be abstract ideas or measurable factors that you will investigate.
    a. For Example: In Case you are interacting with users, consider how different users are and how they behave.
3. **Review existing literature:** Conduct a comprehensive review of existing research and scholarly works related to your topic. Identify theories, models, and frameworks that have been used in previous studies and are applicable to your research.
4. **Determine the relationships between concepts and variables:** Analyze the literature to understand the relationships and interactions between the identified concepts and variables. Consider how changes in one variable may affect others.
5. **Create a visual representation:** There are various ways to visually represent a conceptual framework, depending on your preference and the complexity of your research. Some common formats include flowcharts, **diagrams**, or schematic

representations. You can use software like Microsoft Word, PowerPoint, or **specialized diagramming tools** to create your visual representation.

6. **Arrange the components:** Place the main concepts or variables in the center of your framework. Use arrows, lines, or other connectors to show the relationships between them. Consider including labels, explanations, or additional text to clarify the connections.
7. **Refine and revise:** Review your conceptual framework to ensure that it accurately reflects your research question and the relationships between variables. Revise and refine it as needed, based on feedback from your research advisor or colleagues.

Note: A conceptual framework is a flexible tool that can evolve throughout your research process. It provides a theoretical framework for your study, but it's important to remain open to modifications and adjustments as you gather data and gain new insights.

For Example: In case your proposed solution is to build an e-voting application based on Blockchain, you will need to show.

1. Devices Users will use to give information and to also get Feedback. I.e. mobile phones or PC
2. How data is flowing from one point to another in the proposed solution.
3. You will need a narrative showing how the information will be flowing from one point to another in your conceptual diagram (see the attached proposal on classrooms)

Note: Also you will need to work very closely with your supervisor to ensure that you have the right diagram showing the flow of information.

Chapter 3: Methodology

3.1 Introduction

This section shows the chapter's outline and summary. You will state how the chapter has been arranged and what contents have been covered in those sections. You need to be as brief as possible in this section as it is not forming the main part of the chapter.

- **Note**: In this section you will also mention the Development Paradigm that you will apply. Either SSAD/SSADM or OOAD as discussed in the table below.
- Remember that the development paradigm you choose will affect the methodology of the project. Some methodologies work well with SSAD/SSADM while others only work with OOAD. Do a quick read on the differences on ChatGPT.

3.2 System Development Methodology

Note: Design the Subtopics based on the content that you have, you will need to work very close with your supervisor to address this.

- This is because your work will mostly differ from other peoples.

Discuss the choice of the methodology here, this can include the development of the solution in question. You can choose the methodology such as Agile then you have to narrow down the specific methodology in this category as there are many. Other notable methodologies to use can be **Design Thinking**, **Rapid Application Development (RAD**), **DevOps**, **Modified Waterfall**, **Lean Development** and many more.

3.2.1 Justification of the Methodology

In a paragraph, you will need to provide the rationale for the chosen methodology. Remember to provide references here from the consulted literature.

3.2.2 Methodology Diagram

With references showing the sources of origin, you will present the diagram here after which you will discuss and apply the methodology stages to the project.

Note: We have two Examples below. Design Thinking or Prototyping which is part of Agile Development

First Example: Design Thinking

You do not own the rights to the diagram, so you need to cite the source.

3.2.1 Empathize

What is this stage of the development process? Why is it important? Where do we get the data that is relevant for this stage?

In this stage of research, we will mainly focus on secondary data. Now, while you are answering all the questions raised above, fine tune them to fit your research.

- **Note**: You need to discuss how they will be relevant to your project.

3.2.2 Define

Define what this is and why it is important.

- Define key model/solution parameters or considerations from secondary data

3.2.3 Ideate

Define what this is and why it is important.

- Design approach and why it is important
- Possible ways of looking at the proposed solution

You will mention the design paradigm that you have chosen for your project here. This will affect how you draw your diagrams so you also have to mention the reason as to why the selected design paradigm has been chosen.

The table below should guide you on what diagrams you will be expected to use in **Chapter 4** based on the design paradigm you have chosen.

Click here to see the table

3.2.4 Prototype

Define what this is and why it is important.

- Development approach
- Development tools and techniques and why?

