TECHNICAL PAPER WRITING & IPR

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What is Report?

It is a piece of informative writing that describes a set of actions and analyses any results in response to a specific brief. A quick definition might be: ***"This is what I did and this is what it means."***

What is a good Report?

A good report is easy to be familiar with an issue raised as a subject because:

- ❖its title is precise and informative,
- ❖its layout and format are well organized, and
- ❖Its binding is easy to handle and opens flat to reveal both text and diagrams.

What is technical Report?

- The term "technical" refers to ***specific knowledge of specific area of study***. This is to mean "technical" refers knowledge which is not widespread or worldwide.
- Whenever you try to write or say anything about your field of specialization, you are engaged in technical communications.
- Technical communication is the delivery of technical information to specific audiences. The information should be of:
  - ❖ their needs,
  - ❖level of understanding and
  - ❖background or experience.

- It is direct, informative, clear, and concise language written specifically for an **identified audience**.
- The content must be accurate and complete with **no exaggerations**.
- To deliver the intended message, the text must be **objective** and persuasive **without being argumentative**.
- It has a purpose/ objective. A technical document always is written for a reason, and the purpose of reports may be to explain :
  - ❖**what was done,**
  - ❖**why it was done, and/or**
  - ❖**the results of a study.**
- It conveys information/facts/data. A report **without facts or scientific evidence** to support an opinion also usually **lacks credibility**, and it is likely to be unsuccessful in achieving its purpose and objective.
- It might also include **recommendations** and conclusions of the research.

➢**The Purpose of Technical Report :** *To convey information as clearly and adequately as possible*

- **Scientific Papers** purpose is to **advance scientific knowledge** by reporting *original research*, experiments, data, analysis, and conclusions.
- **Technical Papers** purpose is to **explain technology or engineering solutions, document designs, describe processes, propose improvements, or summarize applied research.**
- All scientific papers are technical in a broad sense, but not all technical papers are scientific. Scientific papers focus on discovering new knowledge, whereas technical papers focus on explaining or improving technology**.**

Aspect	Scientific Paper	Technical Paper
Goal	Produce new scientific knowledge	Explain/apply technology or engineering
Content	Experiments, theories, data	Methods, implementation, specifications
Audience	Scientists, researchers	Engineers, practitioners, technicians
Validation	Strict peer review	May be peer-reviewed, but not always
Focus	Why phenomena occur	How to use/implement technology

Technical Sentences Formation

1) Basic word order in English:

English has a strict order in which words can appear in a sentence. S1 shows an example of this order.

➢ **S1. The researchers sent their manuscript to the journal.**

This order is rarely altered. It is:

1. subject (the researchers)
2. verb (sent)
3. direct object (their manuscript)
4. indirect object (the journal**)**

❖ The key is to keep the subject, verb, direct object and indirect object as close to each other as possible. This is illustrated in S2, which maintains the exact order of S1.

➢ **S2. Last week the researchers sent their manuscript to the journal for the second time.**

➢ **S3.** *The researchers last week sent for the second time to the journal their manuscript.*

- S3 is incorrect English. The position of last week and for the second time is wrong, and the indirect object comes before the direct object.

2) Choose the most relevant subject and put it at the beginning of the sentence

The sentences below (S1–S4) come from a paper written by a physicist in a physics journal. They all contain exactly the same information. However, there are four possible subjects:

S1. Particularly interesting for researchers in physics is the new feature, named X, for calculating velocity.

S2. Physics now has a new feature, named X, for calculating velocity.

S3. Velocity can now be calculated with a new feature, named **X**, which is particularly interesting for physicists.

S4. **X** is a new feature for calculating velocity. It is particularly interesting for physicists.

When deciding what the subject is for your sentence, it is generally best to choose the most recent or newest information. S1 and S2 refer to known situations - physics, and physicists - they do not give any new information, so they are not well constructed sentences. S3 also begins with a known, in this case velocity. This is fine if velocity is the main focus. However, given that velocity is a common factor for physicists, then S4 may be the best solution as it begins with completely new information. The choice between **S3 and S4** will depend on where the author wants to put the focus.

3) Choose the subject that leads to the most concise sentence

If your sentence is short and you have two possible subjects, which you could indifferently put at the beginning of the sentence, then choose the subject that will give the shortest sentence (S2 rather than S1).

S1. The most significant values are **highlighted** in Table 1.

S2. Table 1 **highlights** the most significant values.

Shorter sentences are often obtained by using **active** (S2) rather than passive (S1) **verbs**.

D) **Don't make the impersonal "*it*" the subject of the sentence**

➢using modal verbs (can, must etc.)

original version (ov)	revised version (rv)
It is necessary / mandatory to use X	X must be used (or) X is necessary / mandatory
It is advisable to clean the recipients.	The recipients should be cleaned.
It is possible that inflation will rise.	Inflation may rise.

4) Don't use a pronoun (it, they) before you introduce the noun (i.e. the subject of the sentence) that the pronoun refers to

It is OK to use a pronoun at the beginning of the sentence, provided that this pronoun refers back to a noun in a previous sentence (i.e. a backward reference). For example:

S1. **Beeswax is a** very important substance because … In fact, it is …

In S1 it is clear that it refers to beeswax. But in S2 it refers to a noun that comes after (i.e. a forward reference).

The reader does not know what the pronoun refers to and thus has to wait to find out.

S2. ****Although it is*** a very stable and chemically inert material, studies have verified that the

composition of beeswax is …

S3. **Although beeswax is** a very stable and chemically inert material, studies have verified that its composition is …

S3 immediately tells the reader what the subject is

5) Put the subject before the verb

➢The subject in English must come before their verb

original version (ov)	revised version (rv)
In the survey participated 350 subjects.	Three hundred and fifty subjects participated in the survey
Were used several different methods in the experiments.	Several different methods were used in the experiments.
These values are associated with a series of measurements.	A series of measurements are associated with these values.

➢Say what something is before you begin to describe it.

original version (ov)	revised version (rv)
Among the factors that influence the choice of parameters are time and cost.	Time and cost are among the factors that influence the choice of parameters.
Of particular interest was the sugar transporter, because ..	The sugar transporter was of particular interest, because ..
Important parameters are conciseness and non-ambiguity.	Conciseness and non-ambiguity are important parameters.

6) Avoid inserting parenthetical information between the subject and the verb

If you insert more than a couple of words between the subject and the verb this will interrupt the reader's train of thought. In any case readers will consider this parenthetical information to be of less importance.

original version (ov)	revised version (rv)
The **result**, after the calculation has been made, can be used to **determine** Y.	After the calculation has been made, the **result** can be used to **determine** Y.
This sampling method, when it is **possible**, is useful because it **allows** ..	When this sampling method is **possible**, it **allows** us .
These **steps**, owing to the difficulties in measuring the weight, require some **simplifications**.	Owing to the difficulties in measuring the weight, these **steps** require some **simplifications.** or These **steps** require some **simplifications**, owing to the difficulties in measuring the weight

7) Don’t separate the verb from its direct object

- When a verb is followed by two possible objects, place the direct object (i.e. the thing given or received) before the indirect object (the thing it is given to or received by). This kind of construction is often found with verbs followed by ‘***to***’ and ‘***with***’

Ex-1: We can **separate**, with this tool, **P and Q**.

Correct one - We can **separate P and Q** with this tool.

Ex-2: We can **associate** a high cost, higher overheads, a significant increase in man-hours and several other problems with these **values.**

Correct options are:

a) We can **associate** a high cost with these **values**, along with higher overheads, a significant increase in man-hours and several other problems.

b)We can **associate** several factors with these **values**: a high cost, higher overheads, a significant increase in man-hours and several other problems.

c)The following can be **associated** with these **values**:

i. a high cost

ii. higher overheads

iii. a significant increase in man hours

8) Put the direct object before the indirect object

original version (ov)	revised version (rv)
However, only ***for some cases*** this **operation** is defined, these cases are called …	However, this **operation** is only **defined *for some cases***, which are called …
Although in the ***above references*** one can find **algorithms** for this kind of processing, the execution of …	Although **algorithms** for this kind of processing are reported in the ***above references***, the execution of…
This occurs when in the ***original network*** there is a **dependent voltage**	This occurs when there is a **dependent voltage** in the ***original network*.**

9)Put adjectives before the noun they describe, or use a relative clause

Ex: This is a **paper** particularly ***interesting*** for PhD students

Correct sentences: This is an ***interesting*** **paper**.

- If you want to put the adjective after the noun, you have to **change the construction**
- This **paper *is*** particularly ***interesting*** for PhD students.
- This is a **paper *that is*** particularly **interesting** for PhD students

10) Ensure there is no ambiguity in the order of the words

Ambiguity affects readability. If you force your reader to constantly interpret what you are writing, the reader will soon want to stop reading.

Ex-1: I spoke to the professor with a microphone**.**

did I use the microphone or was the professor holding it?

Correct sentence: I spoke to the professor who was holding a microphone

Ex-2: The European Union (EU) adopted various measures to combat these phenomena. This resulted in smog and pollution levels reduction.

When we read resulted in smog and pollution, our initial interpretation is that the smog and pollution are the result of the EU's measures. Then when we move on and read levels we have to reprocess the information

Correct sentence: The European Union adopted various measures to combat this phenomena. This resulted in a reduction in smog and pollution levels.

Ex-3: We also demonstrated that x does not equal y as suggested by Walker (2011).

Are you saying that - ***Walker suggested that x is equal to y and is thus in contrast to what you are saying ,*** *or that* **he, like you, found that x does not equal y**.

- Unlike what was suggested by Walker (2011), we demonstrated that x does not equal y
- ***Our findings do not concur with Walker (2011). In fact, we demonstrated that x does not equal y.***

(or) In agreement with Walker (2011), we demonstrated that x does not equal y

Transitions to join Sentences

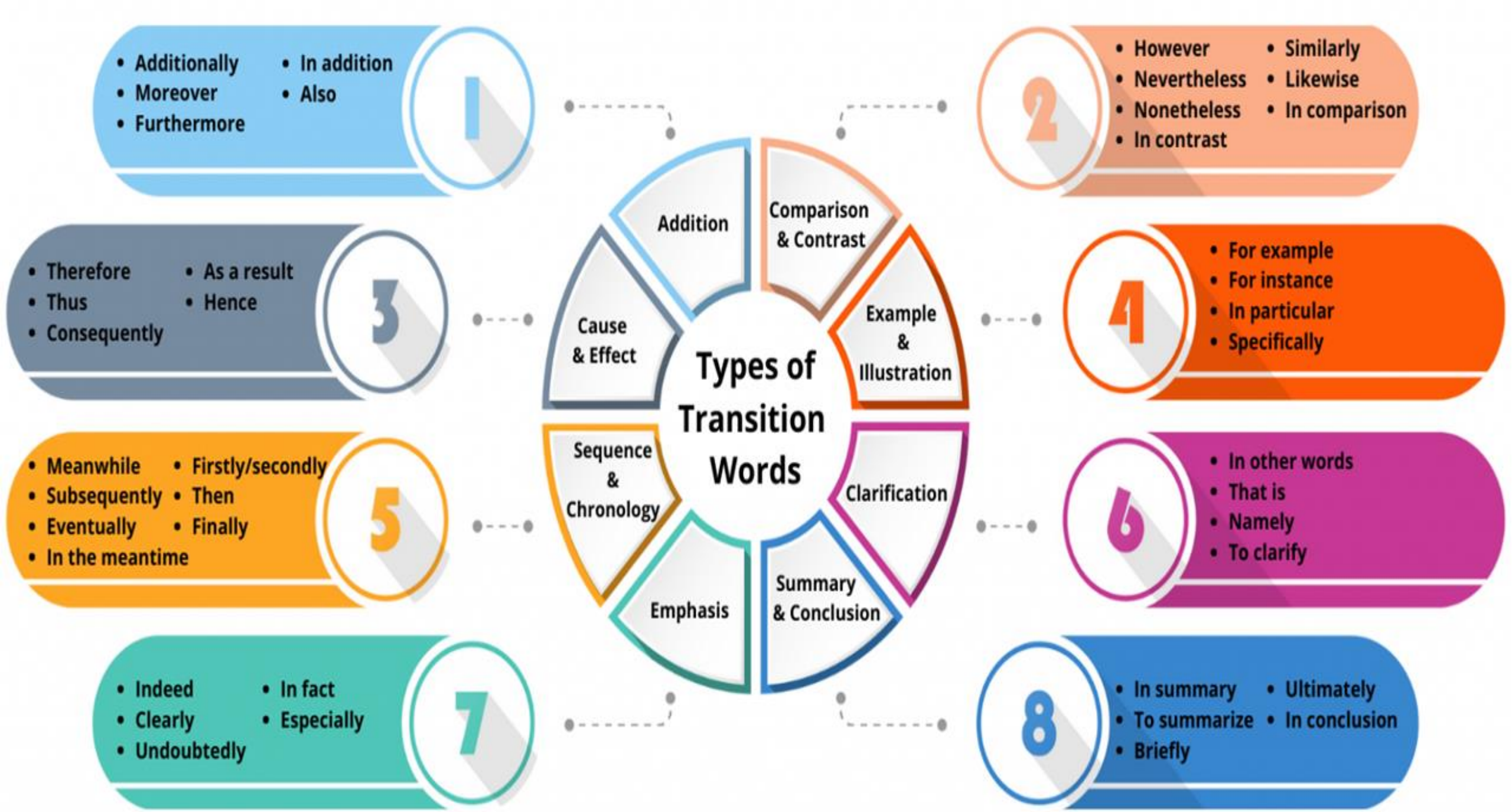
Transition words are words or phrases that help establish connections between sentences, paragraphs, or ideas in a piece of writing. They act as bridges, guiding readers through the logical flow of information and signaling relationships between different parts of the text. Furthermore, they provide coherence and cohesion to your writing by clarifying the relationships between ideas, adding structure, and improving the overall readability.

- **Role of Transition Words in Effective Academic Writing**

➢ **Improving Readability and Comprehension:** By facilitating smooth transitions and organizing information effectively, these words enhance the readability and comprehension of academic writing. They help readers navigate through complex texts, understand complex ideas, and follow the structure of the argument. Transition words facilitate reader navigation and comprehension, enhancing the reading experience with increased engagement and accessibility.

➢ **Organizing Thoughts and Paragraphs:** Transition words assist in organizing thoughts and structuring the content of an academic paper. They provide a framework for presenting ideas in a coherent and systematic manner. By indicating sequence, order, or Cause and Effect relationships, these words help writers create a logical flow that guides readers smoothly from one point to the next. They enable the construction of well-organized paragraphs and facilitate the development of cohesive arguments.

- **Clarifying and Emphasizing:** Transition words contribute to the clarity and precision of academic writing. They help define terms, rephrase or restate ideas, and provide necessary explanations. Additionally, they aid in emphasizing key points and drawing attention to important information. By strategically utilizing these words, writers can guarantee clear understanding of their ideas and effective conveyance of the intended message to the reader.
- **Coherence and Cohesion:** Transition words are instrumental in creating coherence and cohesion within an academic paper. Coherence refers to the logical and smooth progression of ideas, while cohesion refers to the interconnectedness and unity of the text. They act as cohesive devices, linking sentences and paragraphs together and establishing a cohesive flow of information. They strengthen the logical connections between ideas, prevent abrupt shifts, and enable readers to follow the writer's argument effortlessly.
- **Connecting Ideas:** Transition words bridge the gap between sentences, paragraphs, and sections of an academic paper. They establish logical connections, indicating how ideas are related and allowing readers to follow the author's train of thought. Whether showing addition, similarity, contrast, or example, these words help readers navigate between concepts and comprehend the overall message more effectively.



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1. Addition

"Addition" transition words are used to introduce additional information or ideas that support or supplement the main point being discussed. They serve to expand upon the topic, provide further evidence, or present examples that strengthen your claims.

- **Furthermore,** the study not only analyzed the effects of X but also examined the impact of Y.
- **Moreover,** the results not only confirmed the initial hypothesis but also revealed additional insights.
- **Additionally,** previous research has shown consistent findings, strengthening the validity of our study.

2. Comparison and Contrast

"Comparison and Contrast" transition words are used in academic writing when you want to highlight similarities, differences, or relationships between different concepts, ideas, or findings. They help to establish clear connections and facilitate the comparison and contrast of various elements within your research.

- **Similarly,** other researchers have reported comparable findings, corroborating the generalizability of our results.
- **In contrast,** previous studies have demonstrated consistent patterns, reinforcing the existing body of knowledge.
- **In comparison**, the current study offers a unique perspective by examining the relationship from a different angle.

3. Cause and Effect

"Cause and Effect" transition words are used when you want to demonstrate the relationship between a cause and its resulting effect or consequence. They help to clarify the cause-and-effect relationship, allowing readers to understand the connections between different variables, events, or phenomena.

- **As a result**, the data provides compelling evidence for a causal relationship between X and Y.
- **Consequently,** the hypothesis can be supported by the observed patterns in the collected data.
- **Hence,** the proposed model is validated, given the consistent and statistically significant results.

4. Example and Illustration

"Example and Illustration" transition words are used when you want to provide specific instances, evidence, or illustrations to support and clarify your main points or arguments. These words help to make your ideas more tangible and concrete by presenting real-life examples or specific cases.

- **For example,** one study conducted by Jackson et al. (2018) demonstrated a similar phenomenon in a different context.
- **To illustrate** this point, consider the case of Company X, which experienced similar challenges in implementing the proposed strategy.
- **In particular,** the data highlights the importance of considering demographic factors, such as age and gender, in the analysis.

5. Sequence and Chronology

"Sequence and Chronology" transition words are used in academic research papers when you want to indicate the order, progression, or sequence of events, ideas, or processes. These words help to organize information in a logical and coherent manner, ensuring that readers can follow the chronological flow of your research.

- **First and foremost**, the study aims to examine the long-term effects of intervention X on outcome Y.
- **Subsequently**, the participants were randomly assigned to either the control or experimental group.
- **Finally**, the data analysis revealed significant temporal trends that require further investigation.

6. Clarification and Restatement

"Clarification and Restatement" transition words are used in academic writing when you want to provide further explanation, clarify a point, or restate an idea in a different way. These words ensure that readers understand your arguments and ideas clearly, avoiding any ambiguity or confusion.

- **In other words**, the phenomenon can be explained by the interplay of various psychological and environmental factors.
- **Specifically**, the term "efficiency" refers to the ability to achieve maximum output with minimum resource utilization.
- **To clarify**, the concept of "sustainability" encompasses the ecological, economic, and social dimensions of development.

Common Mistakes to Avoid When Using Transition Words in Academic Writing

1. Overusing Transition Words: Using too many transition words can make your writing appear cluttered and disrupt the flow of your ideas. Avoid overloading your sentences or paragraphs with excessive transitions. Instead, use them strategically to enhance clarity and coherence.

2. Using Inappropriate or Irrelevant Transitions: Choose transition words that are appropriate for the context and purpose of your writing. Avoid using them when they don't align with the relationship between the ideas you are connecting. Ensure that the transitions you use are relevant and contribute to the overall coherence of your writing.

3. Neglecting Proofreading and Editing: As with any aspect of writing, proof reading and editing are crucial when using transition words. Carefully review your writing to ensure that you use transitions correctly and effectively. Look for any inconsistencies, redundancies, or errors in your use of transitions and make necessary revisions.

4. Failing to Understand the Meaning: It's important to understand the precise meaning and usage of transition words before incorporating them into your writing. Using a transition word incorrectly or inappropriately can lead to confusion or misinterpretation. Therefore, it is important to consult reliable resources or style guides to familiarize yourself with the correct usage of each of these words.

5. Neglecting the Logical Flow: Transition words should help guide the reader through your writing and create a logical flow of ideas. Failing to use appropriate transitions can result in a disjointed or fragmented presentation. Ensure that your transitions establish clear connections and maintain the coherence of your writing.

6. Relying Only on Transition Words: While transition words are valuable tools, they should not replace effective writing and organization. Relying solely on transitions to connect your ideas can lead to weak or poorly structured writing. Focus on developing strong topic sentences, clear paragraph organization, and logical progression of ideas alongside the use of these words.

7. Ignoring Sentence Variety: Use transition words to enhance the variety and sophistication of your sentence structures. Avoid using the same words repeatedly, as this can make your writing monotonous. Instead, explore different transitions that convey the specific relationships between your ideas.

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7. Emphasis

"Emphasis" transition words are used when you want to place special emphasis on certain points, ideas, or findings. These words help to draw attention to key information, highlight the significance of particular aspects, or underscore the importance of your arguments.

