Chapter 8: Scientific Paper Writing

Wondwossen Bogale (PhD)

Assistant Professor, AAiT, AAU

wondwossenboge@gmail.com

COMPONENTS OF A FULL RESEARCH PAPER

1. *Title page*
2. *Abstract*
3. *Introduction*
4. *Literature review*
5. *Research Methodology*
6. *Result and discussion*
7. *Conclusion*
8. *References*

Layout

Title :

Authors: A[a], B[b]

[a] Addis Ababa University

[b] Awasa

Abstract

- Background :
- Problem statement :
- Objectives
- Methodology :
- Results :
- Conclusion:

Keywords:

1. **Introduction**
   - Broad them or topic of the study
   - Narrowing the topic
   - Make it Specific
   - Literature review :
   - Point out the gap:
   - Reveal the research question
   - Significance of solving this problem
   - Objectives
2. **Methodology**
3. **Results and discussion**
   a. **Model Validation :**
   b. **Main findings :**
4. **Conclusions**
   - Context of the study
   - Stating the main findings
   - Compare your result/Validate
   - State importance of your findings
   - Limitation
   - Future work

References

[1]. C. Dejfors, E. Thorin, and G. Svedberg, Ammonia-water power cycles for direct-fired cogeneration applications, Energy Conversion and Management, vol. 39, 1998, pp. 1675-1681.

COMPONENTS OF ABSTRACT

- *Background*
- *Problem statement*
- *Objective*
- *Methods*
- *Results*
- *Conclusion*
- *Keywords*

EXAMPLE : ABSTRACT

- **Upgrading Biogas for electricity generation: A Case for Addis Ababa University**
- **Author:** Wondwossen Bogale [a]
- [a] School of …..
- **Abstract**
- **Background:** When searching for renewable energy technologies that convert organic wastes into useful energy, biogas is given priorities. To better use the Biogas and increase the calorific value and remove unwanted components from the raw biogas, it is crucial to clean raw biogas and upgrade it.

EXAMPLE : ABSTRACT

- **Problem statement:** However it is hard to find innovative biogas upgrading technologies for electricity generation in Ethiopia. All of the Biogas produced in Ethiopia is used for cooking purpose.
- **Objective:** In this study, a novel technology to upgrade Biogas and reduce H_2S content of Biogas plant has been studied.
- **Methodology:** After producing the Biogas different chemicals has been used to upgrade the Biogas: Activated carbon to remove H_2S, Amine solution to remove CO_2, Silica gel to remove the Moisture.

EXAMPLE : ABSTRACT

- **Results:** The experimental result shows these innovative technologies reduce the acidic content (H_2S) by 99 % and removes the CO_2 by 82 %. Thus, the Methane content has been increased from 56.7 % to 85 %. The CO_2 content reduces from 36 % to 10 %.
- **Conclusion:** Thus, the upgraded Biogas can be used for electricity generation.
- **Keywords:** Biogas, upgrading, activated carbon, silica gel, electricity generation

Effective writing and publishing scientific papers- how to get started

- *Most researchers find it challenging to start writing a new paper and to remain motivated during the process.*
- *Every writer experiences good and bad writing days.*
- *There are, however, many possibilities to make writing generally more efficient and also more fun.*
- *The order of the writing process does not have to be the same as the eventual order of the article sections, and you may find some sections easier to write than others.*

Effective writing and publishing scientific papers- how to get started

- *As the introduction and discussion sections are often perceived as the most difficult ones, you may find it easier to start with the methods and results.*
- *Furthermore, there are advantages to writing or finalizing the introduction and discussion at the end (but before the abstract) as their contents depend on the choice of journal and on the methods and findings presented in the paper.*

Title

- *The title of the scientific paper is an incredibly important component of an article, as this is the first part of the article that an editor, reviewer and reader reads to understand the contents of the scientific paper.*
- *Title must be easy to understand*
- ***Title must contain the primary key words describing the work presented and reflect the entire core contents***
- *The title should be short, unambiguous, **without abbreviations** and contain an adequate description of the entire work without any biased picture*

Introduction

The introduction section must answer the questions

1. *What was being studied?*
2. *What was the important question?*
3. *What did we know about it before?*
4. *and how does this study advance knowledge?*
5. *Identify the key topics that the study deals with and introduce them within 4-5 paragraphs.*
6. *In the first paragraph, describe the magnitude of the problem followed by description of current knowledge and gaps that exist in the literature*

Methods to write Introduction

- *Broad theme or topic of the study*
- *Narrowing the topic*
- *Make it specific*
- *Literature review*
- *Point out of the gap*
- *Reveal the research question*
- *Significance of solving this problem*
- *Objectives*

Method

- *If you consider a research study as a delicate dish of knowledge, a paper's methods section would be like a recipe that lists all the necessary ingredients of the study and how they need to be combined during cooking.*
- *Ideally, it allows the dish to be prepared again with the same result.*
- *The methods section ties the introduction to the results section to create a clear story line; it should present the obvious approach to answer the research question and define the structure in which the results will be presented later.*

Method Section

- *The methods section of a paper presenting original research from a quantitative study has four basic elements:*
  - ***Study design***
  - ***Selection of participants – selection criteria/ selection methods***
  - ***Data collection***
  - ***Data analysis***
- *It is quite common to use such subheadings to structure the section (the target journal may offer specific guidance).*
- *After you have drafted the methods section, ask yourself, ‘‘Would a researcher be able to reproduce our study with the information I provide in this paper?’’*