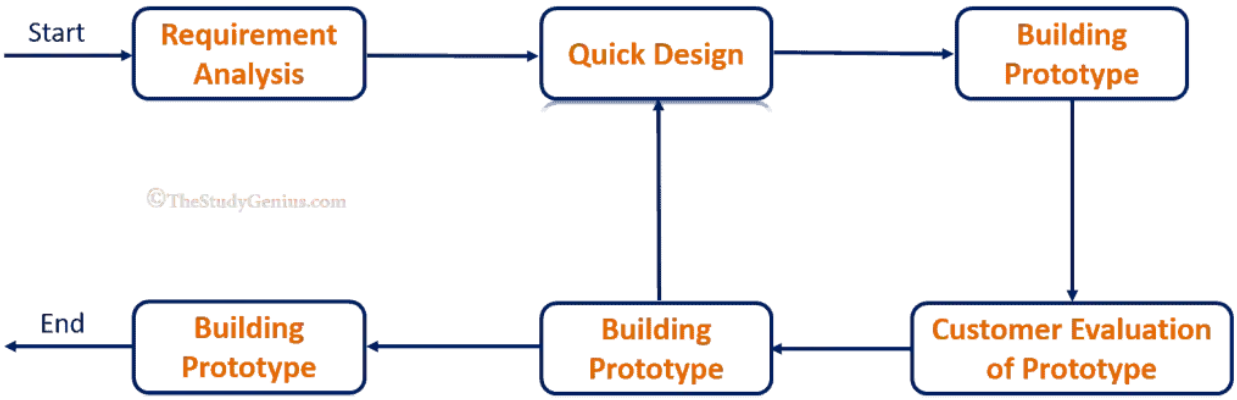
3.2.5 Test

Define what this is and why it is important.

- Testing approaches and why?
    - Unit testing, blackbox testing, white box testing
- Testing types and scenarios
    - Accuracy testing, model prediction performance

- Test cases to be drawn

Prototyping - As example 2



3.2.1 Requirements Analysis

Define what this is and why it is important.

- Gathering requirements, specify the use of primary and secondary sources of data.

3.2.2 Quick Design

Define what this is and why it is important.

- Preferred approach to approach and development
- Analysis and Design diagrams and why

3.2.3 User Evaluation

Define what this is and why it is important.

- Testing for Individual models and prototype

- Testing type and why

3.2.4 Refining Prototype

Define what this is and why it is important.

- Development approach
- Development tools and why - you can mention the various tools and techniques in this section.

3.2.5 Implement and Test

Define what this is and why it is important.

- This section can be theoretical, out of scope.

3.3 Deliverables

As subtopics, list and explain the deliverables that will be realized during this project and why they are important.

- Model and user interface - explain why they are important and their uses {as 3.3.1}
- Proposal - discuss this in details
- Distributed system that can be used to access the applications.

3.4 Tools and Techniques

As subtopics, list and explain the tools and techniques that will be used during this project and why they are important.

For example:

3.4.1 MsQL

- What it is and what are the uses with reference to your project

Points to Note:

In case the design and analysis sections are evaluated independently, they can be outlined and discussed in sections 3.3 and 3.4 respectively and cross referenced in the methodology stages that point to analysis and design.

Such that:

- 3.3 Analysis diagrams
- 3.4 Design Diagrams
- 3.5 Deliverables
- 3.6 Tools and techniques

References:

You will have references listed according to APA referencing. This should appear automatically when you did the right thing from the beginning.

- Avoid non dated references, websites and non academic references such as Wikipedia.
- It is recommended that you use tools such as **Zotero**, **Mendley** and other similar tools.

Appendices

Definition. An appendix contains supplementary material that is not an essential part of the text itself but which may be helpful in providing a more comprehensive understanding of the research problem or it is information that is too cumbersome to be included in the body of the paper.

- Additional images that could be used to show more information in the literature review can be put there and cross referenced in the main sections. .
- Gantt Chart showing your work plan till the end of the project. Use relevant tools that can draw better conclusions from the work plans that you have.

    - Project will end at the end of November 2022 [presentations after exams]
    - You can use Google Sheets, just introducing timelines. Check it out.
- Create a numbering system that shows Appendix as a prefix.
    - Appendix 1. Appendix 2 and so on
        - Eg. Appendix 1: Gantt Chart
        - Eg, Appendix 2: Feature Extraction in CNN

Introduction to Documentation

Briefing: Proposal Corrections

Proposals have been sent out for marking, expect them back next week.

Notable points from the collection experience

- Working at the last minute this leads to:
    - Common sense mistakes
    - Not reading enough and understanding the guidelines.
    - Less time with the supervisors
    - Stress that no one will help you with
- Most of us don't read
    - This is a Kenyan problem, please do not make it yours too.
- People want to bribe their way out without the work fully done and crying foul of not being in the know.

How do we make sure we move forward with the right behavior?

Some of the notable corrections that you will do include but are not limited to.

- Change of tenses - moving forward, from chapter 4 onwards, your tenses will change to past tense or past participle since you are now forming your documentation. For this uniformity, you will also have to change the tense in your proposal.
    - You will have to go back to your proposal and amend the tenses too. Do it now, it will cost you a lot during the final submission.
- In case you had formatting issues in the original proposal, this should be the right time to change it moving forward.