- **Notably,** this study addresses a significant gap in the existing literature.
- **Importantly**, the findings have implications for future policy decisions.
- **In particular,** the study examined the relationship between age and cognitive performance.

8. Summary and Conclusion

"Summary and Conclusion" transition words are employed in academic writing when you want to provide a concise summary of the main points discussed in your paper and draw a conclusion based on the findings or arguments presented. These help to signal the end of your paper and provide closure to your research.

- **In conclusion**, the findings unequivocally support the initial hypothesis, emphasizing the significance of the proposed theory.
- **Overall**, the results indicate a consistent pattern, providing a foundation for future research in this area.
- **In summary**, this research makes a valuable contribution to the existing literature by extending our understanding of the topic.

Tenses in writing

1. Present Simple Tense: Used to describe **facts, general truths, and accepted scientific principles**.

➢**When to use:**

- Scientific facts
- General statements
- Permanent truths
- Descriptions of figures/tables

➢**Examples:**

- *Stress increases as the temperature rises*.
- *XRD provides information about crystal structure*.
- *Table 2 shows the mechanical properties*.

2. Present Continuous Tense

➢**Used rarely:** only for ongoing actions happening at the moment of writing.

➢**Examples:**

- *The team is currently analyzing the SEM images.*
- *Researchers are investigating new composite materials*

3. Present Perfect Tense

➢Used to connect **past research** with its **current relevance**.

➢**When to use:**

- To refer to previous studies without mentioning specific time
- To show progress in the field
- To introduce background research

➢**Examples:**

- *Many researchers have studied the creep behavior of alloys.*
- *Several methods have been proposed to improve XRD accuracy.*

4. Past Simple Tense

➢Used to describe **what you did** in your own experiment or study.

➢**When to use:**

- Specific actions completed in the past
- Your methodology
- Your results

➢**Examples:**

- *Samples were cut and polished using standard procedures.*
- *The thermal analysis showed a clear endothermic peak.*
- *We prepared the specimen according to ASTM standards.*

5. Past Perfect Tense

➢Used when discussing **two past events**, one happening before the other.

➢**Examples:**

- *The material had already fractured before the load was removed.*
- *We verified the calibration after we had assembled the equipment*

6. Future Tense

➢Used for **recommendations**, **future work**, and **expected outcomes**.

➢**Examples:**

- *Further studies will focus on optimizing the cooling rate.*
- *The next phase will include TEM analysis.*

Purpose	Best Tense	Example
General facts	Present Simple	*Creep increases with temperature.*
Your experiment (methods)	Past Simple	*We heated the specimen to 600°C.*
Your experiment (results)	Past Simple	*The fracture surface showed dimples.*
Describing figures	Present Simple	*Figure 4 illustrates the structure.*
Previous studies	Present Perfect	*Many authors have reported similar results.*
Future work	Future	*Further research will investigate…*

Technical Report Planning and Structuring

A **technical report** is a structured document that presents technical information, research findings, or project results in a systematic manner. It is written to communicate clearly with engineers, researchers, managers, or decision-makers.

- A technical report is used to convey important findings or test results to a controlled audience.
- Technical reports seldom undergo peer review.
- Distribution of a technical report is done at the discretion of the author or employee.
- The typical technical report is between two and twenty pages long in content and form.
- Technical documents require considerable thought and preparation.

➢ The report follows a **standardized format** to ensure clarity, consistency, and ease of reference. A typical technical report contains three major sections:

1. **Preliminary Section (Front Matter)**
2. **Main Body**
3. **End Matter (Back Matter)**

1. Preliminary Section (Front Matter)

- These are the elements that appear before the main text:
- **Title Page**
  - Report title (clear and specific)
  - Author's name & designation
  - Institution/organization name
  - Date of submission
  - Project/course details (if applicable)
- **Acknowledgments***(optional)*
  - Recognition of people, organizations, or funding agencies that supported the work.
- **Abstract / Executive Summary**
  - A short summary (150–300 words) of the purpose, method, results, and conclusions.
  - Helps readers quickly understand the report without reading the entire document.
- **Table of Contents (ToC)**
  - List of chapters/sections with page numbers.
- **List of Figures & Tables**
  - Optional, but useful in long reports for quick reference

2. Main Body

This is the core of the report, containing detailed information:

- **Introduction**
  - Background of the topic or problem.
  - Objectives and scope of the report.
  - Importance or relevance of the study/project.
- **Literature Review / Background Study***(if applicable)*
  - Summary of previous work, theories, or standards related to the topic.
  - Helps in establishing context.
- **Methodology / Experimental Procedures**
  - Tools, techniques, and methods used.
  - Detailed enough for others to **replicate the work**.
  - Includes formulas, equipment, software, standards followed.
- **Results / Findings**
  - Presentation of data collected.
  - Use of charts, graphs, tables, and figures for clarity.
  - Objective description without interpretation.

- **Discussion / Analysis**
  - Interpretation of results.
  - Comparison with expected outcomes or previous studies.
  - Implications, strengths, and limitations of the work.
- **Conclusion**
  - Summary of major findings.
  - Whether objectives were achieved.
  - Implications of the work.
- **Recommendations***(if required)*
  - Suggestions for improvements, further research, or actions to be taken

3. End Matter (Back Matter)

- **References / Bibliography**
  - List of books, journal articles, websites, or standards cited in the report.
  - Follow citation style (APA, IEEE, MLA, or institutional guidelines).
- **Appendices**
  - Supplementary information not included in the main text.
  - Example: raw data, detailed calculations, code snippets, maps, questionnaires.

How to Plan a Technical Report

1. Identify the Purpose

➢Before writing, decide:

- Why is the report being written?
  → *To inform, explain, analyze, recommend, or evaluate?*
- What problem or question does it address?

Example: "To present tensile test results and recommend suitable material for load-bearing applications."

2. Know Your Target Audience

➢Ask:

- Who will read it? (engineers, managers, students, clients)
- What is their technical level?
- What do they expect to learn?

❖**Why this matters:** Audience decides your language, depth of explanation, visuals, and format.

3. Define the Scope

➢Be clear about:

- What is included in the report
- What is NOT included

❖This prevents unnecessary content.

4. Collect and Organize Information

➢Gather:

- Data (measurements, results, tables, graphs)
- Literature (journal references, background theory)
- Methods/procedures used
- Observations

➢Organize everything into:

- Facts
- Evidence
- Explanation

5. Prepare a Report Outline: A typical technical report outline according to a standard

6. Decide Writing Style and Tenses

➢Technical writing usually uses:

- **Past tense** for methods and results
- **Present tense** for facts
- **Future tense** for recommendation

7. Plan Visuals

➢Decide where to include:

- Graphs
- Tables
- Diagrams
- Charts
- Photographs

❖Visuals must support the explanation, not decorate.

8. Set Timeline

➢Plan:

- When to collect data
- When to draft sections
- When to revise
- When to proofread

❖A clear schedule avoids last-minute writing

9. Check Institutional/Company Guidelines

➢Follow required:

- Format
- Font
- Margin
- Citation style
- Length

10. Draft → Revise → Finalize

➢Write first draft

- Edit for clarity
- Check grammar and tense consistency
- Ensure logical flow
- Add final formatting

❖After writing the first draft, at least a dozen revision are usually needed to improve to the text. Make sure that all authors read the first draft. Give them timeline…

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Full length article

Artificial intelligence for experimental investigation and optimal process parameter selection in PM-EDM of nimonic alloy 901

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ARTICLE INFO

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Taguchi design
Signal-to-noise ratio
L18 orthogonal array

ABSTRACT

Electrical discharge machining (EDM), a widely used non-contact machining method, employs electric discharge to remove conductive material from workpieces. This study focused on experimentally investigating and optimizing input process parameters for the PM-EDM process of a Nimonic alloy 901 (NA-901) workpiece with a silver electrode. The silicon carbide (SiC) powder particles were explored for their exceptional properties, including high temperature resistance, hardness, thermal conductivity, and resistance to corrosion and oxidation. The study evaluated the impact of input process parameters such as servo voltage (V_s), powder concentration (C_p), pulse-on-time (T_{on}), and peak current (I_p) on surface roughness rate (SRR),tool wear rate (TWR), and material removal rate (MRR). The Taguchi design approach with an L18 orthogonal array was used to identify the optimal parameter combination based on signal-to-noise (S/N) ratio analysis. To improve optimization, a feed-forward backpropagation neural network (FF-BPNN)was utilized to approximate solutions. The results of the experimental MRR confirmation test (E-MRR) were compared to the MRR values predicted using the FF-BPNN model (P-MRR). Similarly, the SRR (E-SRR) and the TWR (E-TWR) were compared to the predicted SRR and TWR obtained from the proposed FF-BPNN model. In summary, this study presents an experimental examination and optimization of input process parameters in the PM-EDM process of an NA-901 workpiece with a silver electrode.The use of SiC powder particles, the impact of input process parameters, and optimization were explored using Taguchi design and FF-BPNN techniques. This study's results demonstrate these approaches' effectiveness in achieving optimal PM-EDM process parameters.Finally, results revealed E-MRR as 0.894, P-MRR as 0.8913, E-SRR as 0.891, P-SRR as 0.897, E-TWR as 0.116, and P-TWR as 0.015.

1. Introduction

Due to the ever-increasing quality of current engineering materials, conventional machining techniques are no longer practicable. It is because of the intrinsic properties of those parts. In conventional machining, the requirements placed on the tool should be significantly higher than those placed on the workpiece [1]. Because of the damage it produces, and the high price of the tool materials required to utilize it, indicators of triggering material ejection from the workpiece. With the help of various non-traditional machining methods [3], it is possible to complete various tasks.So, EDM is a technique that is castoff to remove excess material and form intricate shapes by passing an electric current between a tool and a workpiece. A substantial voltage difference must be delivered across the electrodes in close contact with a dielectric medium. The workpiece's substance melts and evaporates because of the sparks' ability to generate pinpoint hot spots. The distance between two

1.3. MRR mechanism of PM-EDM

An electrical field with an intensity of 105–107 V/m is produced by applying a voltage between the electrodes in PM-EDM that falls within this range (80–320 V). It causes the positive and negative charges in the powder to congregate at the top and bottom, respectively. The discharge breaks down wherever the electric field density is highest in the universe. The powder may disintegrate by colliding with another particle or encountering an electrode on a tool or workpiece. The electric charges reorganize after the first discharge, congregating at points c and d. Repeating sparks whose frequency is set by the electric field's strength. A chain is formed when powder particles of varied sizes and shapes unite and lock with one another. Short-circuiting is simplified with this order, leading to an early explosion in zero gravity. The plasma channel is modified with particle bridging and suspended additive particles, potentially reducing the discharge power density and pulse explosive gas pressure.

1.3.1. Enlargement of the discharge gap

The discharge gap size is primarily affected by the physicochemical and electrical characteristics of the powder particles. Free electrons in powder particles cause a drop in dielectric resistance when the powder is heated to high temperatures. As a result, the discharge gap is increased for longer-range spark generation.

1.3.2. Widening of the discharge passage

After the powder particles, the first discharge is laden with electrical charges and circulates quickly with the ions and electrons. By interacting with dielectric molecules, the powder particles produce more electrons, ions, and hence more electric charges than traditional EDM. The

mizing input process parameters and enhancing output response parameters.

The rest of the article is organized as follows: Section 2 focused on existing EDM and PM-EDM methods with detailed survey analysis. Section 3 focused on the materials and methods used in this work. Section 4 focused on experimentation setup. Section 5 focused on results and discussions with MRR, SRR, and TWR performance analysis. Finally, Section 6 concludes the article.

2. Literature survey

Recent advancements in EDM techniques for high-performance ceramics have been extensively analyzed by Ming et al. [15]. Initially, numerous procedures were described in detail based on their electrical conductivity. Recently developed EDM hybrid machining methods were also emphasized for their capacity to process difficult ceramics effectively. Lastly, the difficulties of EDM of high-tech ceramics are covered, and several potential research directions are proposed for further investigation. Ferreiro et al. [16] looked at the feasibility of industrial EDM in advanced yttria-stabilized tetragonal zirconia (3YTZP) composites comprising 20-volume per cent graphene nanostructures of varying form. The outcomes were influenced by the cleanliness of the graphene nanostructures, precision of the machining, and dimensional tolerances. Lazar et al. [17]proposed a technique for producing a conductive ZrO2-TiN ceramic nanocomposite, in which a nanoscale TiN phase occupies 30 % vol% of the material to both improve the mechanical strength of the zirconia matrix and adds electrical conductivity for use in EDM. Singh et al. [18] discovered incorporating conducting particles into the ceramic matrix material for better electrical conductivity.

tionship to process parameters and optimization, and the continued development of PM-EDM were discussed. The study by Viet et al. [26] was conducted to provide support for this theory. Ti-6Al-4 V was milled using a modified PM-EDM procedure, which included scattering silver nanoparticles of varying densities throughout the dielectric fluid. Surface quality, coating thickness, microhardness, microelements, and antibacterial properties were then evaluated for the machined and coated surfaces produced. While following the steps outlined by Viet et al. [27], the powder material in the dielectric fluid and the material

3. Materials and methods

The workpieceis made of 6 mm thick, 70 * 40 mm dimensions with NA-901. Molybdenum, titanium, and aluminum are found in high concentrations in NA-901 (UNS N09901/W.Nr. 2.4662), making it an age-hardenable Ni-Fe-Cr superalloy.NA-901 is a nickel-iron-chromium superalloy with many properties. NA-901 can maintain its strength and resistance to deformation even at high temperatures up to 650 °C (1200 °F). This alloy has good resistance to oxidation and corrosion in

Fig. 4. PM-EDM machining process.

Table 4
Input process parameters and their levels.

Parameter	Level1	Level2	Level3	Level4	Level5	Level 6
C_p(%)	0	4	6	8	10	12
T_{on}(μs)	10	15	20			
I_p(*amps*)	5	10	15			
V_s(*Volts*)	4	5	6			

Table 5
Experimental conditions.

Working conditions	Description
Electrode	Silver (Diameter 10.5 mm and length 21.5 mm)
Workpiece	NA-901 (60×35 × 4 mm)
Polarity	Normal
Dielectric	SiC powder
Machining time	5 mins
Gap voltage	70 V

photographic printing sheets include silver chloride, a light-sensitive substance. Further, AgCl and AgBr are used simultaneously in certain

the tool electrode experiences during the process, expressed as a ratio of the volume of material removed from the workpiece to the volume removed from the tool electrode. A high TWR indicates that the tool electrode is experiencing a lot of wear relative to the workpiece, which can lead to shorter tool life and higher machining costs. As a result, the TWR has better performance because of its lower features. The following equation is used to determine the TWR.

$$\mathrm{TWR} = \frac{T_b - T_a}{t} \times 1000\mathrm{mg/min} \tag{1}$$

T_b refers to the tool weight before machining, and T_a denotes the weight after machining. The MRR measures the amount of material removed per unit time during the PM-EDM process. The MRR is affected by various factors, such as the electrical discharge voltage and current, the type and composition of the workpiece material, the type and composition of the electrode material, and the gap distance between the electrode and the workpiece. A high MRR is desirable in PM-EDM as it can result in a more efficient and productive machining process. The following equation is used to determine the MRR.

$$\mathrm{MRR} = \frac{W_b - W_a}{\rho_w \times t} \times 1000\mathrm{mm^3/min} \tag{2}$$

experiments are performed on die sinking EDM machine of FORMATICS 50 model integrated with ELECTRONICA PRS 20. Before machining, the surfaces of electrodes and workpieces are polished and cleaned. In Table 4, the selected input factors and corresponding levels are presented for this investigation. In Table 5, the chosen conditions of experiments are shown. By using the tester of Talysurf, the SR on the machined surfaces is computed. In the transverse direction, the measurements of roughness have been performed with cut-off length of 0.8 mm. The process is repeated for three times, and average values are estimated. Figure 5 illustrates the workpiece images after experimentation.

5 Results and discussion

This section describes the experimental results and discussion on PM-EDM of Nimonic alloy 901 workpieces with Cu–W electrode using SiC as a powder particle.

5.1 Computation of SR, MRR and TWR

The values of SR can be obtained by calculating the mean of surface finish is retrieved based on a tester of computer-controlled SR. The values of MRR and TWR can be computed using Eqs. (2), and (3), respectively.

Table 8 Response table for S/N ratios of SR

Level	C_p	T_{on}	I_p	V_s
1	−10.913	−8.840	−9.361	−9.704
2	−10.426	−9.929	−8.289	−8.598
3	−9.962	−10.176	−11.296	−10.644
4	−9.291	–	–	–
5	−7.210	–	–	–
6	−10.090	–	–	–
Delta	3.704	1.336	3.007	2.045
Rank	1	4	2	3

5.2 *S/N ratio for response characteristics*

The output-influenced parameters can be classified as two classes such as controllable, i.e. design parameters, and uncontrollable, i.e. noise parameters. Usually, the factors whose values can be adjusted and easily set out by the

6 Conclusion

Powder mixing into the EDM's dielectric fluid is a modern evolution to ensure the better rates of machining at reduced TWR with the desired surface quality. Based on the main and trial experiments, the proposed investigation on PM-EDM of Nimonic alloy 901 resulted in the minimum TWR and higher MRR in addition to the powder concentration in EDM oil. The current studies obtained the results to choose the optimum conditions of machining the workpiece made of Nimonic alloy 901, which has been widely utilized in exhaust system of formula one car, rocket engine and steam turbine. The experimental results have drawn the below-mentioned conclusions within the range of chosen parameters.

- The maximum values of MRR and the minimal values of SR and TWR are obtained at I_p of 5A, 5 V of V_s, a moderate T_{on} as 20 µs, and C_p of 10%.

tion and is not under consideration for publication elsewhere. On behalf of all the co-authors, we shall bear full responsibility for the submission. We declare that I shall not submit the paper for publication in any other journal till the decision is made by journal editors.

Author contribution **Author 1: Ravi Varma Penmetsa**, Conceived and design the analysis, Collecting the data, Wrote the paper. **Author 2: Ashok Kumar Ilanko**, Contributed data and analysis tools. **Author 3: Siriyal Rajesh**, Performed the analysis. **Author 4: Rama Bhadri Raju Chekuri**, Manuscript editing and figure design.

Declarations

Ethics approval This article does not contain any studies with animals performed by any of the authors.

Consent to participate Not applicable.

Consent for publication Not applicable.

Conflict of interest The authors declare no competing interests.

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Minutes of Meeting (MoM)

Minutes of Meeting are the **official written record** or **the notes that capture** of what happened during a meeting. When approved, minutes of meetings are official and can be used as evidence in legal proceedings.

➢**Key Components of MoM**

1. Meeting Details

- Date
- Time
- Venue
- Meeting Type (Project, Department, Review, etc.)
- Participants (Present/Absent)

2. Agenda Items

List of points to be discussed.

3. Discussion Summary

Short and clear description of what was discussed under each agenda item.

4. Decisions Made

What decisions were finalized

5. Action Items

- Task
- Person Responsible
- Deadline

6. Next Meeting Details

- Date
- Time
- Venue

7. Signature

Prepared by / Approved by

❖Despite the team, they are not a minute-by-minute record but include the key details that the team will want to know.

❖They are an important source of information for people who were unable to attend or looking back to reflect on what happened. They're also an incredibly effective tool to notify or remind people of tasks assigned to them or timelines to keep everyone on track

❖They also provide a reminder for future meetings and serve as an official reference

Meeting Minutes

Date and Time: October 10, 2050, 2:00 PM - 3:00 PM

Location: Conference Room A, **[Your Company Name]** Headquarters

Attendees

- John Johnson - Project Manager
- Jane Smith - Lead Developer
- Bob Johnson - UX Designer
- Alice Brown - QA Analyst
- Michael Lee - Marketing Director

Absentee

- Emma Davis - Financial Analyst

Agenda

1. Project Status Update
2. Timeline Review
3. New Feature Discussion
4. Q&A Session

Meeting Notes

Agenda Item	Discussion Points	Action Items
Project Status Update	• John provided a status update on the current project phase. • Completed tasks and outstanding issues were discussed.	• John to circulate the updated project report by October 12, 2050.
Timeline Review	• Jane reviewed the project timeline and noted the milestones. • Identified potential delays and discussed mitigation strategies.	• Jane to adjust the project timeline and distribute it by October 13, 2050.
New Feature Discussion	• Bob presented the new feature proposal with mockups. • Group provided feedback on design and functionality.	• Bob to revise the feature design based on feedback and present it in the next meeting.
Q&A Session	• Open floor for team questions and discussion. • Answered questions regarding resource allocation and budget concerns.	• Michael to prepare a detailed budget report for the next meeting.

Next Meeting

Scheduled for October 17, 2050, at 2:00 PM in Conference Room A.

Adjournment

The meeting was adjourned at 3:00 PM.

Prepared by: **[Your Name]**

For clarifications, please contact **[Your Name]** at **[Your Email]**.

Signature of In charge

Drafts in Technical Writing

After you have collected your information, identified your document's purposes, objectives, and audience, developed an appropriate outline, and, if appropriate, sketched out key graphics and tables, you are ready to begin writing the first draft of your document. Drafting is the stage of the writing process in which you develop a complete first version of a piece of writing.

Draft helps to:

1. Organizing Thoughts and Structure
2. Improving Clarity and Accuracy
3. Identifying Gaps and Errors
4. Enhancing Readability
5. Peer Review and Feedback
6. Ensuring Compliance with Format and Standards

Tips for writing an effective rough draft

- Begin writing with the part you know the most about
- Do not worry at this stage about style, spelling or word processing. i.e. Don't aim for perfection; aim for completion
- Take short breaks to refresh your mind
- Use placeholders for tricky parts
- Write one section at a time and then reevaluate what to write next.
- Be reasonable with your goals.
- Keep your audience and purpose in mind as you write.

Revising your work:

Ask yourself questions such as the following:

- Does the manuscript include all the information it should?
- Should any content be deleted?
- Is all the information accurate?
- Is all the reasoning sound?
- Is the content consistent throughout?
- Is everything logically organized?
- Is everything clearly worded?
- Have you stated your points briefly, simply, and directly? In other words,
- Is everything concise?
- Are grammar, spelling, punctuation, and word use correct throughout?
- Are all figures and tables well designed?
- Does the manuscript comply with the instructions?

Once your manuscript is nearly the best you can make it, show it to others and request their **feedback**. After receiving feedback from those reviewing your manuscript, consider how to apply it. Of course, follow those suggestions that you find useful. Even if a suggestion seems unsuitable, keep it in mind. Revise your writing thoroughly but avoid the temptation to keep revising it forever. No manuscript is perfect, so be satisfied with mere excellence.

Jargon Issues in Drafts

Jargon are special words or expressions used by a profession or group that are difficult for others to understand.

1. Overuse of Technical Jargon

- Early drafts sometimes contain too many technical terms, abbreviations, or discipline-specific language.
- This can make the report difficult to understand for non-specialist readers.

2. Unexplained Terminology

- Writers may assume readers know certain terms.
- Drafts often miss definitions, expansions of abbreviations, or explanations of concepts.

3. Inconsistency in Terms

- A term may be written differently in different sections (e.g., “SEM,” “S.E.M.,” “Scanning Electron Microscope”).
- Drafts help standardize terminology.

4. Misuse or Incorrect Use of Jargon

- Sometimes terms are used inaccurately or with unclear meaning.
- Drafting allows correction to maintain technical accuracy.

5. Unnecessary Complexity

- Using jargon where simple language would be clearer reduces readability.
- Drafts help replace unnecessary jargon with clear expressions.

Final Layout Issues in Drafts

Drafts also help identify and correct layout and formatting problems before the final version.

1. Paragraph and Section Alignment Problems

- Headings, subheadings, and paragraphs may not follow a uniform style.
- Drafts allow standardization using templates or formatting guidelines.

2. Poor Organization of Visual Elements

- Tables, figures, graphs may be misplaced, poorly labeled, or not referenced in the text.
- Draft revision ensures:
  - proper numbering,
  - captions,
  - placement near relevant text.

3. Inconsistent Text Formatting

- Different fonts, sizes, spacing, or margins may appear in early drafts.
- Drafts help correct style inconsistencies.

4. Improper Page Breaks

- Sections may break awkwardly across pages.
- Draft review ensures smooth flow and clean pagination.

5. Incorrect Numbering

- Problems with:
  - table numbering,
  - figure numbering,
  - equation numbering,
  - section numbering.
- Drafts are essential for cross-checking and fixing these.

6. Lack of Uniform Layout Structure

- Title page, abstract, contents, references, and appendices may not follow required format (IEEE, APA, or institutional guidelines).
- Drafts ensure compliance with required layout standards.

7. Incomplete Headers/Footers

- Missing page numbers, report title, date, author details, etc.
- Drafts help finalize header and footer formatting.

8. Spacing and Alignment Issues

- Misaligned text, uneven spacing, inconsistent indentation, or irregular bullet points.
- Drafts are used to polish overall appearance.

Spelling in Technical Writing

Importance

- Correct spelling prevents misinterpretation of technical terms.
- Enhances credibility and professionalism of the document.
- Avoids confusion in scientific names, units, measurements, and technical terminology.

Common Issues

- Misspelling of scientific terms (e.g., “microscope” vs “micrscope”).
- Incorrect spelling of units (e.g., “metre” vs “meter” depending on standards).
- Mixing British and American spelling inconsistently (e.g., “colour” and “color”).

Best Practices

- Use technical dictionaries or glossaries.
- Enable spell-check tools.
- Maintain consistency in spelling style (UK or US).
- Double-check abbreviations and acronyms.

Punctuation in Technical Writing

Importance

- Punctuation helps in clarifying the meaning of a sentence.
- Avoids ambiguity in technical statements.
- Makes content readable and logically structured.

Common Mistakes

- Overuse/underuse of commas.
- Incorrect use of apostrophes in technical terms.
- Missing punctuation in long sentences.
- Incorrect punctuation in equations or units (e.g., “kg/s” not “kg s”).

➢Key Punctuation Elements

a. Full Stops

- Used to end complete statements.
- Important in separating independent ideas.

b. Commas

- Separate items in lists, clauses, or conditions.
- Prevent misreading of complex data-rich sentences.

c. Colons and Semicolons

- **Colon (:)** introduces lists, definitions, explanations.
- **Semicolon (;)** links closely related ideas or separates items containing commas.

d. Hyphens and Dashes

- Hyphens link compound words (e.g., “high-speed camera”).
- Dashes may indicate breaks or additional explanations.

e. Parentheses

- Used for additional information, equations, units, and references.

Grammar in Technical Writing

Importance

- Ensures clarity and precision.
- Avoids confusion, misinterpretation, or errors.
- Improves the logical flow of ideas.

❖Common Grammar Errors

- **Subject-verb agreement**

  ✕ *The **results** of the experiment **shows** significant improvement.*

  ✓ *The **results** of the experiment **show** significant improvement.*

- **Run-on sentences**

  ✕ *The theory was widely **accepted it** lacked empirical support.*

  ✓ *The theory was widely **accepted, but** it lacked empirical support.*

- **Faulty sentence structure**

  ✕ *Although the sample size was small**. The** results were valid.*

  ✓ *Although the sample size was small**, the** results were valid.*

- **Incorrect tense usage.**

  Technical reports often use :
  - **Past tense** for methods and results
  - **Present tense** for established facts.
  - **Future tense** for recommendations

- **Inconsistent use of active/passive voice.**

  Active voice for **clarity** & **Passive** voice for **objectivity**

  Subject + Verb + Object :*The engineer + designed + the circuit* .

  Object + (form of)+ Past Participle + (by + Subject): *The circuit +was+ designed +(by +the engineer)*

Active Voice	**Passive Voice**
We tested the steel samples under tensile load.	The steel samples were tested under tensile load.
The sensor detects the change in voltage.	A change in voltage is detected by the sensor.
The software calculates the stress distribution.	The stress distribution is calculated by the software
The team recorded the hardness values.	The hardness values were recorded by the team

- **Improper use of prepositions**

✗ *The results were consistent **to** previous studies.*

✓ *The results were consistent **with** previous studies.*

Depend	on	*The results depend on the sample size.*
Consist	of	*The group consists of five participants.*
Comply	with	*All researchers must comply with ethical guidelines.*
Focus	on	*This study focuses on adolescent behavior.*
Contribute	to	*This research contributes to the existing literature.*
Succeed	in	*The experiment succeeded in proving the hypothesis.*
Interfere	with	*Noise can interfere with signal clarity.*

- **Confusing homophones**

✕ ***Their*** *going to present* ***there*** *research in the next meeting.*

✓ ***They're*** *going to present* ***their*** *research in the next meeting.*

Their / There / They're	Their (possessive pronoun): *The researchers presented their findings at the conference. (Belongs to them)* There (adverb/place): *The lab is located over there, near the main entrance. (Refers to a location or place).* They're (contraction of they are): *They're conducting interviews all week.*
Its / It's	Its (possessive pronoun): *The company updated its cybersecurity policy. (Belongs to them)* It's (contraction of it is or it has): *It's important to cite all your sources.*

- **Redundant phrasing and wordiness**

  ✕ *In the event that the experiment fails, we will **repeat it again**.*

  ✓ *If the experiment fails, we will **repeat it**.*

- **Wrong word choice or form**

  ✕ *The new policy had a positive **affect** on productivity.*

  ✓ *The new policy had a positive **effect** on productivity.*

- **Using informal language or contractions**

  ✕ *The study **didn't** prove anything new**.***

  ✓ *The study **did not** provide any new findings.*

- **Unnecessary or missing apostrophe**

  ✕ ***Its** a common issue in student writing.*

  ✓ ***It's** a common issue in student writing.*

- **Unnecessary or missing hyphen**

  ✕ *The researcher conducted a **long term** study on corrosion.*

  ✓ *The researcher conducted a **long-term** study on corrosion.*

- **Spelling and typos**

✗ *The researchers **recieved** unexpected results.*

✓ *The researchers **received** unexpected results.*

- **Faulty parallelism**

1. Parallelism Errors in Lists

✗ The objectives of the experiment are **to measure** hardness, **calculating** tensile strength, and **the analysis** of microstructure."

✓ "The objectives of the experiment are **to measure** hardness, **to calculate** tensile strength, and **to analyze** the microstructure.".

3. Parallelism Errors in Comparisons

✗ The new alloy is **stronger, lighter, and it lasts longer** than the previous one.

✓ The new alloy is **stronger, lighter, and more durable** than the previous one

4. Parallelism Errors in Technical Procedures

✗ The sample was **cut, polished, and then we etched it**.

✓ The sample was **cut, polished, and etched**.

5. Parallelism Errors in Tables/Figure Captions

✕ Figure 4 shows **measuring stress**, **recording strain**, and **how the sample fractured**

✓ Figure 4 shows **stress measurement**, **strain recording, and fracture observation**

6. Parallelism Errors in Bullet Points

The experiment required the following steps:

- **Preparing** the sample
- The solution was **heated**
- To **record** the temperature

➢ **Forms are mixed → verb, sentence, infinitive (Wrong)**

The experiment required the following steps:

- **Preparing** the sample
- **Heating** the solution
- **Recording** the temperature

➢ **All items start with *-ing* verbs → parallel (Correct)**

7. Parallelism Errors in Headings/Subheadings

1. Sample Preparation
2. Testing the Samples
3. Data Analysis
4. To Interpret the Results

➢ **inconsistent structure(Wrong)**

1. Sample Preparation
2. Sample Testing
3. Data Analysis
4. Result Interpretation

➢ **all noun phrases (Correct)**

- **Grammar errors in lists, tables, and figure captions.**

➢Lists

- **Inconsistent Verb Forms**

The objectives of the experiment are:
- **To measure** hardness
- **Calculating** tensile strength
- **Analysis** of microstructure

➢ **Wrong**

The objectives of the experiment are:
- **To measure** hardness
- **To calculate** tensile strength
- **To analyze** microstructure

➢ **Correct**

- **Inconsistent Parts of Speech**

The system can:
- **Store** data
- Real-time data **processing**
- Be efficient in **analysis**

➢ **Wrong**

The system can:
- **Store** data
- **Process** real-time data
- **Analyze** information efficiently

➢ **Correct**

- **Missing Articles / Missing Plurals**

The device includes:
- Sensor
- Battery
- Circuit

➢ **Wrong**

The device includes:
- **A** sensor
- **A** battery
- **A** circuit

➢ **Correct**

➢Tables

- **Ambiguous Titles**

  ✕ Table 3: **Results**

  ✓ Table 3: **Mechanical Test Results for Mild Steel Samples**

- **Inconsistent Units / Labels**

Parameter	Value(Wrong)	Value(Correct)
Pressure	5	5 **bar**
Inlet Temperature	300°C	300**°C**
Outlet Temperature	300°F	100**°C**
Speed	1500 rpm	1500 rpm

- **Inconsistent Tense**

Test	Result (Wrong)	Result(Correct)
Hardness	Was high	***High***
Tensile Strength	High	***High***
Impact Energy	Shows good toughness	***High toughness***

➢Figure Captions

- **Missing Verb / Fragment**

  ✕ Figure 4: **Stress vs. Strain curve for sample**

  ✓ Figure 4: **Stress–strain curve for the tested sample**

- **Overly Long / Wordy Captions (Padding)**

  ✕ Figure 6: **This figure shows the graph that illustrates the variation of hardness values of the material samples which were heat treated at different temperatures**

  ✓ Figure 6: **Hardness variation of heat-treated samples at different temperatures**

- **Inconsistent Capitalization**

  ✕ Figure 2: **m**icrostructure of the **S**ample after etching.

  ✓ Figure 2: **M**icrostructure of the **s**ample after etching.

- **Incorrect Prepositions**

  ✕ Figure 5: Crack formed **on** the welded joint.

  ✓ Figure 5: Crack formed **in** the welded joint.

- **Wrong or Missing Articles**

  ✗ Figure 3: SEM image of crack in sample

  ✓ Figure 3: SEM image of **the** crack in **the** sample.

- **Non-parallel phrasing**

  ✗ Figure 8: **Measuring stress, strain measurement, and how the material fractured.**

  ✓ Figure 8: **Stress measurement, strain measurement, and fracture observation**.

Padding in Technical Writing

Padding is the use of *unnecessary words, phrases, or repeated ideas* that make the writing longer without improving clarity. Technical writing values **precision**, so padding reduces effectiveness.

➢Why Padding Happens

- Writers try to sound “formal.”
- They are unsure of the content and add filler.
- They try to lengthen the report.
- They use conversational (spoken) phrases.

Over-explaining obvious points also leads to padding

- **Wrong:**
  “The experiment was carried out in the laboratory because that is where experiments are usually conducted.”
- **Correct:**
  “The experiment was carried out in the laboratory.”

Wordy (Padding) Phrases	Concise Alternatives
At this moment in time	Now / Currently
Due to the fact that	Because
In the event that	If
Has the ability to	Can
A total of 10 samples	10 samples
It is important to note that the experiment was completed successfully.	The experiment was completed successfully.
It can be clearly seen that the results improved.	The results improved.
Due to the fact that the temperature increased…	Because the temperature increased…
At this point in time, the system is stable.	The system is currently stable
It is worth mentioning that no errors occurred.	No errors occurred

Paragraph Issues in Technical Writing

Technical paragraphs must be **organized, focused, and logically connected**.

Common Paragraph Problems

A. Too Many Ideas in One Paragraph

Wrong: Cause of failure, corrective actions taken and results in a single paragraph

Correct: Paragraph 1: Cause of failure.
Paragraph 2: Corrective action and new results.

B. Missing Topic Sentence : A paragraph must begin with a **clear purpose statement**

Wrong: Data was collected from three machines. The values were different. The variation increased with load

Correct: The performance variation of the machines was evaluated. From the data collected …

C. Paragraph Too Short (One-line Paragraphs): One-line paragraphs look incomplete.

Wrong: "The test failed." (short, no explanation)

Correct: "The test failed because the sample fractured prematurely due to improper heat treatment."

D. Paragraph Too Long: Long paragraphs hide key information.

Fix: Break into **logical steps**, **subheadings**, or **bullet points**.

Ambiguity Issues in Technical Writing

Ambiguity means the sentence can be understood in multiple ways. Technical writing must be **unambiguous**

A. Ambiguous Pronouns

- **Ambiguous:** "When the valve was placed near the pump, it failed."
  (What failed - the valve? or the pump?)
- **Fix:** "The valve failed when it was placed near the pump."

B. Ambiguous Modifiers

- **Bad:** "We measured the pressure with the damaged gauge."
  (Was the gauge damaged? Or the pressure area?)
- **Fix 1 (damaged gauge):** "We used the damaged gauge to measure the pressure."
- **Fix 2 (damaged pressure area):**"We measured the pressure in the damaged section."

C. Ambiguous Statistics/Quantities

- **Bad:** "The temperature increased slightly."
  (How much?)
- **Fix:** "The temperature increased by 3°C."

D. Ambiguous Timelines

- **Bad:** “The test will be completed soon.”
- **Fix:** “The test will be completed within two hours.”

E. Ambiguous Technical Words: Words like “high”, “sufficient”, “fast”, “heavy” are subjective.

- **Bad:** “The applied load was high.”
- **Fix:** “The applied load was 12kN

F. Ambiguous Comparisons

- **Bad:** “The new system is more efficient.”
  (More efficient than what? Older model? Competitor?)
- **Fix:** “The new system is 15% more efficient than the previous model.”

- **Tips To Avoid Ambiguity**

1. **Write Explicit Requirements:** To be explicit means more than mentioning the feature/technique/program you want to implement. You must be specific, detailed, and avoid assuming that the reader knows what you mean. To make your point explicit and super clear, it is a good idea to add examples.
2. **Would** and **Should** Must Be **Avoided**

   Ex: The tank **should** be filled automatically **(wrong)**
3. **Adverbs are great at causing ambiguity:** Adverbs like **generally, reasonably, usually, normally**, and so on are not specific and are open to interpretation.
4. **Absolute Modifiers Add Clarity:** Absolute modifiers are words like **only, always, unique** and so on. They describe a quality that is either present in full or not present at all and that avoid ambiguity
5. **Write Using Consistent Terms:** Consistently use terms, even if that may sound as repetition, to not confuse the reader. Care should be also taken to see that they are not too repetitive.
6. **Avoid Abbreviation Altogether:** Abbreviations are a useful shortcut to make your writing shorter and more comfortable for you. However, sometimes abbreviations may not be adequately understood by your reader
7. **Short Sentences and a Clear Layout:** Using short sentences is a good practice for most kind of writing. Short phrases that go straight to the point make texts very easy to read and, most importantly, easier to understand. Proper use of list and bullet points helps a great deal in adding clarity to your writing

Proofreading

Proofreading in a technical paper means **carefully reviewing the final draft** to correct errors in **grammar, spelling, punctuation, formatting, logic flow, and consistency** before submission or publication. It is the stage of verification, by the author him or herself, or by another person. Thus, it is not only important to check grammar and spelling, it is also highly advised to ensure that the idea of the writer/author that the article/work is clearly written for its intended target audience and is communicated effectively. No author creates an excellent text without reviewing, reflecting, and revising or trusting someone to do so before the final version of their manuscript is complete and submitted.

➢**Why Proofreading is Important in Technical Writing**

Because technical reports must be:

- **Precise** → No ambiguity
- **Accurate** → No factual or numerical errors
- **Professional** → No language mistakes
- **Easy to read** → Clear, logical, well-organized

Errors reduce credibility and may cause **misinterpretation of technical data**, which can lead to faulty conclusions or unsafe engineering decisions.

Proofreading Checklist

- Grammar mistakes
- Spelling errors
- Punctuation issues
- Consistent units, symbols and terminologies
- Figure/Table captions
- Numbering consistency
- Ambiguous statements
- Matching the format with guidelines

Steps in effective Proofreading

1.Take a break after writing

A short break helps you view your writing with a fresh mind.

2. Make a list of errors that you commonly make and keep an eye out for them.

3. **Use a printed version (if possible)**

Errors often appear more clearly on paper.

4. Read aloud

Sometimes writing sounds different in your head than it sounds on paper.

5. Proofread more than once

➢Do separate passes (i.e., Proofread for only one type of error at a time) for:

- Grammar
- Formatting
- Figures/tables
- References

6. Read slowly and carefully.

Summaries

- A **summary** in technical writing is a short, precise restatement of the main ideas, key findings, or essential information from a longer document. It removes all unnecessary detail and presents only the **core message**, so that readers can understand the content quickly and efficiently.

➢**Types:**

1. Executive Summary

- **Purpose:** To provide a brief overview of the entire (long) report, including its main points, conclusions, and recommendations, for busy executives and decision-makers.
- **Content:** A condensed version of the report's most important takeaways, often written to stand alone and allow a reader to grasp the entire document's essence without reading it in full.