    - For proposals that were not approved by the supervisors. This is the right time to make sure that you are on the right terms with your supervisor.

- From now onwards:
    - You will be working in parallel on the other tasks. For example, you will be working on your documentation as well as your project. Additionally, remember that you have to host the projects on Git. (I will be giving a deep dive on Introduction to Git next Friday on SSTG)

- Points to Remember.
    - Let us revisit our first class. We said that:
        - You are alone, no one cares about you if we speak the truth. For example, have a look at the proposals. You already know what happened.

Sprint 1: Authentication Module

We have started our sprints, let us have a look at what is required.

- CourseWork Distribution | Milestones and To Do List

Chapter 4: System Analysis and Design

4.1 Introduction

Talk about what the chapter is about, what is covered in different sections and what analysis and design diagrams you have drawn, you can also recap on the design paradigm that you have used for instance OOAD or SSAD/SSADM.

4.2 System Requirements

System requirements are the configuration that a system must have in order for a hardware or software application to run smoothly and efficiently. Failure to meet these requirements can result in installation problems or performance problems. The former may prevent a device or application from getting installed, whereas the latter may cause a product to malfunction or perform below expectation or even to hang or crash.

You may start by writing:- Some of the system requirements reviewed in the project include:

4.2.1 Functional Requirements

These are product features or functions that developers must implement to enable users to accomplish their tasks. So, it's important to make them clear both for the development team and the stakeholders. Generally, functional requirements describe system behavior under specific conditions. For example:

- The system sends an approval request after the user enters personal information in the requirements and in the login section.
- A search feature allows a user to hunt among various invoices if they want to credit an issued invoice. This can also be applied to the catalog.
- The system sends a confirmation email when a new user account is created.

In your documentation, using a **listing format i.e. Roman Numbers in small**, you can list and describe some of these requirements as follows.

i. Authentication Modules - Describe what it is and how it was done, that is what type of data you are collecting (Login and Registrations, mention how the hashing was done to make it a bit secure)
ii. File transfer Module - description of this module
iii. List more information about what your system requirements are and how they were implemented.

4.2.2 Non - Functional Requirements

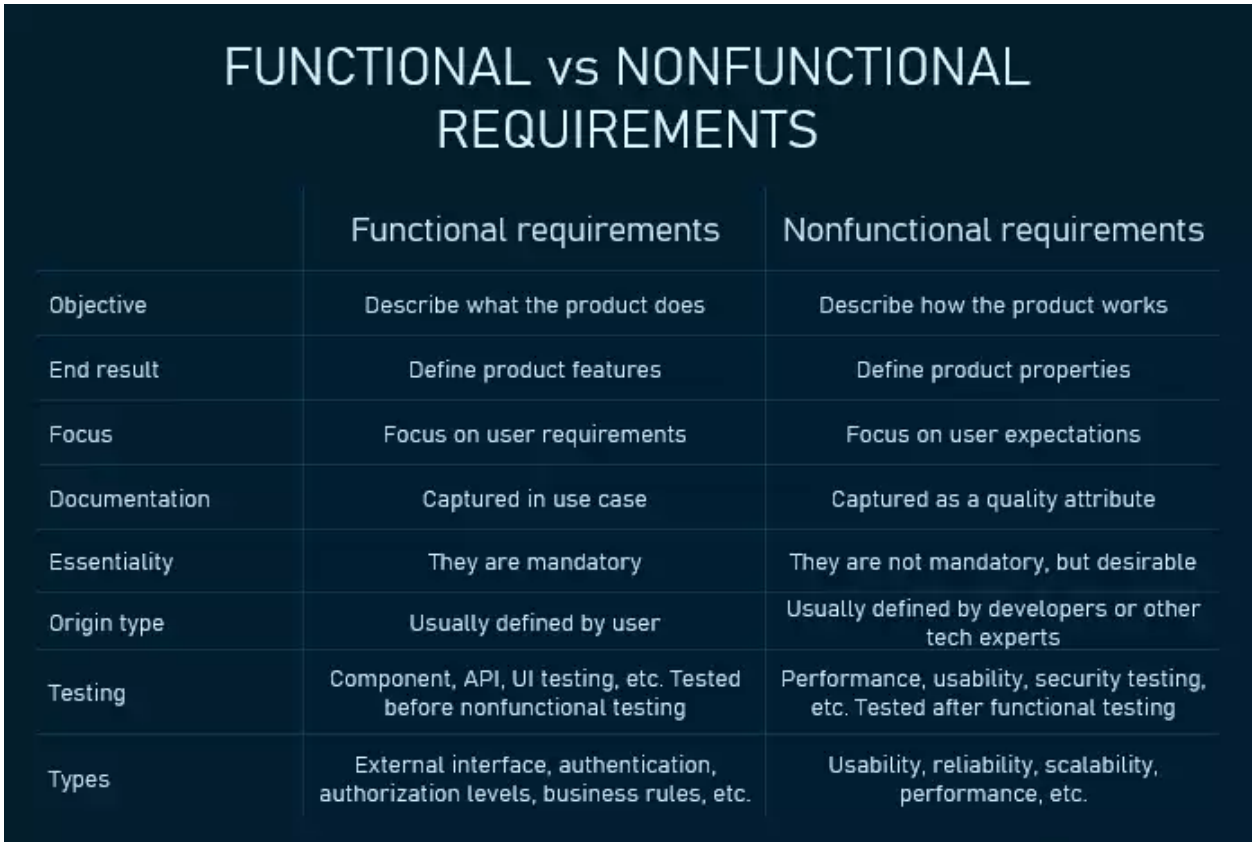
They are not related to the system functionality, rather define how the system should perform. For example:

- The website pages should load in 3 seconds with the total number of simultaneous users <5 thousand, this shows the performance of the system.
- The system should be able to handle 20 million users without performance deterioration.

In your documentation, using a **listing format**, you can list and describe some of these requirements as follows.

i. System Security - Describe what it is and how this was achieved. [password hashing, safe https usage]
ii. Secure File transfer - Did you have End to end encryption? If yes, then give more information.
iii. You may also add something to do with privacy and security or encryption or even the speed at which the system performs or how your model performs against other benchmarks.

Here's a brief comparison on functional and non functional requirements.



For more quick information, always be quick in prompting ChatGPT for the differences (Remember what we said about Responsible usage of Technology and AI)

Discussion of Diagrams and their purposes:

System analysis diagrams serve several purposes in the process of system analysis. These diagrams are used to visualize, analyze, and communicate various aspects of the system being studied. Here are some key purposes of system analysis diagrams:

1. Understanding System Requirements
2. Identifying System Boundaries
3. Modeling System Structure
4. Analyzing System Behavior
5. Communication and Collaboration
6. Supporting Decision-Making

Overall, system analysis diagrams play a crucial role in system analysis by aiding in requirements understanding, system modeling, behavior analysis, communication, and decision-making. They help stakeholders gain a comprehensive understanding of the system, leading to effective analysis and design of the desired system solution.

SSAD/SSADM	OOAD
Use Case	Use Case
Sequence	Sequence
ERDs	ERDs
Class	Context Level Diagram
Activity	DFD Level 0
Package**	DFD Level 1
Database Schema	Database Schema
UI Mockups - Wireframes	UI Mockups - Wireframes
System Architecture	System Architecture
Network Topology **	Block Diagram**
Block Diagram / Circuit **	FSM**
FSM**	

KEY:

	Analysis Diagrams		Design Diagrams	**	Optional

NOTE: Context Level Diagrams and DFD Level 0 are two different diagrams with very distinct purposes. Read more here.

4.3 System Analysis Diagrams

In this section, you will heavily rely on the design paradigm that you defined in Chapter 3 since you promised to draw the diagrams in Chapter 4. Refer to the section in Chapter 3

You may start with a statement like: Some of the system analysis diagrams include:

4.3.1 Use Case Diagram

Points to Note:

- You need a narrative for each diagram. This narrative describes the diagram and how it is relevant to the project. For example: what is the flow of information in your project?
- Then you will have to draw the diagram itself. This diagram must be very clear and not very small such that it is very visible to the supervisors.
- Each **diagram MUST** be captioned
    - Revisit the formatting tutorial that we have in our Google Classroom.

Note: Use the table provided above to draw your respective diagrams in this section. Remember the diagrams will flow based on the design paradigm that you chose, either SSAD/SSADM or OOAD.

4.4 System Design Diagrams

The format of this section takes the same fashion seen in the System Analysis section. Such that:

- Specific diagram in the section as the subtopic. For example: ERD
- Then you will have the narrative of the diagram with the same context as the sections described above.
- Then you will have the diagram itself.
- Each diagram MUST be Captioned with the proper captions

Important Notes:

1. What type of Database Schema do we need to be drawn?
    a. In the diagrams, we need a **Logical Database Schema** and NOT a **physical Database Schema**. So what are the differences between them?
    b. Let us check them here on ChatGPT. Remember to always be Responsible with the usage of the Technology.
2. For Consistency in your diagrams, use the recommended tools below. You are free to use what works best for you though.
    a. Star UML - Good for Class Diagrams and Schema Diagrams.
    b. Visual Paradigm - Works best when downloaded and installed locally. But there is also an online version. Should be free for about 30 days after which you can pay the full subscription.
    c. Ms Visio - known for the right tools and symbols for the diagrams.
    d. Avoid mistakes like having watermarks on your document, instead, take screenshots of the diagrams then paste them on your documents.