2. Informative/ Abstract Summary

- **Purpose:** To present the essential information and findings of a report clearly and concisely, enabling the reader to understand the core content. It is written in 150–250 words
- **Content:** Includes the key data, methods, and results, aiming to provide enough detail so that a reader might not need to read the original document

3. Descriptive Summary

- **Purpose:** To provide a neutral, objective description of a document's content and purpose without interpretation or judgment.
- **Content:** Outlines what the report is about, its structure, and its main topics, and *does not include results or conclusions,* thus acting as a neutral overview.

4. Technical Summary

- **Purpose:** To summarize complex or technical information for a specific audience, such as in scientific or engineering reports.
- **Content:** Focuses on the technical details, methods, findings, and implications of the report.

➢ **A Conclusion** appears at the end of a report and sums up the key ideas contained therein. The conclusion reiterates key ideas discussed and draws inferences based on the discussion or findings.

➢ **Briefing notes** are often written by government workers to give the busy minister a summary of important information needed for a meeting or for a decision

➢Steps in writing a summary

Step 1: Read the text

- You should read the article more than once to make sure you've thoroughly understood it. It's often effective to read in three stages:
  - **Scan** the article quickly to get a sense of its topic and overall shape.
  - **Read** the article carefully, highlighting important points and taking notes as you read.
  - **Skim** the article again to confirm you've understood the key points, and reread any particularly important or difficult passages.

Step 2: Break the text down into sections

- To make the text more manageable and understand its sub-points, break it down into smaller sections.
- If the text is a scientific paper that follows a standard empirical structure, it is probably already organized into clearly marked sections, usually including an introduction, methods, results and discussion.
- Other types of articles may not be explicitly divided into sections. But most articles and essays will be structured around a series of sub-points or themes.

Step 3: Identify the key points in each section

- Now it's time go through each section and pick out its most important points. What does your reader need to know to understand the overall argument or conclusion of the article?
- Keep in mind that a summary does not involve paraphrasing every single paragraph of the article. Your goal is to extract the essential points, leaving out anything that can be considered background information or supplementary detail.
- In a scientific article, there are some easy questions you can ask to identify the key points in each part.

Step 4: Write the summary

- To avoid plagiarism and to show that you've understood the article, it's essential to properly paraphrase the author's ideas. **Do not copy and paste parts** of the article, not even just a sentence or two. If you're summarizing many articles as part of your own work, it may be a good idea to use a **plagiarism** checker to double-check that your text is completely original and properly cited. Just be sure to use one that's safe and reliable.

❖**Some points to be considered while writing the initial draft of the summary are:**

- Write in your own words
- Start with a strong introduction
- Organize logically
- Keep it concise and unbiased

Step 5: Check the summary against the article

Finally, read through the article once more to ensure that:

- You've **accurately represented** the work
- You **haven't missed** any essential information
- The phrasing is **not too similar** to any sentences in the original. **Proofread and edit** for clarity, coherence, grammar, spelling, and punctuation errors. The final version should be polished and professional. While proof reading see that the **condensed/cut text** does not lead to misrepresenting the author's ideas.

Step 6: Ensure it stands alone

Make sure the summary makes sense to someone who has not read the full report. It should be a standalone document that conveys all the necessary information for decision-making.

Presenting Final Reports

Presenting a final technical report is an essential skill in engineering, science, IT, and business environments. It involves both **written (printed)** and **oral (verbal)** communication, as well as understanding how to prepare **proposals** for future work. Presentation skills generally focus on structuring of the matter, designing of slides, body language, and vocal aspects.

➢Purpose of a Presentation

- **Provide information or giving instructions:** Providing information or giving instructions to the audience is the most common purpose of a presentation. When a manager has to inform about the efforts made by their team and outcomes there of then presentation is a good option. Similarly, for passing on instructions to a group of people attending a training program, presentations are being used. The goal here is that everyone listening to presentation clearly understands and follows the instructions.
- **Convince:** Another situation when a presentation is adopted as a tool of communication is for persuasion. The convincing purpose of presentation states that after attending the presentation, listeners will agree to your proposal. A sales presentation falls under this category where a salesperson tries to convince the potential buyers to place an order after the completion of the presentation.
- **Entertain:** Entertainment purpose of a presentation is applicable in relatively more informal situations like celebrating success, promotion parties, during induction or retirement occasion. During these situations, humour is an essential part of the presentation

➢**Key Components of Presentation:**

- A topic serving the purpose of the presentation
- A presenter
- An audience
- A venue or location
- Audio- visual aids
- Time limit

➢**Pre- Presentation Preparations**:

- Inspection of venue
- Get an audience profile
- Prepare the presentation
- Decide on audio- visual aids
- Deciding Presentation process
- Practicing

1. Printed Presentation

A **printed presentation** refers to the *final written format* of your technical report. It must be clear, professional, and easy to navigate. The printed report is what stakeholders read, refer to, archive, and use for decision-making.

A. Structure & Layout

- A printed report typically includes:
- Title page
- Abstract or Executive Summary
- Table of Contents
- Introduction
- Methodology
- Results
- Discussion
- Conclusions and Recommendations
- References
- Appendices

B. Formatting Guidelines

- Consistent **font**, **margin**, and **spacing**
- Numbered **sections**, **figures**, and **tables**
- Clear **headings** and **subheadings**
- Proper **pagination**
- Appropriate **captions** and **labels**
- Use of **white space** to avoid clutter

C. Visual Elements

- Graphs and charts must be **easy to read**
- Tables should be **aligned** and **labelled**
- Use **colour** only **where necessary**
- Maintain **consistent formatting** for all visuals

D. Language & Style

- **Clear, concise, and objective**
- Prefer **active voice** unless passive is required
- **Avoid unnecessary jargon**
- Ensure **grammatical accuracy**

2. Verbal Presentation Skills

Verbal presentation is the **oral delivery** of your final report. It is used in technical meetings, conferences, project reviews, viva voce, and client interactions.

A. Planning the Presentation

- Identify your audience
- Select the key findings
- Design clear PowerPoint slides
- Structure presentation:
  - Introduction
  - Problem statement
  - Methodology
  - Results
  - Recommendations
  - Conclusion

B. Effective Delivery Techniques

- Maintain eye contact
- Use a confident tone
- Control your pace (not too fast, not too slow)
- Avoid reading from slides or notes
- Engage with audience by asking/answering question
- The pitch should not be too high or too low
- Giving breaks during long presentations
- Give the audience a variety of content, and different methods of delivery - and activities too if possible.
- Keep your audience attentive and enjoying themselves by
  - Stories
  - Questions and 'hands-up' feedback
  - Inviting a volunteer to take the stage with you (should be carefully planned)
  - Asking the audience to do something physical (clapping, blinking and other more inventive ideas)
  - Fables and analogies
  - Prizes, awards and recognizing people/achievements
  - Etc..

C. Slide Design Principles

- 5–7 lines per slide
- Use bullet points
- Clear visuals
- Avoid overcrowding
- Use consistent templates

D. Handling Questions

- Listen completely
- Stay calm and factual
- Acknowledge limitations
- Provide examples when needed

E. Body Language

- Stand upright
- Use purposeful hand gestures
- Face the audience, not the screen
- Avoid nervous movements

Proposal

A proposal is a document written to persuade readers that what is proposed will benefit them by solving a problem or fulfilling a need. When you write a proposal, therefore, you must convince readers that they need what you are proposing, that it is practical and appropriate, and that you are the right person/organization to provide the proposed product/service.

Purpose of a Proposal

The main purposes of writing proposals are:

✓ **To identify a problem**

- Proposals begin by clearly explaining the issue or need that must be addressed.

✓ **To present a solution or plan of action**

- They outline how the problem can be solved through research, design, testing, or implementation.

✓ **To request resources**

- A proposal may ask for funding, equipment, manpower, or approval from authorities.

✓ **To demonstrate feasibility**

It must show that the proposed idea is realistic, practical, and technically achievable.

✓ **To persuade decision-makers**

- Proposals act as a persuasive tool to convince supervisors, clients, or sponsors.

➢Qualities of a Good Proposal

A well-written proposal demonstrates:

✓ Clarity

- Problem, plan, and benefits must be easy to understand.

✓ Conciseness

- Avoid unnecessary details; focus on essential information.

✓ Logical Structure

- Sections should follow a clear sequence.

✓ Technical Accuracy

- Use correct data, methods, and terminology.

✓ Feasibility

- Show that the plan can realistically be completed with available time and resources.

✓ Persuasive Power

- Convince the audience through strong justification and evidence.

✓ Professional Presentation

- Correct formatting, grammar, spacing, visuals, and referencing.

➢Proposal Types

- **Internal Proposals:** Internal proposals are written by and for someone within the same organization. Since both the writer and reader share the same workplace context, these proposals usually address some way to improve a work-related situation (productivity, efficiency, profit, etc.).
- **External Proposals:** External proposals are sent outside of the writer's organization to a separate entity (often to solicit business, or to respond to another organization's request for proposals). Since these are external documents, they are usually formal in nature and may be introduced by a letter of transmittal. These kind of proposals may be solicited or unsolicited.
- **Solicited Proposals:** You may write a solicited proposal if an organization identifies a situation it wants to improve or a problem that it wants to solve. A department or an organization may issue a request for proposals (RFP), asking for proposals on how to address the situation or issue. The requesting department or organization will evaluate proposals and choose the most convincing one, often using a detailed scoring rubric or weighted objectives to determine which proposal best responds to the request and addresses the organization's needs.
- **Unsolicited Proposals:** You may initiate a proposal yourself if you see a problem or an opportunity to make a beneficial change. With unsolicited proposals within an organization, you need to identify your audience very carefully in order to get your ideas to the right audience, either an individual or group with decision-making responsibility, or a supervisor who can support the proposal and move it to a higher decision-making level. Always consider your organization's environment, internal politics, and how your proposal potentially may be received. For unsolicited proposals outside of your organization, make sure that you clearly create a need for your audience to convince that audience to read and respond. Unsolicited external proposals are often the most difficult kind of proposal to get approved

❖Informal Proposals

An **informal proposal** is short, simple, and less structured. It is usually used within an organization or between individuals where the request does not require extensive documentation.

➢ Characteristics of Informal Proposals

- Usually **1–5 pages**
- Simple structure, may be written as a memo, email, or short document
- Less strict formatting
- Direct and brief
- Used for **routine requests** or **small projects**

➢ Common Uses

- Requesting additional equipment, Proposing a small repair or minor modification, Asking for permission to attend a workshop, Recommending purchase of tools or software & Internal project suggestions.

➢ Typical Structure of an Informal Proposal

- Introduction / Purpose
- Problem or Need
- Proposed Solution
- Cost Estimate (if required)
- Benefits
- Conclusion / Request for Approval

RESEARCH PROPOSAL

Submitted to
Sales Manager: Vikas Kumar

Submitted by
Manali Batra, Senior Researcher
MSD Research Institute

Name: Manali Batra

Designation: Senior Researcher

Location of the Work: Max New York Life, Elegance Tower, Jasola Vihar

Working Days: Monday to Saturday

Working Hours: 9:30 am to 5:00 pm

Contact Number: +919XXXXX69

Time Frame for the Project: 2 months

Expected Cost of the Project: ₹ XXX thousand

(This includes the cost of project designing, travelling, administration and reporting.)

Name of the Reporting Officer: Mr. Vikas Kumar
Designation: Sales Manager

Contact Number: +919XXXXX66

Title of the Project

Comparative Analysis of Max New York Life (MNYL) and HDFC Life Insurance: A Detailed Study on MNYL

Objectives:

- To study and compare the sales process of MNYL and HDFC
- To study the policies and products of MNYL and HDFC
- To compare the customer satisfaction of both the companies
- To study the impact of advertisement on the sale of both the companies

Methodology

The research methodology of this project consists of:

1. Research design
   - Descriptive research design
   - Hypothesis testing
2. Data collection
   - Primary data – Questionnaire, in-depth interviews
   - Secondary data – the Internet, articles in different sources (print media), MNYL
3. Sample
   - Sampling – Purposive and convenient sampling
   - Sample size – 200
   - ™ Sample population – Customers of MNYL and HDFC
4. Tools
   - Excel
   - SPSS

Importance of the Research Work

This study will help us in determining the sales process, products and policies of MNYL and HDFC. It will also shed light on the impact of advertisement on the sale of insurance companies.

In addition, the study will help us in comparing MNYL and HDFC to know which one is doing well in the market and satisfying its customers.

Expected Outcomes

The study aims to obtain information about:

- The sales process of MNYL and HDFC
- Products and policies of two companies
- The effect of advertisement on sales
- The trend of sales in both the companies
- Comparison of customer satisfaction and expectations from respective companies

Limitations of Study

This study covers data analysis of MNYL and HDFC for only a limited period of time from the financial years 2014–15 to 2018–19. Hence, the results are comparable and representative for this period only.

❖Formal Proposals

A **formal proposal** is a detailed, well-structured document prepared for major projects, research funding, engineering designs, or external clients. It requires extensive planning, documentation, and strong justification.

➢Characteristics of Formal Proposals

- Can range from **10 pages to several hundred pages**
- Follows a strict format and organization
- Includes detailed technical information
- Professional layout, visuals, tables, and references
- Used for **major projects** requiring large budgets or long timelines

Common Uses

- Government tenders, Engineering project proposals, Research funding applications, Business contracts and consultancy projects &Large construction or manufacturing projects

➢Typical Structure of a Formal Proposal

- Title Page
- Executive Summary
- Table of Contents
- Introduction / Background
- Problem Statement
- Objectives
- Scope of Work
- Methodology / Plan of Work
- Schedule / Timeline (Gantt chart)
- Budget and Resource Plan
- Expected Results / Deliverables
- Evaluation Criteria
- Qualifications of Team or Organization
- References / Appendices

Technical Proposal

Technical proposal writing requires transforming technical details into a persuasive, proposal pitching your solution or offerings. It is a written official document proposed to carry out some activity, with specified conditions on either side, with some financial considerations.

➢ Proposal Writing General Practice

A. Understanding the audience

- Knowing who will read the proposal helps tailor the language and level of detail.

B. Breaking down complex ideas

- Strong proposals simplify technical content without losing accuracy.

C. Using data and evidence

- Supporting the proposal with research, diagrams, graphs, or case studies makes it more credible.

D. Drafting and revising

- Good proposals go through multiple drafts to refine clarity, structure, and persuasion.

E. Following guidelines

- Many organizations have fixed proposal formats; writers must follow them exactly.

F. Proofreading

- Grammar, punctuation, and formatting errors reduce professionalism and weaken the proposal.

➢Technical Proposal Structure

❖**Prefatory sections**: Include a ***title page***, ***letter of transmittal***, and an ***executive summary*** to give a brief overview.

❖ **Body of proposal:**

- **Problem statement:** Clearly define the **problem** or **need** and **background/Introduction** about which the project will address.
- **Proposed solution: Detail** your **technical solution**, including specifications, how it works, and what it will accomplish. It can also contain **Objectives , Scope and limitations**.
- **Methodology:** Explain the approach and strategy you will use to complete the project. This may include a **project timeline, schedule** and **milestones**.
- **Management plan**: Outline **who will manage** the project and the **roles** of the team members. Highlight the **qualifications** and **skills** of the project team.
- **Cost breakdown:** Provide a transparent and **detailed breakdown** of the **costs** involved. If necessary, provide the details of any cost, data and any other provisions needed to be provided by the client.

❖**Conclusion:** Reiterate the strengths of your proposal and why your solution is the **best choice** and should summarizes why the proposal **should be accepted**.

A **Letter of Transmittal** is a short, formal letter that **accompanies a technical report or proposal** when it is submitted to the reader (client, supervisor, or committee). It serves as a polite introduction to the main document.

➢A letter of transmittal introduces the report or proposal that follows:

- States **why** the document is being submitted.
- Identifies the **title and purpose** of the report.
- Mentions **who requested it** (if applicable).
- Highlights the **scope**, **methods**, or **major findings** briefly (optional).
- Expresses appreciation or willingness to provide clarification.
- Provides **contact details** (usually in formal reports).

❖It is placed **before the title page** in printed or formal technical reports.

Transmittal Sample Letter

October 28, 2001

Dr. Amado L. Mariano
Bataan Peninsula University
Limay, Bataan

Dear Dr. Mariano:

Good day!

As requirements on the subject “English Correspondence”, the proponents would like to present the proposal entitled “Proposed English Grammar Correction System”, in accordance with your instruction.

The purpose of the paper is to propose an English Grammar Correction for BPU students. This system has the ability to correct grammar in your paper works that’s why student will learn how to use proper grammar in their writing projects.

We just hope that his proposal will meet your approval.

Very truly yours,

Leilani D. Samaniego

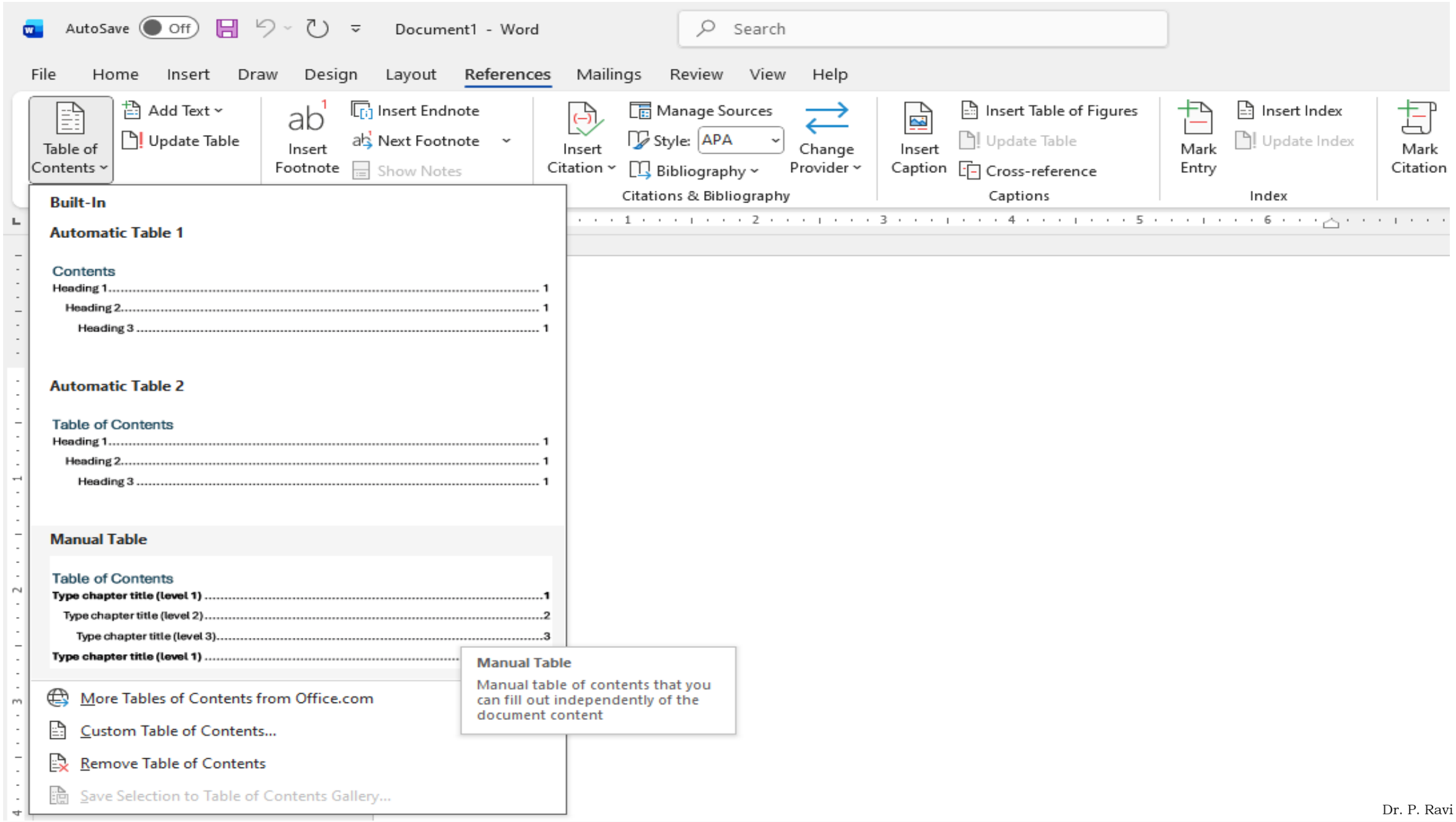
Word Processor in Technical Writing

A modern word processor such as **Microsoft Word** provides powerful tools that help writers prepare professional technical documents. These tools support organization, revision, collaboration, navigation, citation, and document security. The following sections explain the major features used in technical report preparation.

1. Adding a Table of Contents (TOC)

Contents

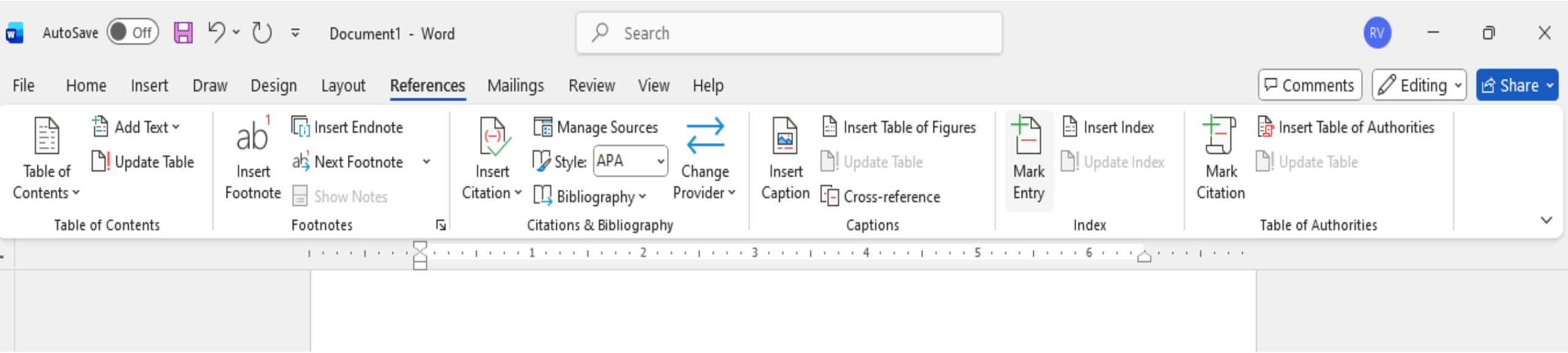
Adding process: **References → Table of Contents → Automatic Table/Manual Table**



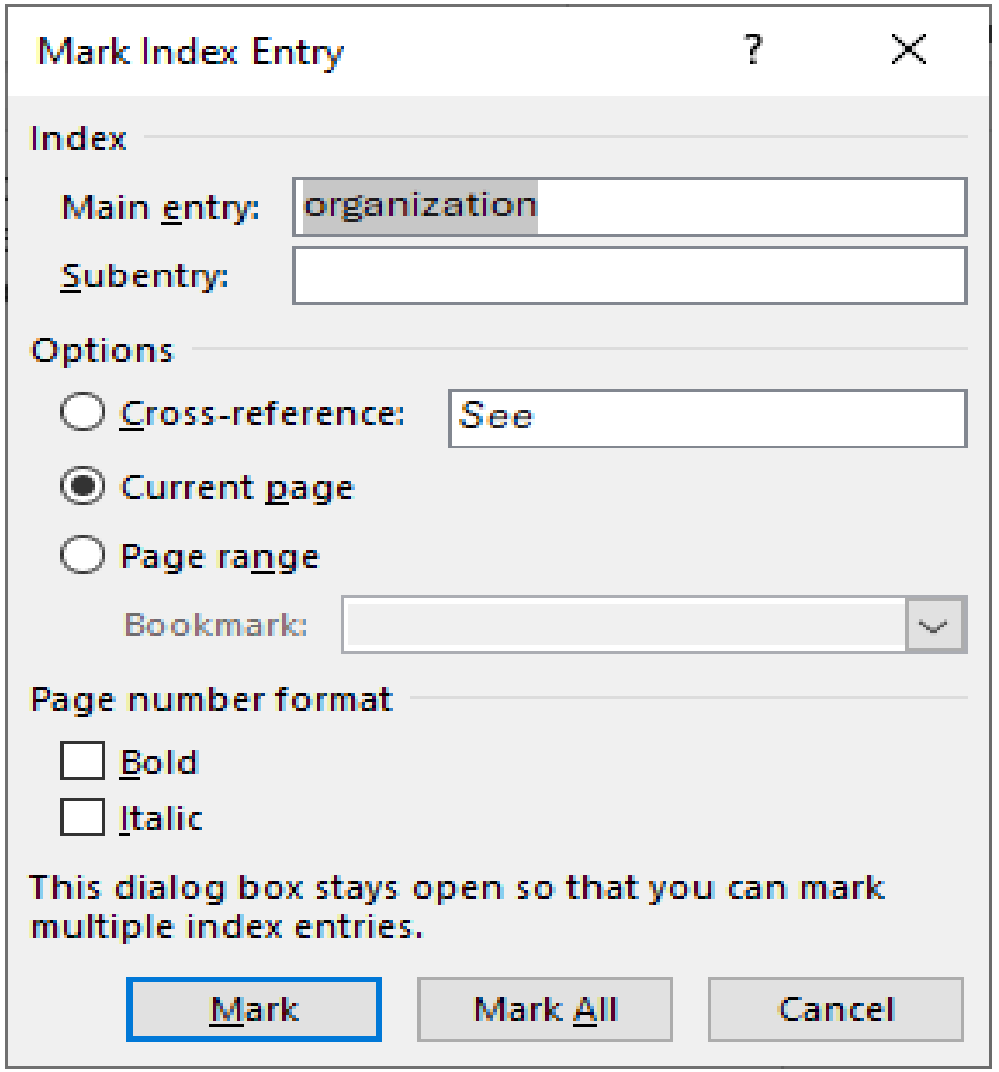
Dr. P. Ravi Varma

➢Adding an Index

- Reference → **Select the Word** from one of the page → Mark Entry

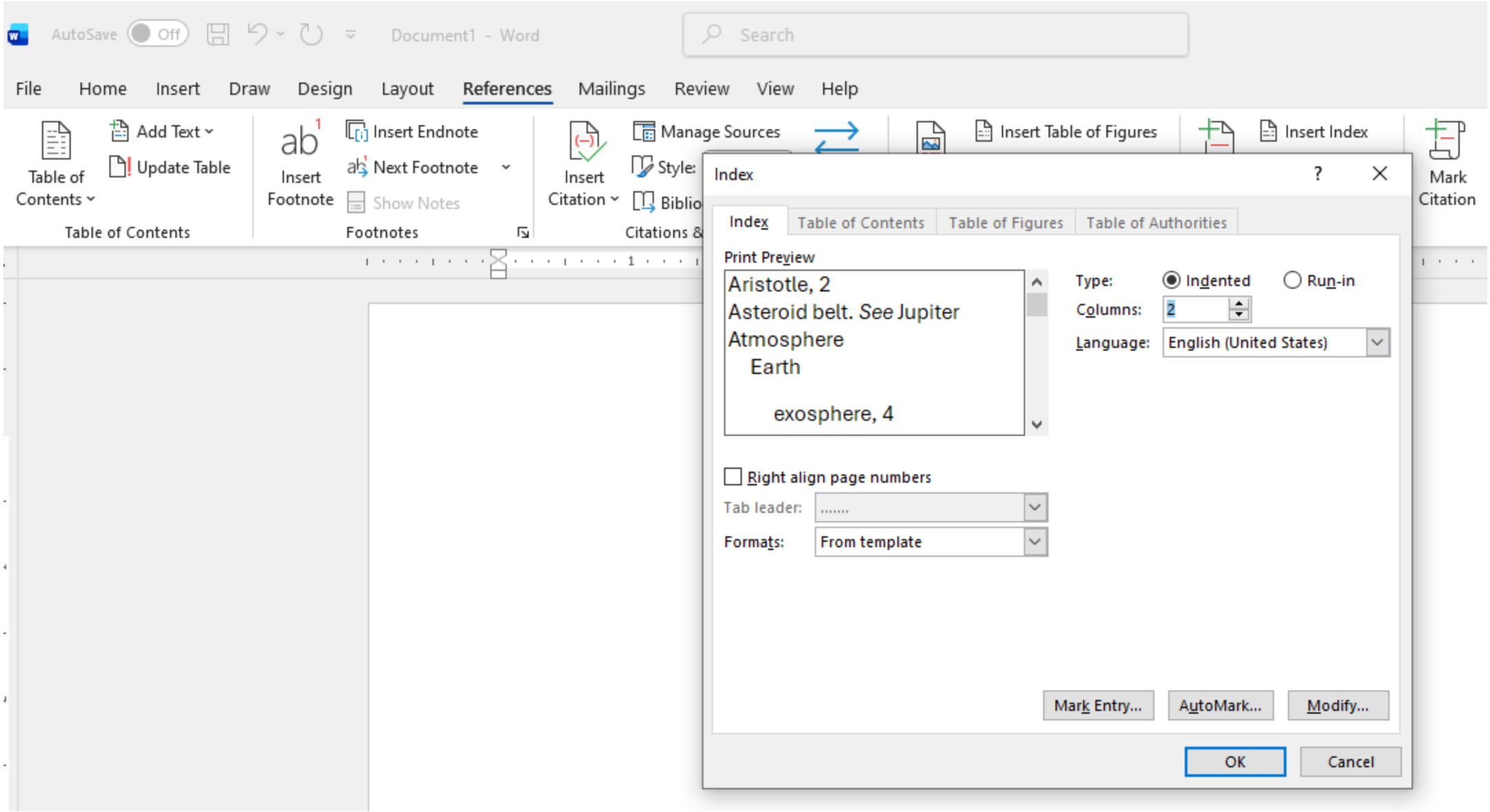


- Mark for indexing the word from single page only
- Mark all for indexing the word from all pages of the document
- Then select close

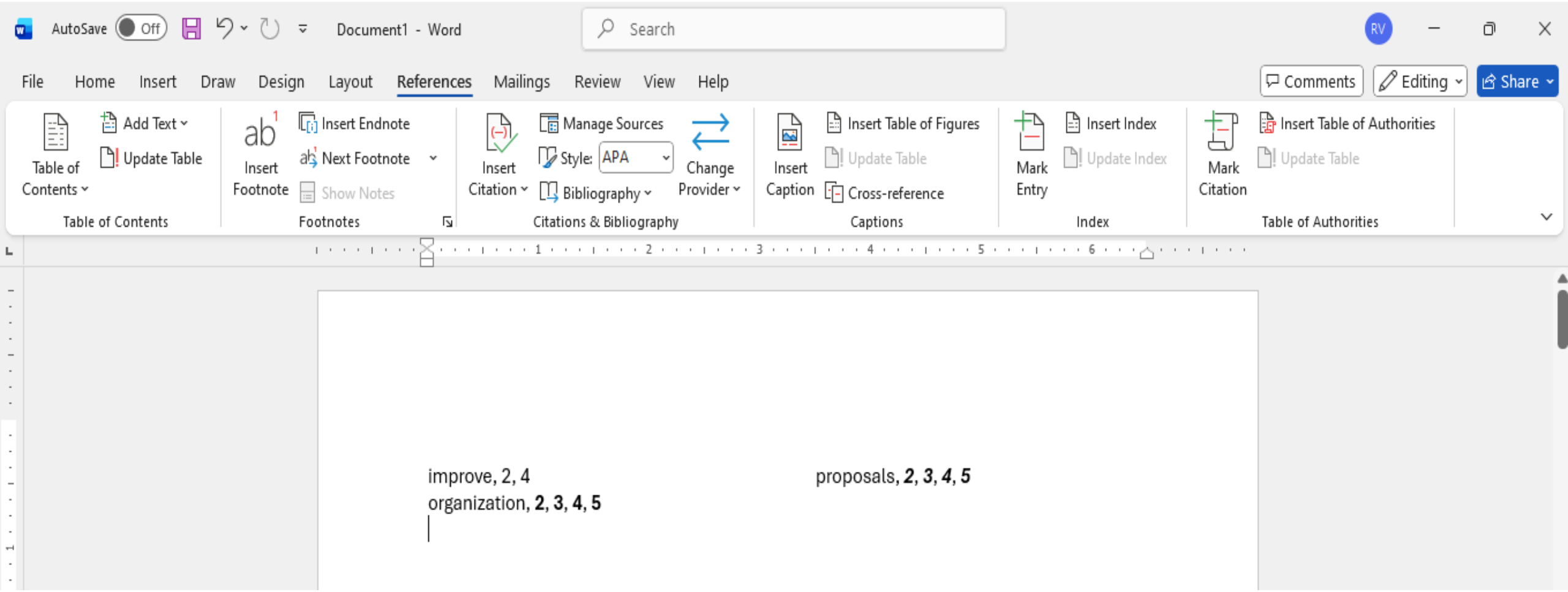


- Select the words required for indexing one by one

- Blank page → Reference → Insert Index → select 2 or 3 Columns → OK

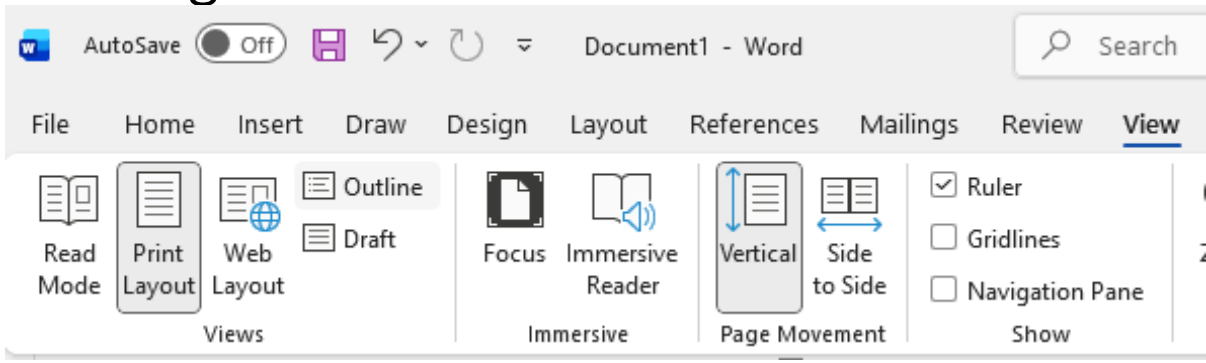


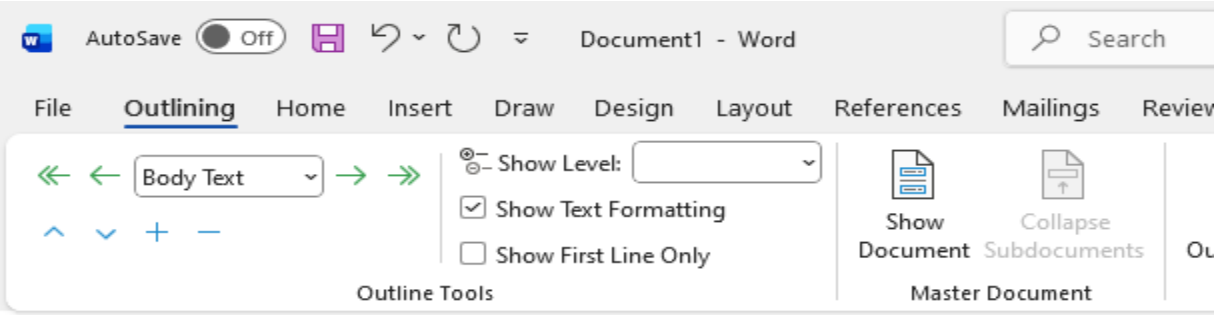
- They appear as per the selection



➢**Creating an outline:** View → Outline

- Outlining helps structure a technical report before writing the full text.
- Effective planning and organization.
- Helps maintain logical flow in long documents



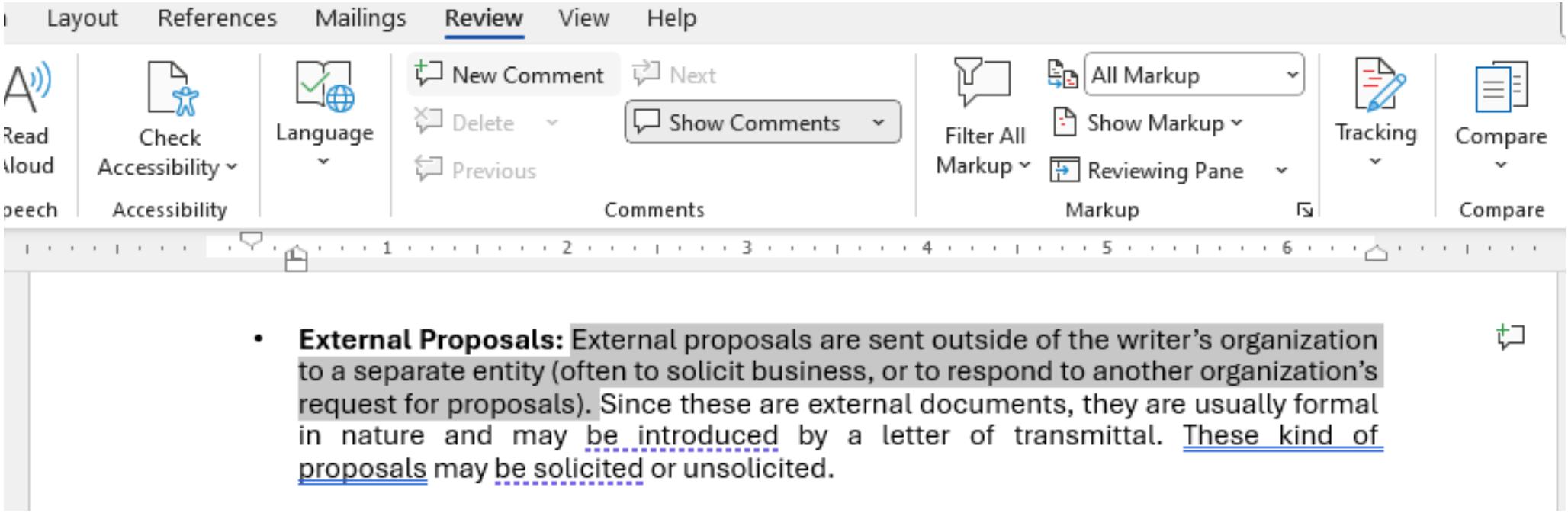


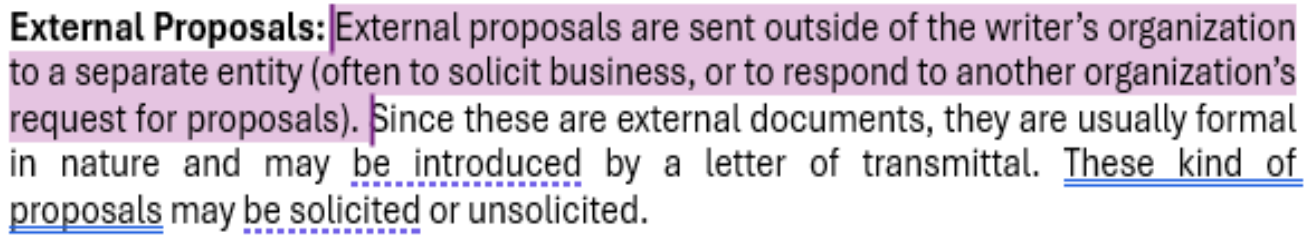
- **External Proposals:** External proposals are sent outside of the writer's organization to a separate entity (often to solicit business, or to respond to another organization's request for proposals). Since these are external documents, they are usually formal in nature and may be introduced by a letter of transmittal. These kind of proposals may be solicited or unsolicited.

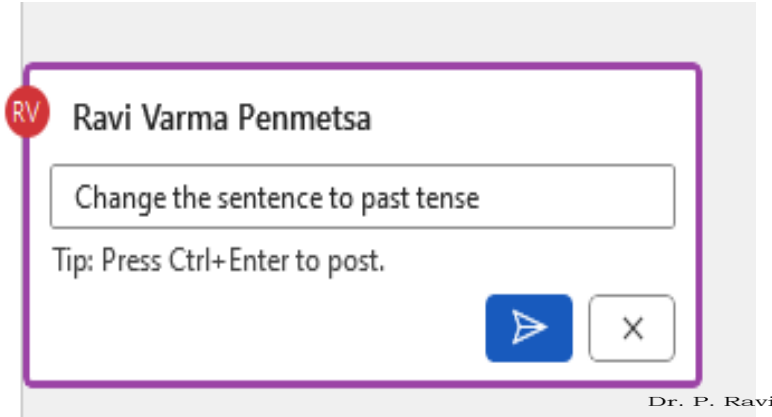
Solicited Proposals: You may write a solicited proposal if an organization identifies a situation it wants to improve or a problem that it wants to solve. A department or an organization may issue a request for proposals (RFP), asking for proposals on how to address the situation or issue. The requesting department or organization will evaluate proposals and choose the most convincing one, often using a detailed scoring rubric or weighted objectives to determine which proposal best responds to the request and addresses the organization's needs.

➢**Adding Comments:** Comments allow reviewers to provide feedback without altering the main text.

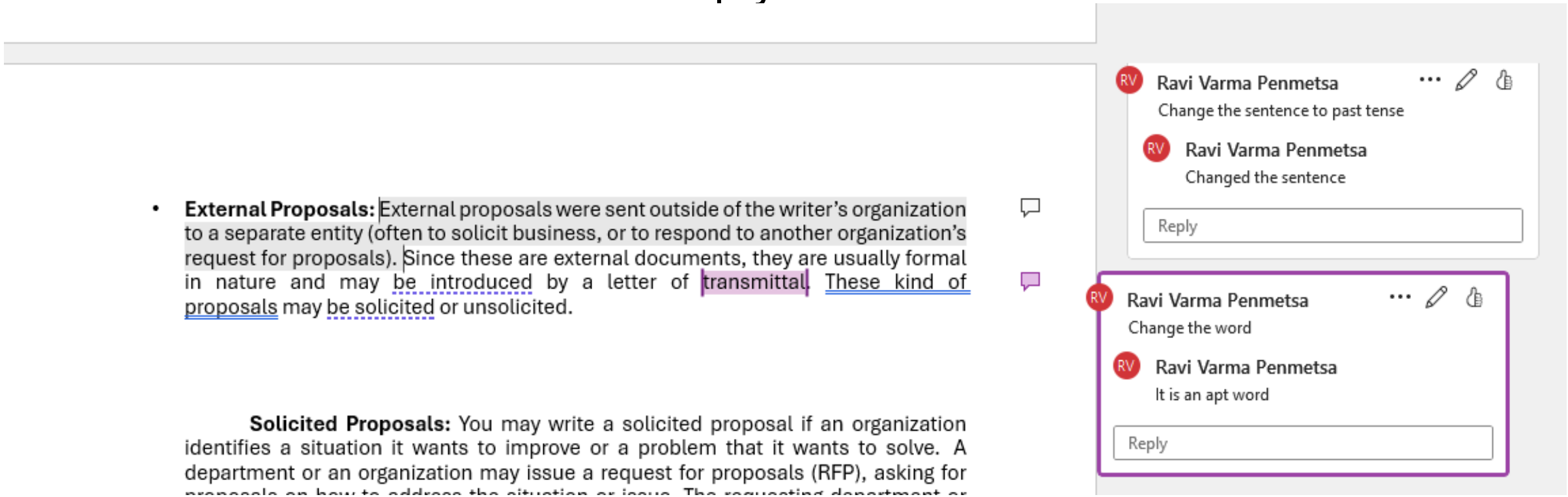
Review → **Select text** → New Comment → Type the comment→ Post



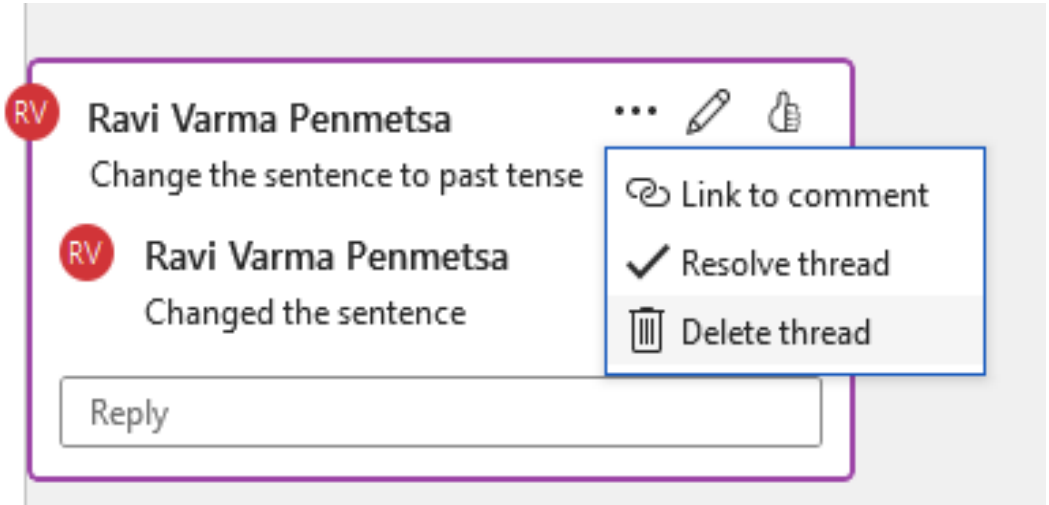




- One can edit the document and reply to the comment

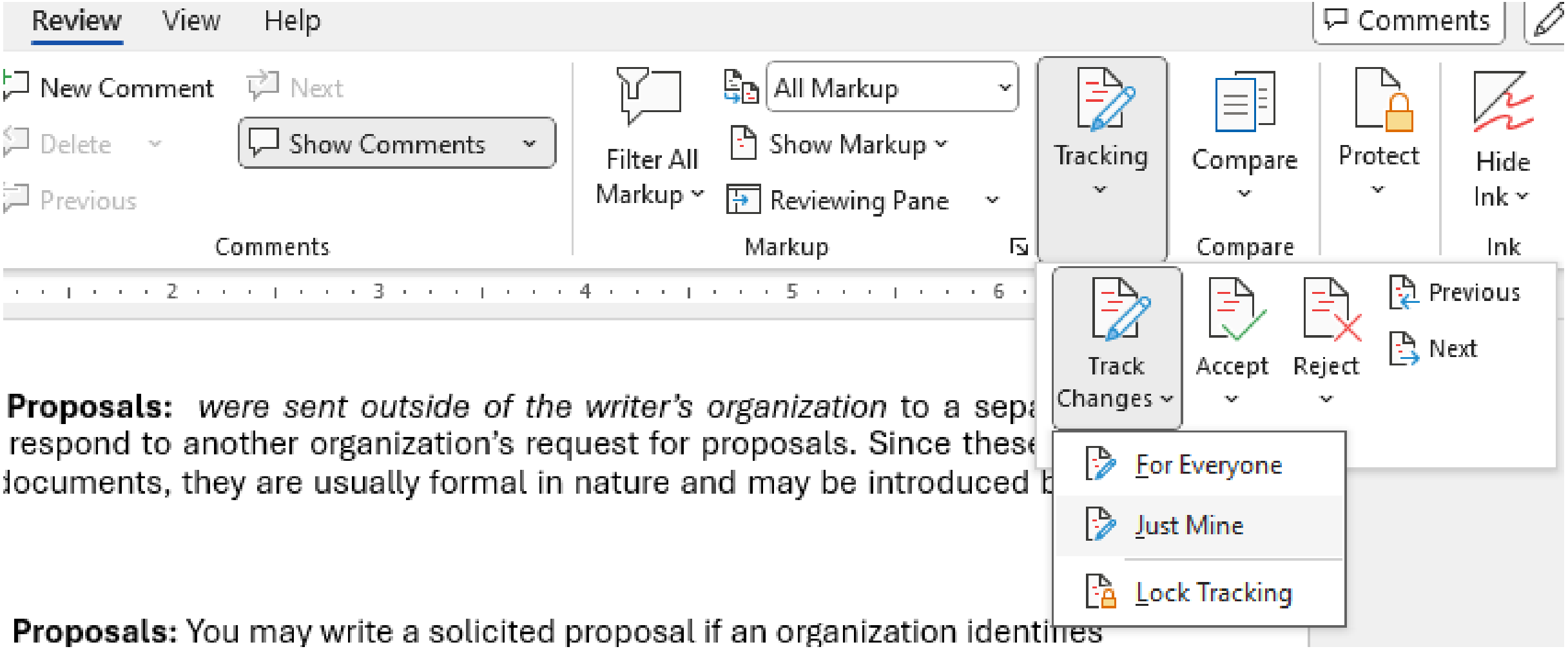


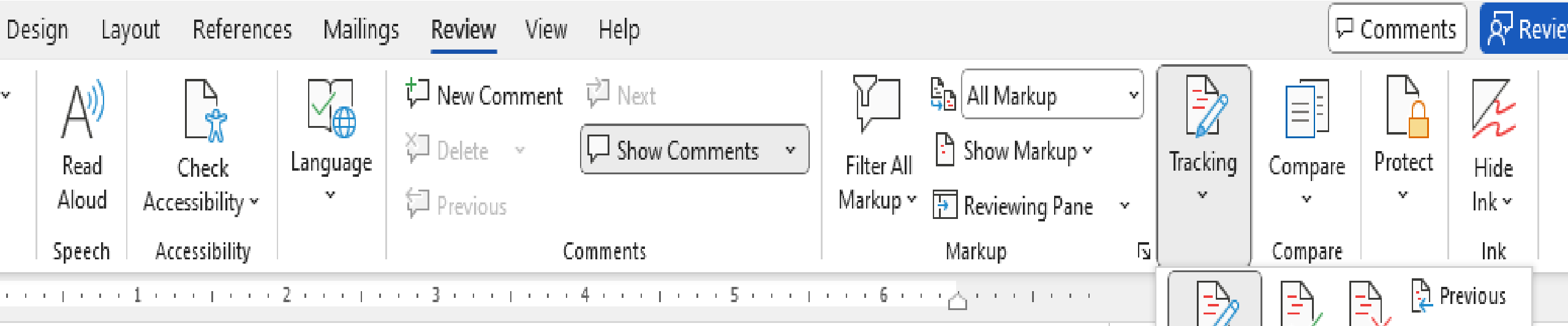
- Click on the three dots and select the delete thread icon to delete all the comments



➢**Tracking Changes:** It shows all edits: insertions, deletions, formatting changes.

Review → Tracking → Tracking Changes





entity to respond to another organization's request for proposals. Since these are external documents, they are usually formal in nature and may be introduced by **a letter**[1].

Solicited Proposals: You may write *a solicited* proposal if an organization identifies a situation it wants to improve or a problem that it wants to solve. A department or an organization may issue a request for proposals (RFP), asking for proposals on how to address the situation ~~or issue.~~ The requesting department or **organization will** evaluate proposals and choose the most convincing one, often using a detailed scoring rubric or weighted objectives to determine which proposal best responds to the request and addresses the **organization's needs.**

Ravi Varma Penmetsa
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Ravi Varma Penmetsa
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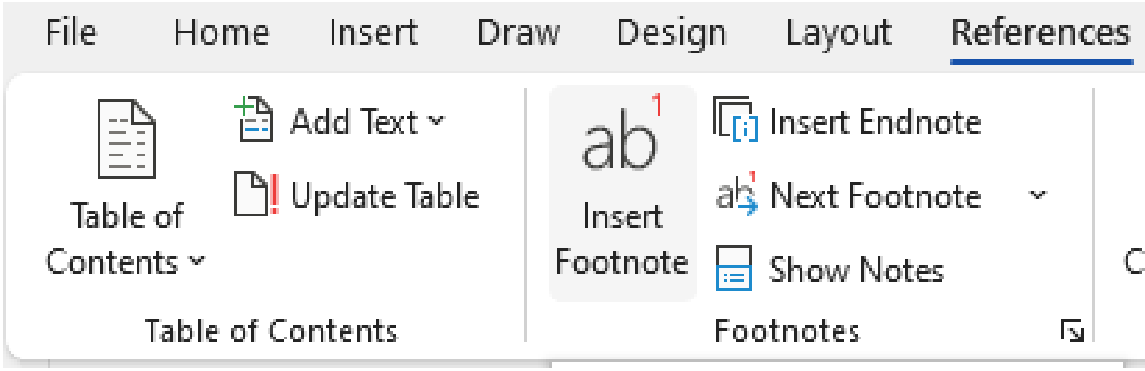
➢Working with Footnotes and Endnotes

- Footnotes appear at the bottom of the page; endnotes appear at the end of the document.
- They are used for: Citing sources, Adding explanations without interrupting main text & Providing technical references
- **References → Insert Footnote / Insert Endnote.**



audience to read and respond. Unsolicited external proposals a
kind of proposal to get approved

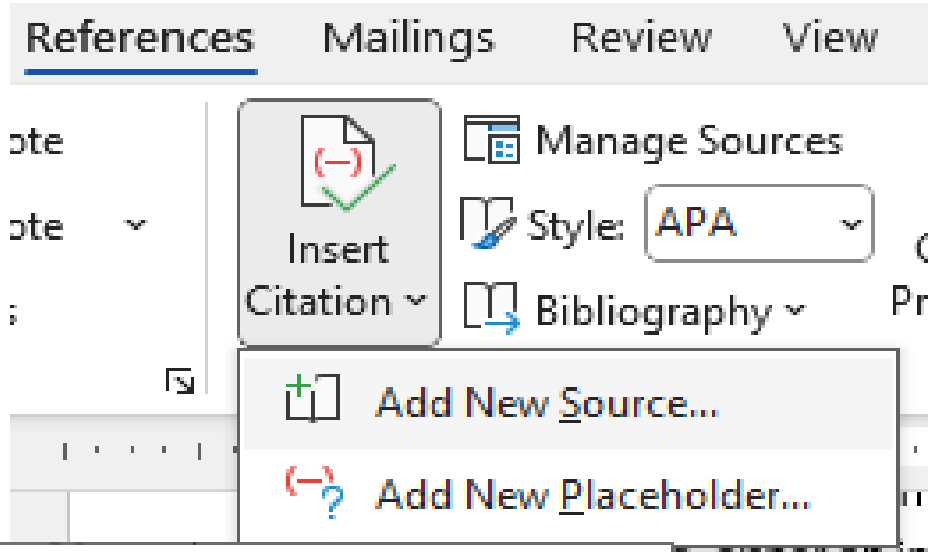
[1] SRKREC

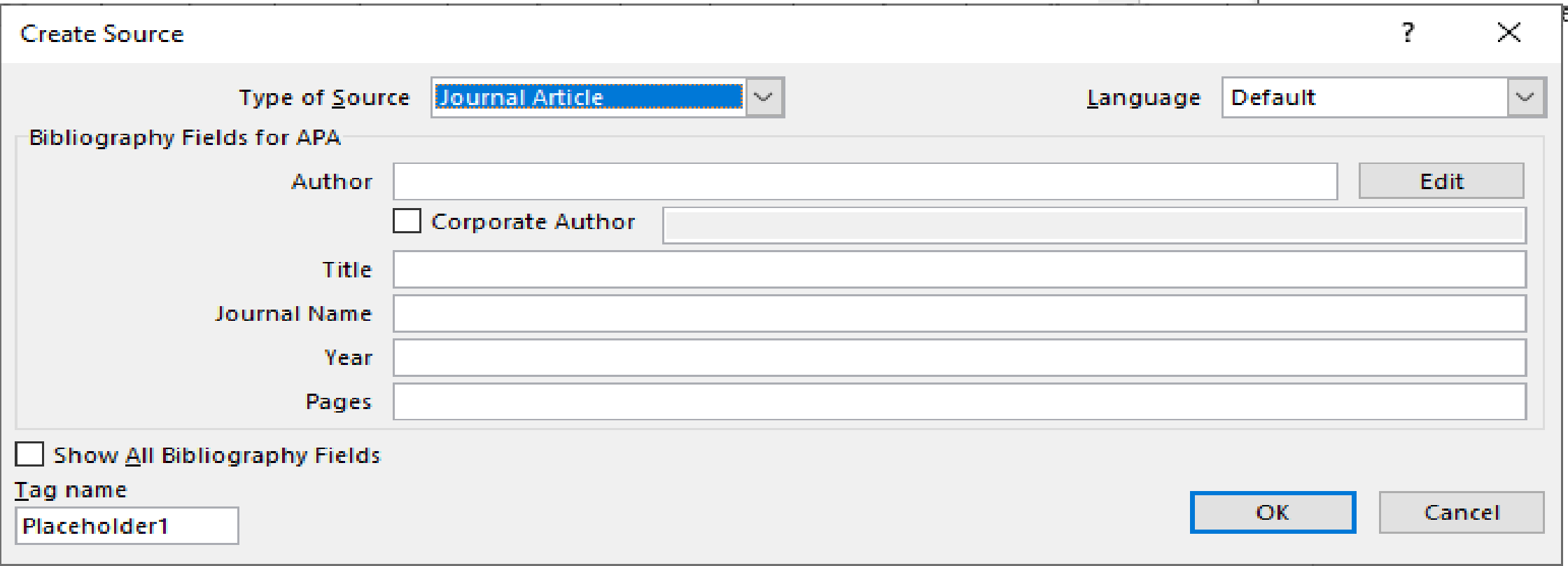
[1] PRV

[2] Mechanical

➢**Inserting Citations and Bibliography:** Word contains a built-in referencing system.

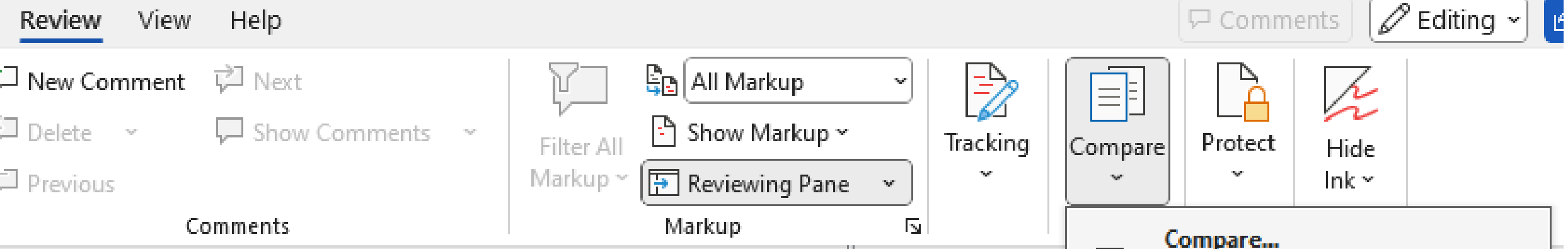
- **References → Insert Citation → Add New Source.**
- Enter details (author, year, title, etc.).
- Insert a Bibliography or Works Cited page.
- Supported formats: APA, MLA, Chicago, IEEE, etc.

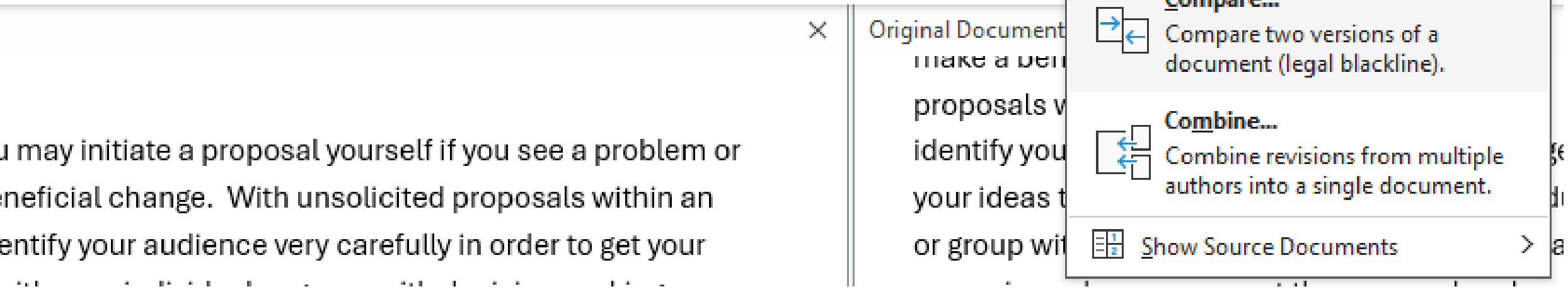


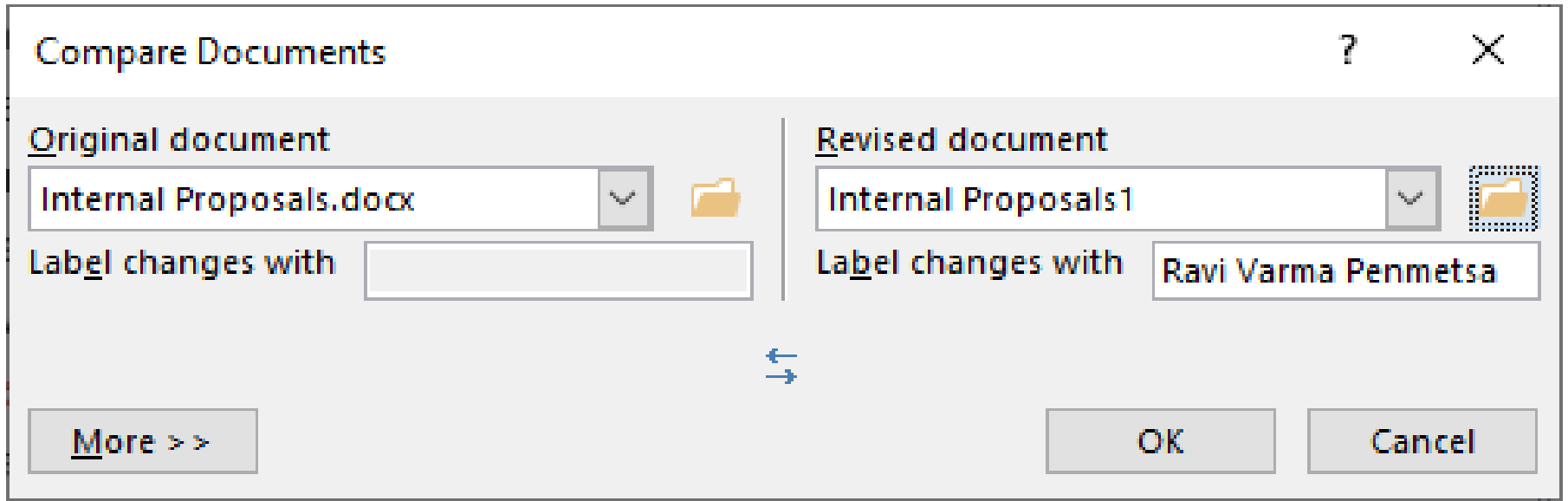


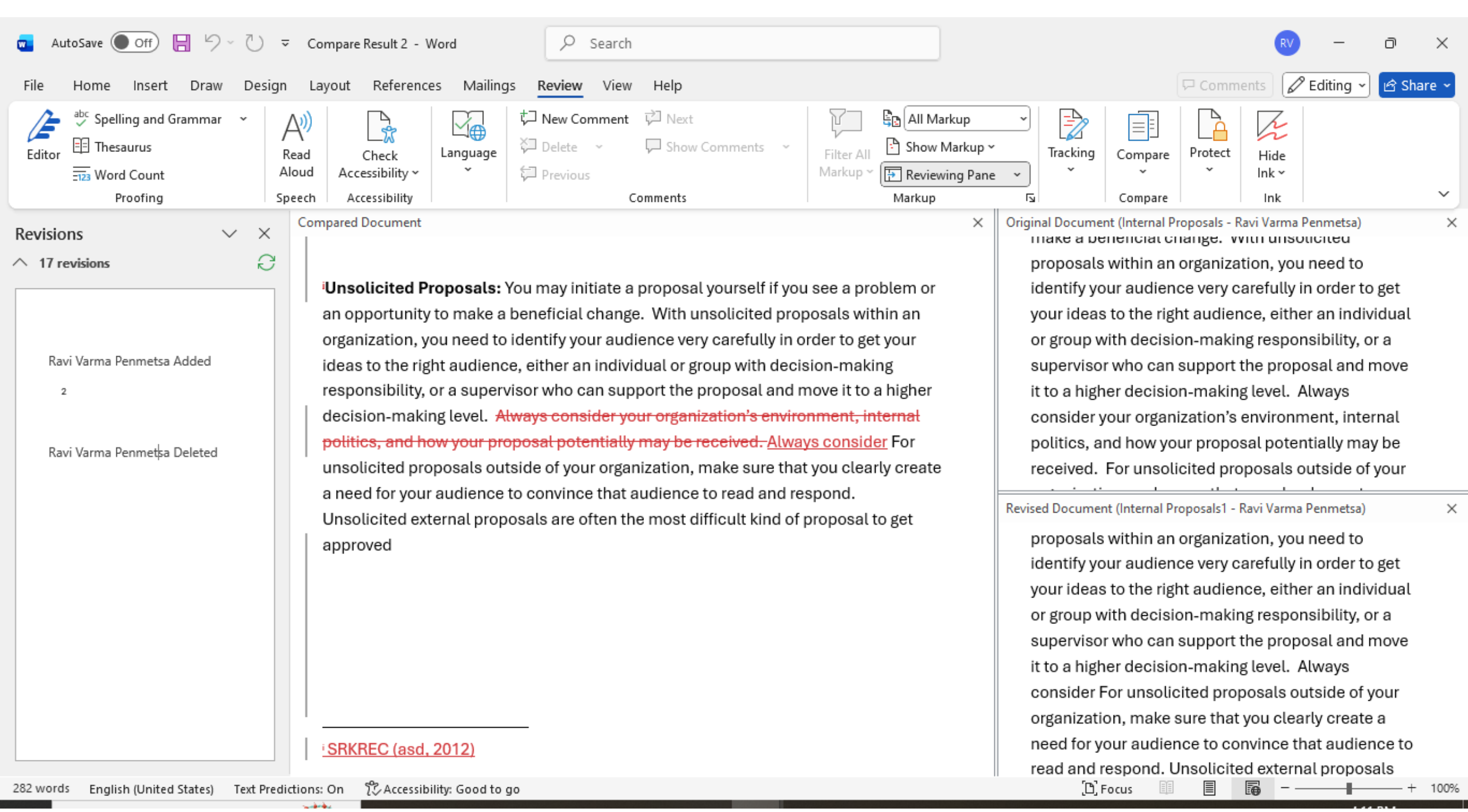
➢**Comparing Documents:** Used to compare two versions of a document.

- Word highlights differences in a new window.
- Checking revisions made by collaborators.
- Ensuring no content is lost.
- **Review → Compare → Compare Documents**.


Review
View
Help
Comments
Editing
New Comment
Next
Delete
Show Comments
Previous
Comments
Filter All Markup
All Markup
Show Markup
Reviewing Pane
Markup
Tracking
Compare
Protect
Hide Ink
Compare...
Compare two versions of a document (legal blackline).
Combine...
Combine revisions from multiple authors into a single document.
Show Source Documents

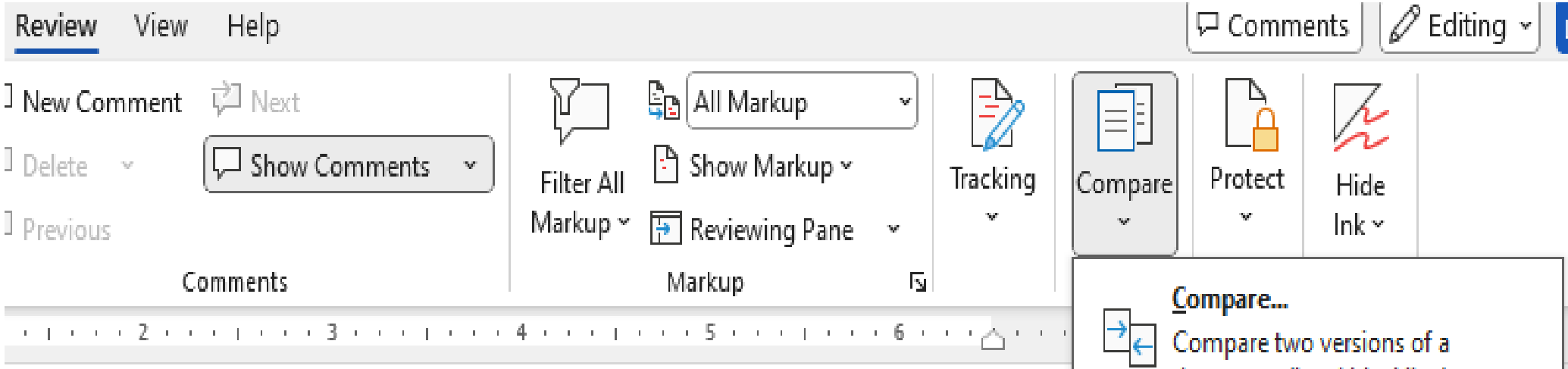

Original Document
u may initiate a proposal yourself if you see a problem or
neficial change. With unsolicited proposals within an
entify your audience very carefully in order to get your

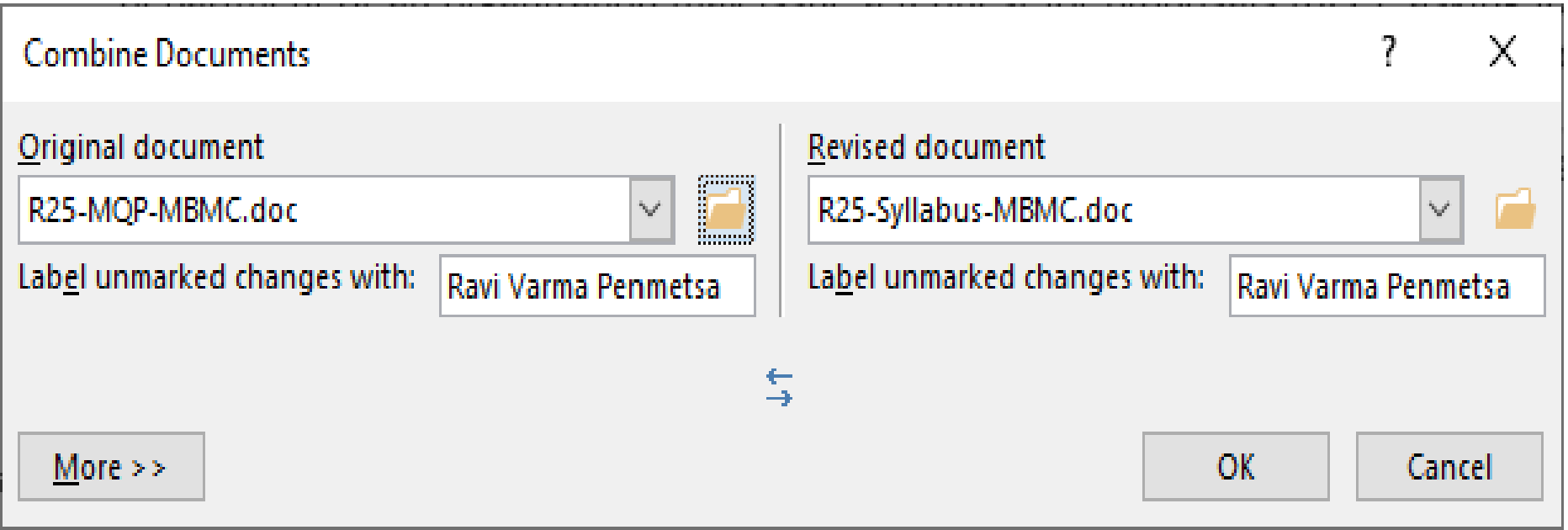

Compare Documents
Original document
Internal Proposals.docx
Label changes with
Revised document
Internal Proposals1
Label changes with
Ravi Varma Penmetsa
More >>
OK
Cancel



➢**Combining Documents:** Merges multiple edited versions into a single file.

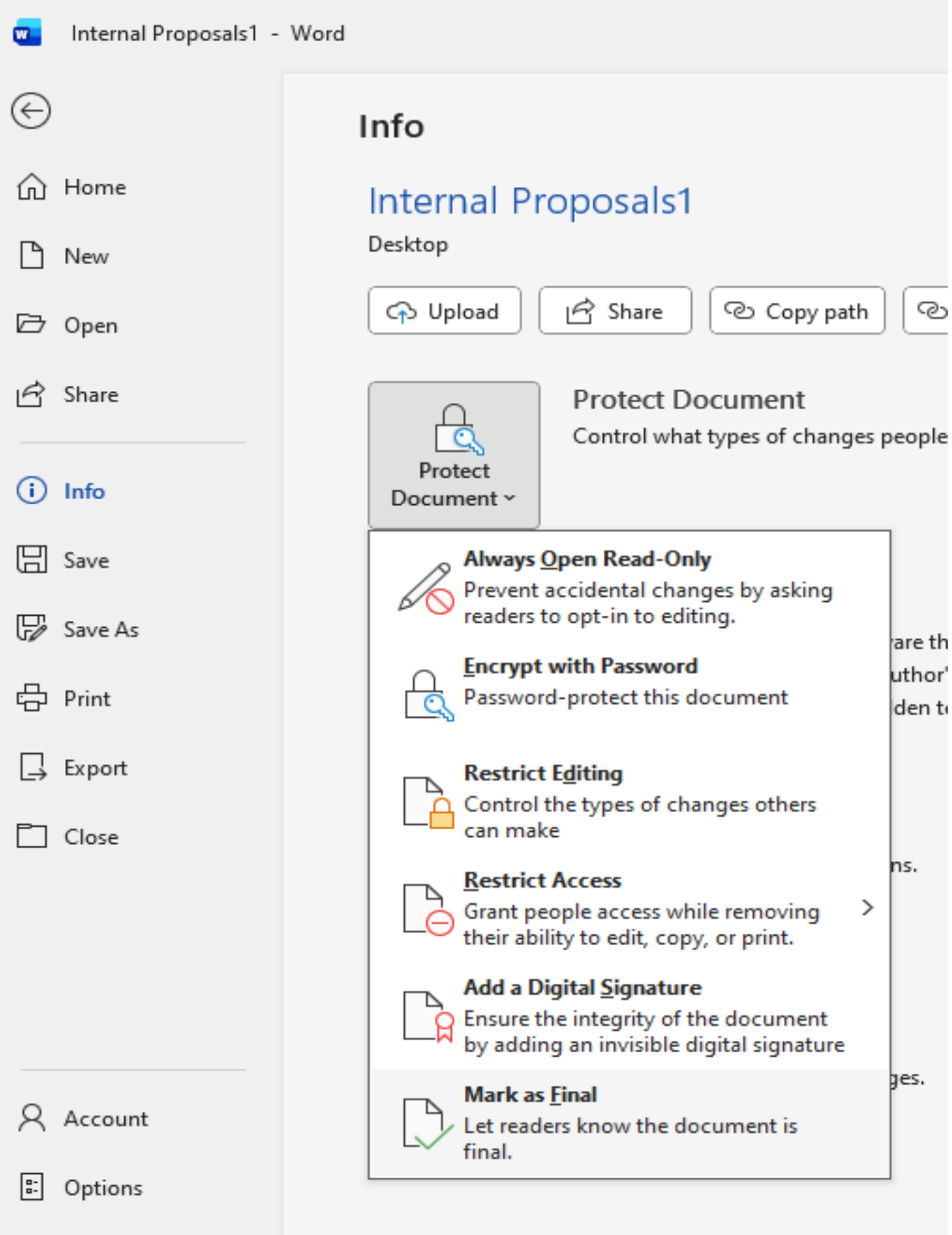
- Useful for team projects.
- Review → Compare → Combine.

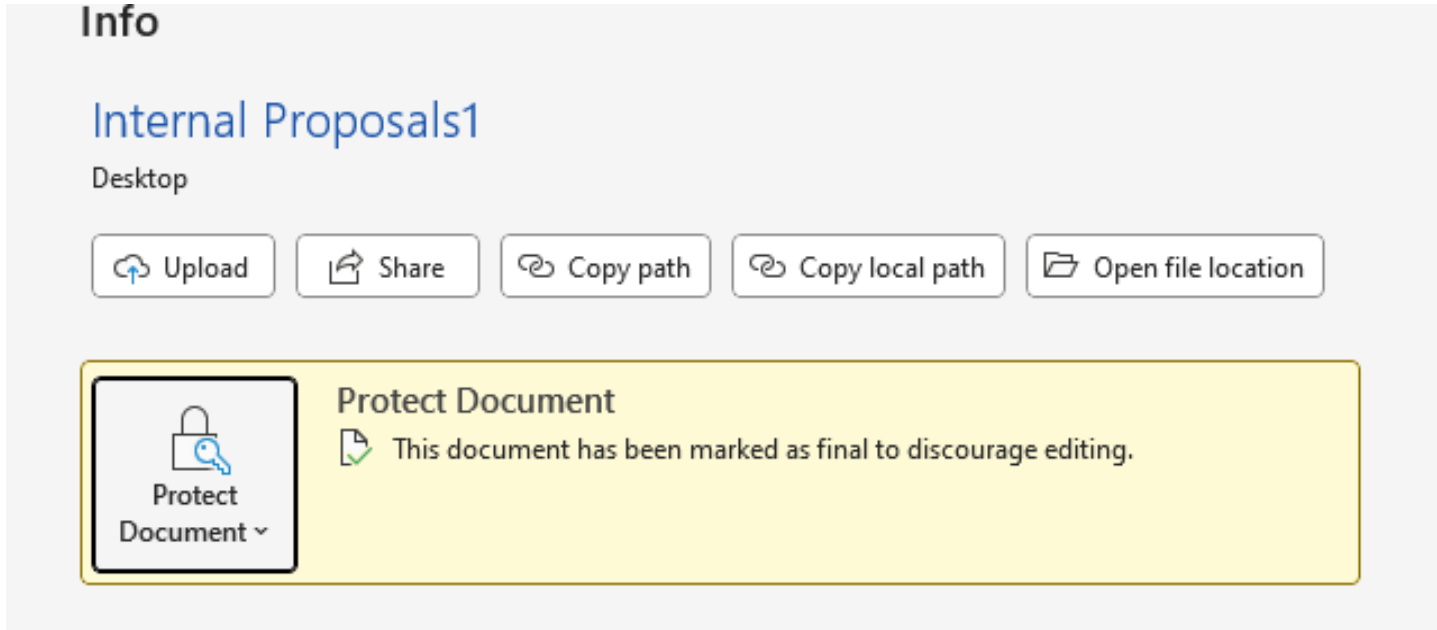




➢ Mark Document Final & Make Read-Only

- Disables typing and editing (can be reversed).
- Adds a "Marked as Final" notification.
- **File → Info → Protect Document → Mark as Final**
- Making a document fully read-only: **Save As** → **Tools** → **General Options**

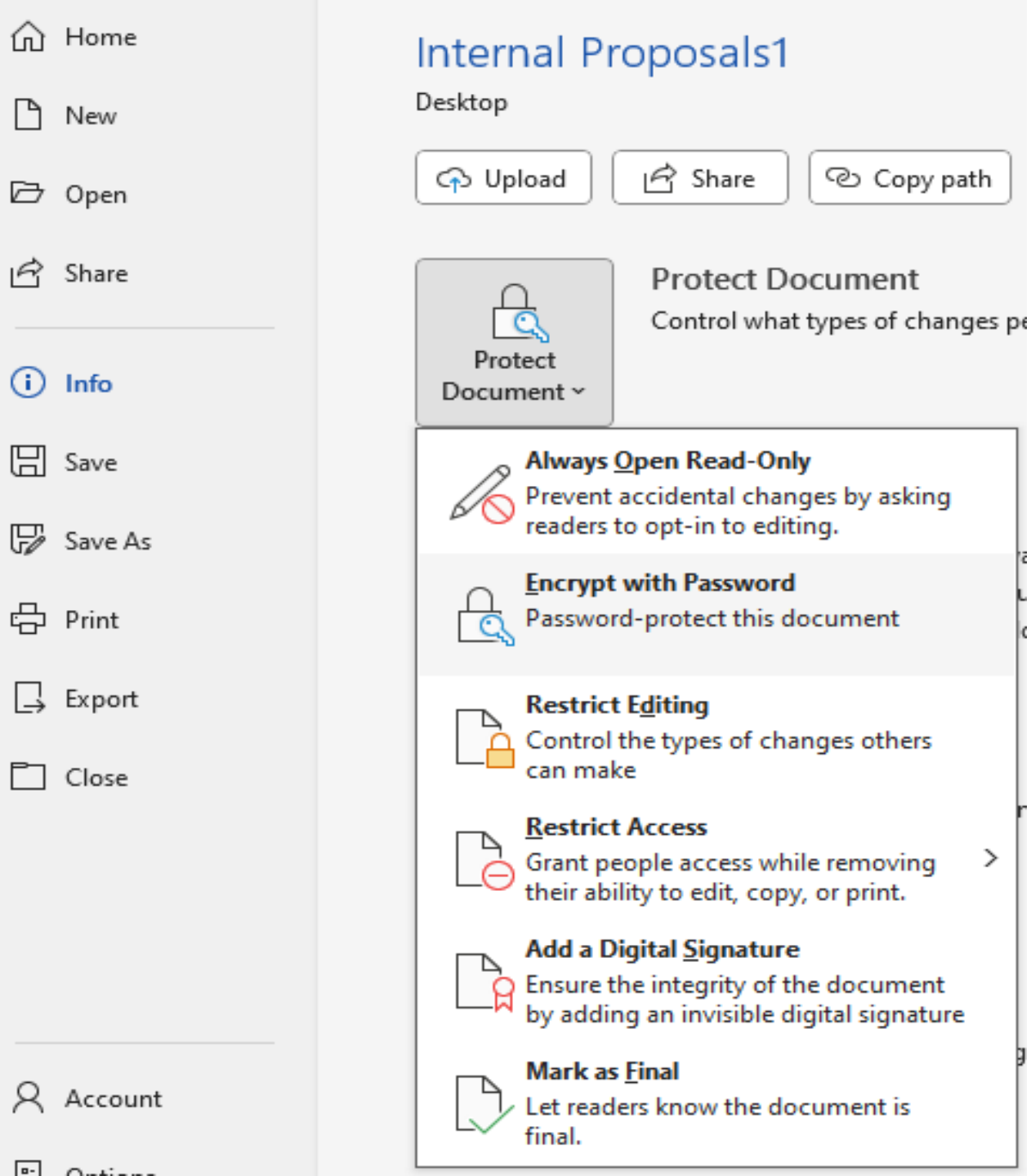


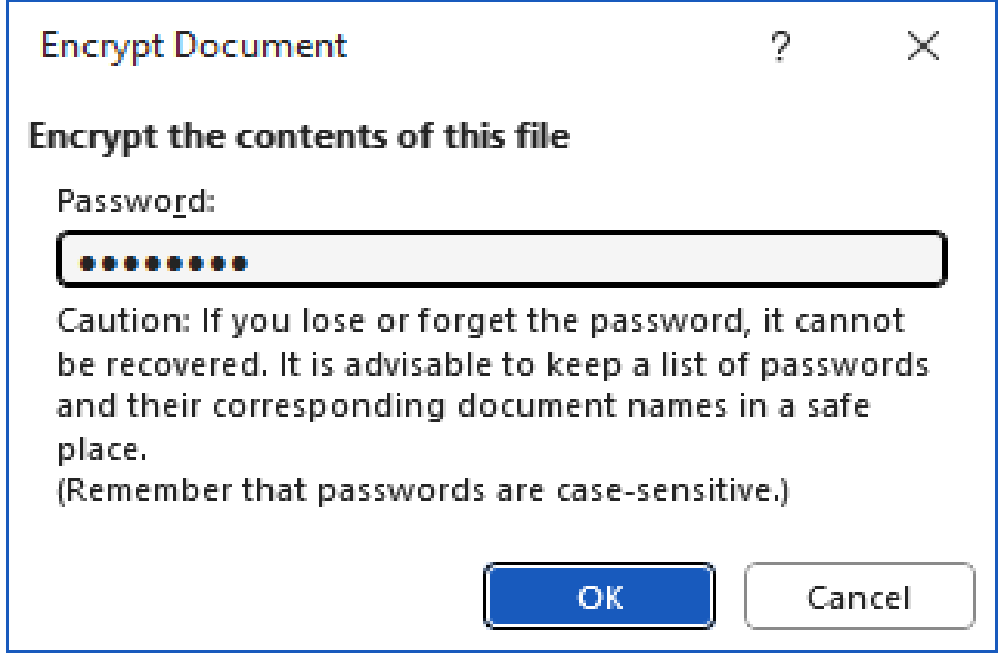


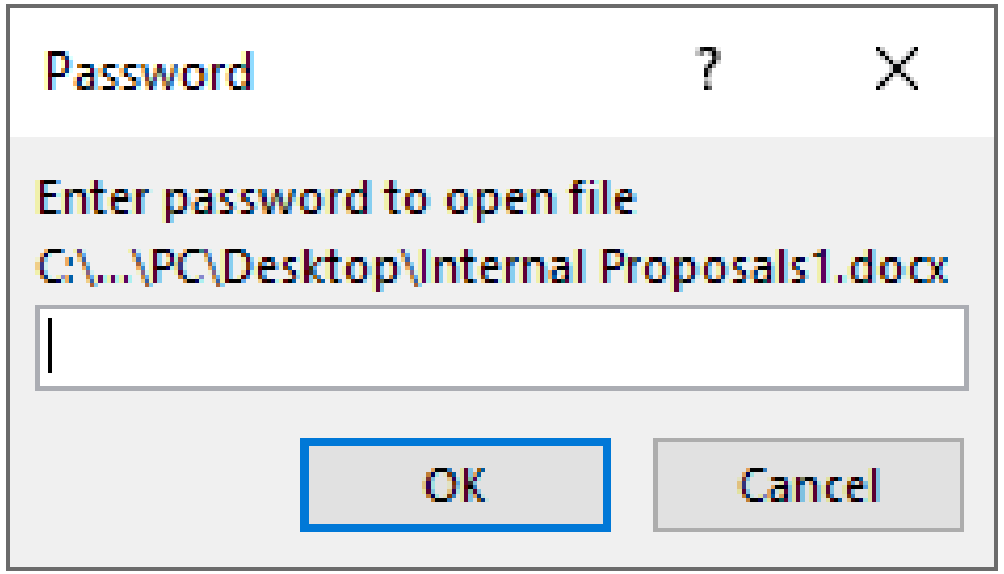
Dr. P. Ravi Varma

➢Password Protect Word Documents

- To secure confidential technical reports.
- Enter a strong password and if the password is forgotten, the document cannot be recovered
- File → Info → Protect Document → Encrypt with Password.







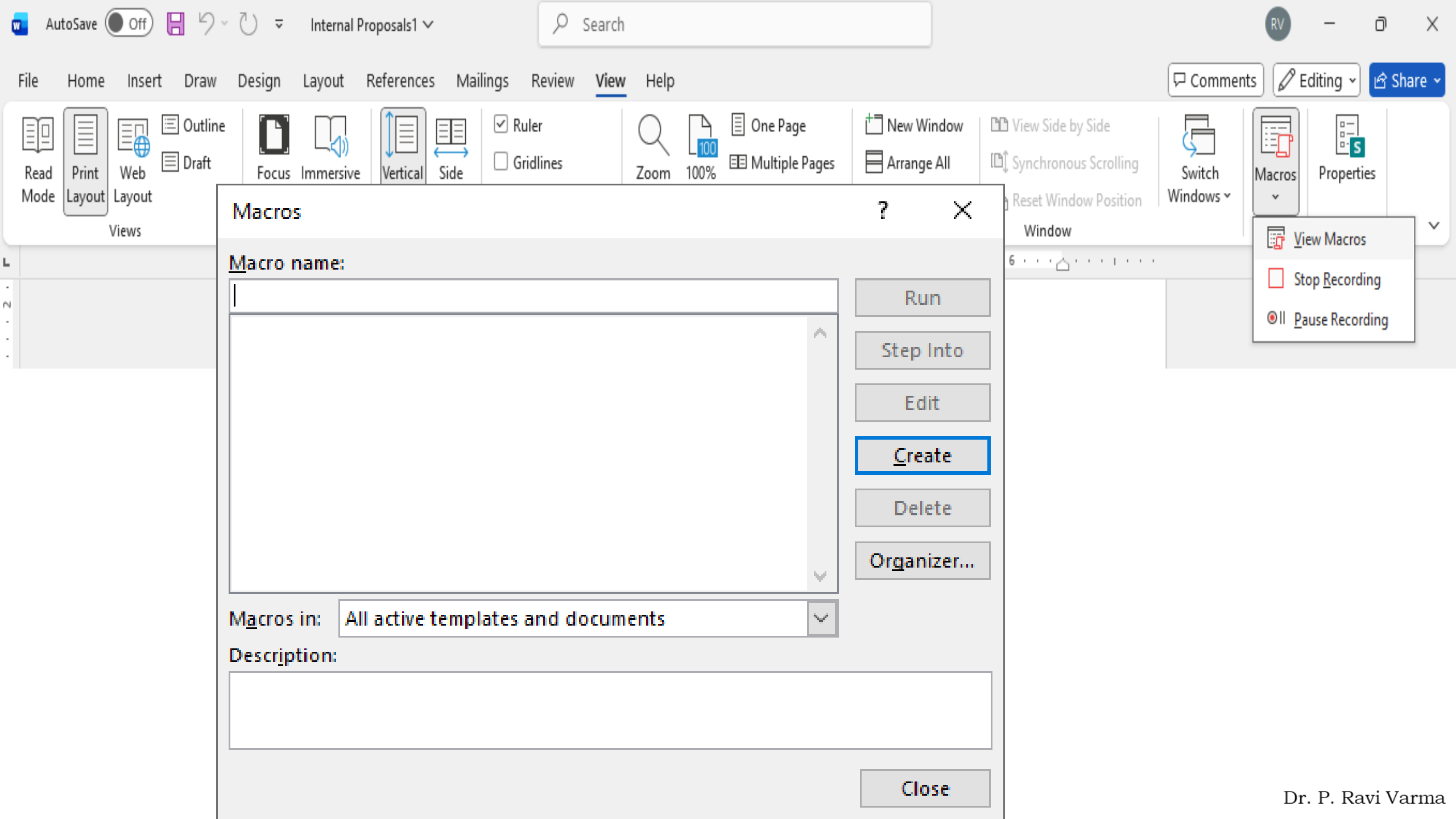
Dr. P. Ravi Varma

➢Using Macros

- A **macro** automates repetitive tasks by recording a sequence of actions.
- **View → Macros → Record Macro**.
- Perform actions to be automated.
- Click **Stop Recording**.
- Run macro when needed.

▪ **Examples:**

- Formatting large documents
- Inserting repeated tables or symbols
- Automating calculations



Intellectual Property

Intellectual property rights are the legal rights that cover the privileges given to individuals who are the owners and inventors of a work, and have created something with their intellectual creativity. Individuals related to areas such as literature, music, invention, etc., can be granted such rights, which can then be used in the business practices by them. The creator/inventor gets exclusive rights against any misuse or use of work without his/her prior information. However, the rights are granted for a limited period of time to maintain equilibrium.

➢ **Legislations covering IPRs in India:**

Patents: The Patents Act, 1970 as amended in 1999, 2002 and 2005

Design: The Designs Act, 2000

Trade Mark: The Trade Marks Act, 1999

Copyright: The Copyright Act, 1957 as amended in 1983, 1984 and 1992, 1994, 1999

Layout Design of Integrated Circuits: The Semiconductor Integrated Circuits Layout Design Act, 2000

Protection of Undisclosed Information: No exclusive legislation exists but the matter would be generally covered under the Contract Act, 1872

Geographical Indications: The Geographical Indications of Goods (Registration and Protection) Act, 1999

Plant Varieties: The Protection of Plant Variety and Farmers' Rights Act, 2001

➢Patents

- A **patent** is a legal right granted for an invention that is *new, useful, and non-obvious*. The invention may be a product, process, machine, chemical composition, or technological improvement.

Nature and Features of Patents

- Provides exclusive rights to the inventor for **20 years** (from filing date).
- Others cannot make, use, sell, or import the invention without permission.
- Encourages innovation by providing commercial benefits.
- Requires public disclosure of the invention after the grant.

Examples

- A new drug molecule
- A novel electricity-saving device
- Improved manufacturing process

➢Industrial Designs

- Industrial Design (Design Rights) protect the *aesthetic or ornamental* aspects of a product.

Key Characteristics

- Protects shape, pattern, configuration, or visual appearance.
- Does **not** protect the function of the product (only looks).
- Valid for **10 years** (extendable in many countries).

Examples

- Design of a mobile phone body
- Shape of a furniture piece
- Pattern on textiles

➢Trademarks

- A **trademark** is a sign, symbol, word, or logo that distinguishes goods or services of one company from another.

Nature of Trademarks

- Builds brand identity and customer trust.
- Protects logos, brand names, slogans, sound marks, etc.
- Renewable **every 10 years**, so protection can last indefinitely.

Examples

- Nike "✓" logo
- Coca-Cola wordmark
- Intel chime sound logo

➢Copyright

- Copyright protects *original literary, artistic, dramatic, musical, and software works*.

Nature of Copyright

- Covers the *expression* of ideas, not the idea itself.
- Protection lasts for the **lifetime of the author + 60 years** (varies by country).
- Automatically granted when the work is created.

Examples

- Books, articles, software code
- Movies, songs, paintings
- Photographs, architectural designs

Process of Patenting and Development

Innovation to commercialization involves several stages. The typical process includes **technological research, innovation, patenting, and development**.

1. Technological Research

This is the foundation for creating new inventions.

Activities involved

- Literature review
- Identifying problems and research gaps
- Experimental work, prototyping, simulations
- Collecting data and validating results

❖Research provides the scientific or technical foundation required for innovation.

2. Innovation

- Innovation converts research outcomes into a practical, useful invention.
- **Characteristics**
- Must solve a real-world problem
- Should have technical advancement
- Adds commercial or societal value
- Leads to a patentable invention

❖Innovation transforms theory into application

3. Patenting Process

The patenting procedure involves:

a. Patentability Check

- Determine whether the invention is:
  - Novel
  - Non-obvious
  - Industrial applicable

b. Prior-Art Search

- Search existing patents and publications to confirm originality.

c. Drafting the Patent Application

Includes:

- Title
- Field of invention
- Background
- Description
- Claims (most important)
- Drawings (if required)

d. Filing the Patent

Types:

- Provisional Application
- Complete Specification

S. No	Action	Form No	Conditions
1.	Application for grant of a patent	Form 1*	This form will be accompanied by provisional or complete specification filled in Form 2
2.	Provisional or Complete specification	Form 2*	
3.	Statement and undertaking foreign applications	Form 3*	In this form the applicant gives the undertaking that he has not made any application outside India and will inform the Patent Office as and when he files the same abroad.
4	Declaration as to inventorship	Form 5	The applicant discloses the names of all the inventors. This is generally used when complete specification is filed after provisional specification.
5.	Request or claim regarding mention of inventor as such in a patent	Form 8	If this form is filled then the letters patent document will have the name of the inventors, otherwise not.

6.	Request for examination of a patent application	Form 18*	This form can be filed anytime with in 48 months of filing an application. It can be filed even at the time of filing the patent application. Without filing this form the patent specification will not be examined.
7.	Form of authorization of a Patent Agent	Form 26	This form is required when the applicant is authorizing a patent agent to act before the patent office on his/her behalf
8.	Request for early publication	Form 9	This form is required to be filled if the applicant wants that his application is published before 18 months of filing

e. Examination

- Patent office evaluates the invention for novelty and usefulness.

f. Grant

- If all conditions are satisfied, patent is granted for 20 years.

g. Maintenance

- Periodic fees are required to keep the patent active.

No.	Action	Limits, conditions and timelines	Official Fees	
			Individual	Legal entity
1.	Filing of patent application along with complete/provisional specification	For maximum number of pages 30 and maximum number of claims 10	Rs.1000/-	Rs.4000/-
		For each additional sheet	Rs.100/-	Rs.400/-
		For each additional claim	Rs.200/-	Rs.800/-
2.	Request for examination of patent		Rs.2,500/-	Rs.10,000/-
3	Request for early publication		Rs.2,500/-	Rs.10,000/-
4.	Renewal fee (every year)	2^{nd} year to 6^{th} year	Rs.500/-	Rs.2,000/-
		7^{th} year to 10^{th} year	Rs.1500/-	Rs.6000/-
		11^{th} year to 15^{th} year	Rs.3000/-	Rs12,000/-
		16^{th} year to 20^{th} year	Rs.5000/-	Rs.20000/-

Publication of a Patent

- A patent application will be published in the Official Journal of the Patent Office on expiry of eighteen months from the date of filing or date of priority of the application, whichever is earlier. It can also be published earlier, if such a request is made by the applicant.
- An application will not be published in cases where directions have been given for secrecy, until the term of those directions expires. If an applicant wishes to withdraw the application on his own without any secrecy consideration, he can do so by withdrawing his application at-least three months before the date of the publication. In that case the application will not be published.
- The publication of every application includes the particulars of the date of application, application number, name and address of the applicant, an abstract, and is open for public inspection. However, the whole patent document can be obtained from the Patent Office upon payment of the requisite fees. These documents are now also available online at the Patent Office website www.ipindia.nic.in. The Official Journal of the Patent Office and the patent database in the searchable form can be accessed through this website.

- Each country is free to grant or refuse a patent on the basis of scrutiny by its patent office. This means that grant of a patent in one country does not guarantee that some other country will also grant patent for the same invention. Similarly, the refusal of the patent in one country does not mean that it will be refused in other countries.
- There is nothing like a global patent or a world patent. Patent rights are essentially territorial in nature and are protected only in a country (or countries), which has (have) granted these rights. Therefore, the patent could only be enforced in such countries. In other words, for obtaining patent rights in different countries one has to submit patent applications in all the countries of interest for grant of patents. This would entail payment of official fees and associated expenses, like the attorney fees, essential for obtaining patent rights in each country. However, there are some regional systems where by filing one application, one could simultaneously obtain patents in the member countries of a regional system; European Patent Office is an example of a similar system.

➢Opposition under the Indian Patents Act 1970

The Act now provides for pre-grant and post-grant opposition. Pre-grant opposition can be filed after the publication of patent application and before the grant of patent. Post-grant opposition can be filed within one year of the grant of the patent. An opposition board will be constituted for each of the opposition notifications accepted by the Controller for the post grant opposition proceedings. Opposition in both cases will be allowed on all grounds specified in the Act.

Pre-grant and post-grant opposition can be filed only on the following grounds:-

i. Claimed invention or its part wrongfully obtained;

ii. Claimed invention is published in a patent or any other document before the priority date;

iii. Claimed invention is published in a patent after the priority date having earlier priority date;

iv. Claimed invention was publicly known or publicly used before the priority date;

v. Claimed invention is obvious and does not involve clearly any inventive step, as regards to the matter published or used (in India) before the priority date;

vi. Claimed invention is not an invention within the meaning of the Patents Act or is not patentable under the Patents Act;

vii. The complete specification does not sufficiently and clearly describe the invention or the method by which it is to be performed;

viii. The applicant has failed to disclose to the Controller the information regarding foreign applications filed by him for the same invention or has furnished the information which in any material particular was false to his knowledge;

ix. In case of convention application if the application is not filed before the expiry of 12 months from the date of first application in convention country;

x. The complete specification does not disclose or wrongly mentions the source and geographical origin of biological material used in the invention;

xi. Claimed invention was anticipated having regard to the knowledge, oral or

otherwise available within any local or indigenous community in India or elsewhere.

4. Development and Commercialization

- Once patented, the invention can be:
- Manufactured and sold commercially
- Licensed to companies
- Assigned (sold) to another party for royalties
- Used as a basis for startups

❖This phase converts intellectual property into economic value.

International Scenario: International Cooperation on Intellectual Property

As technology and trade become global, countries cooperate through international agreements to protect IP across borders.

1. WIPO – World Intellectual Property Organization

➢ A United Nations agency that promotes worldwide IP protection.

Functions

- Administers international treaties
- Provides global databases for patents and trademarks
- Encourages IP development and harmonization

2. TRIPS Agreement (WTO)

➢ Trade-Related Aspects of Intellectual Property Rights (TRIPS) sets minimum IP standards for all WTO members.

Key Features

- Standardizes patent protection for 20 years
- Protects trademarks, copyrights, geographical indications
- Ensures enforcement mechanisms

3. PCT – Patent Cooperation Treaty

➢Allows inventors to file one **international patent application** that is recognized in over 155 countries.

Benefits

- Simplifies global patent filing
- Provides international search reports
- Delays national-phase expenses

4. Madrid System (Trademarks)

➢Provides a centralized system for registering trademarks in multiple countries through a single application.

5. Hague System (Designs)

➢Allows international registration of industrial designs through one application

6. Cooperation in Enforcement

Countries share:

- Anti-piracy measures
- Anti-counterfeiting actions
- Border enforcement rules
- Collaborative IP training programs

The Patent Cooperation Treaty (PCT) is a multilateral treaty entered into force in 1978. Through PCT, an inventor of a member country (Contracting State) of PCT can simultaneously obtain priority for his/her invention in all the member countries, without having to file a separate application in those countries, by filing of PCT application, which is popularly known as International Application. India joined the PCT on December 7, 1998.

Intellectual Property Rights are essential for protecting creativity, encouraging innovation, and supporting economic development. Patents, designs, trademarks, and copyright each protect different aspects of intellectual creation. The process of patenting involves research, innovation, filing, examination, and commercialization. Globally, systems such as WIPO, TRIPS, PCT, Madrid, and Hague ensure international cooperation and uniform protection standards. Together, these frameworks help maintain innovation and competitive growth in a globalized world.