Method Section

Checklist for the methods section

- *Include basic information on study design, setting and subjects, data collection, data analysis, and ethical approval*
- *Refer to previous publications from the same large research project, such as a study protocol, for additional information (if applicable)*
- *Consider providing detailed information on the methods as supplementary materials*
- ***Ask yourself, ''Would a researcher be able to reproduce the study with the information I provide in this paper?''***
- ***Note : To master the writing of the methods section it is important to look at many other examples of methods sections in articles with similar scopes and aims as ours***

Result Section

- *The results section of an article presents a clear, concise, and objective description of the findings from a particular study and is mostly written in the past tense.*
- *The findings are presented without interpretation, as this should occur in the discussion section only.*
- ***You may think of the results section as mirroring the methods section: For every method (what you did), there should be a corresponding result (what you found) and vice versa.***

Result Section

- ***Keep the story line of your paper in mind:*** ***Findings in the results section should match and answer the research questions from the introduction, using the procedures explained in the methods section.***
- Retaining this focus will help you to be more concise, that is, to decide which findings to present and which to leave out.

Result Section

Checklist for the results section

- *Write the results section in the past tense.*
- *Structure it by highlighting your key findings*
- *Match the results section with the methods section.*
- *Present findings without interpretation.*
- *Highlight findings from tables and figures in the text.*
- *Present estimates with 95% confidence intervals.*
- *Consider providing additional results in tables and figures as supplementary material.*

Discussion

- *The purpose of the discussion section is :*
  - ***To give the reader a summary of the main findings***
  - ***To put them into context by comparing with literatures***
  - ***To discuss future implications***
  - ***To state any shortcomings of the research design.***
- *Although the structure of the introduction can be visualized as a funnel, the discussion can be visualized as an inverted funnel.*
- *Thus, the introduction and discussion together form an hourglass shape.*
- *The discussion starts with the narrowest part by answering the research question in the summary of*

Discussion

- *main findings, and it then gradually widens out to comparisons with other studies and the interpretation of the study findings in the wider context of the study topic.*
- Although the results section merely presents data, the discussion section offers an interpretation of the data, and should never present new results.
- A typical discussion section consists of:
  - ***Main findings***
  - ***Comparison of findings with literatures***
  - ***Strengths and limitations***
  - ***Implications of the research.***

Discussion

- *Start by presenting the main findings, by answering the research question in exactly the same way as you stated it in the introduction section (see ‘‘Introduction’’).*
- *If you cannot present the main findings in three sentences, it may mean that you have forgotten the storyline of the paper.*
- *Do not waste words by repeating results in detail, and only use numbers or percentages if they are really necessary for your message.*
- *Do not ignore or cover up inconvenient results.*

Discussion

- *Reviewers will pick them up anyway, and it weakens your paper if you try to hide them.*
- *Also, do mention unexpected findings by explicitly stating that they were unexpected and did not relate to a prior hypothesis; such honesty will strengthen your paper.*
- *Include a separate subsection about the strengths and weaknesses of the study.*
- *Every study has its limitations, and you should make sure to mention them.*
- *Sometimes it is possible to counterbalance a limitation with a specific strength.*

Discussion

Checklist for the discussion

- Check if the discussion has a clear inverted funnel shape with distinct sections providing:
  - ***A summary of main findings (What did we find?);***
  - ***Comparisons with other studies (What is known?, What is new? and How does this fit in?)***
    - When comparing with other studies, discuss the reasons for differences and similarities with your results and do mention the limitations of those studies, but be respectful and objective.
  - ***Strengths and limitations (Are the findings true?***
  - ***Implications (Are the findings important? What can we do with them?).***
- Answer the research question in the first paragraph and check if this is in line with the research question posed in the introduction.
- Check if the discussion section does not present new results.
- Be frank about acknowledging limitations.

Conclusions

- *What are the larger implications of your work?*
- *What is the bigger picture?*
- *Work on incorporating these implications into your very last sentence*

Components of conclusion

- *Context of the study*
- *Stating the main findings*
- *Compare your result/Validate*
- *State importance of your findings*
- *Limitation*
- *Future work*

Example : Conclusion

- **Context of the study:** In this study a detailed experimental analysis to upgrade raw Biogas has been performed in order to increase the calorific value and remove unwanted components from the raw biogas.
- **Stating the main findings:** Based on the experimental result shows these innovative technologies reduce the acidic content (H_2S) by 99 % and removes the CO_2 by 82 %. Thus, the Methane content has been increased from 56.7 % to 85 %. The CO_2 content reduces from 36 % to 10 %.

Example : Conclusion

- **Compare your result/Validate**: The experimental has been validated by using data coming from literatures.
- **State importance of your findings:**
- **Limitation**: It is highly recommended to do economic analysis to prove that the additional cost to upgrade biogas can be returned back by selling the upgrade Biogas.
- **Future work**: Future works can be performed by using different Biogas upgrading technologies to better select the right technologies that are efficient, economical and environmental friendly.

Conclusion - examples

- The net electric efficiency of WTE plant can be increased by about **3 percentage points** compared with the most efficient, state of the art WTE plant without facing corrosion problems of boiler tubes.
- Among the configuration considered, the novel configuration based on **reheating with a "flue gas quench concept"** appears to be the most appealing one since it **increases the efficiency**, **limits the size and cost of radiative part** in an **environmental-friendly** way **without facing** corrosion problems of boiler tubes.
- Preliminary, conservative estimates show that, with **P_{EV} = 130 bar** and **T_{max} of steam 450°C,** it is possible to increase the net efficiency over **3.60 percentage points** and the extra electricity generated with RH comes at a cost in the neighborhood of **68 €/MWh.**
- Further investigation with **P_{EV}** below 130 bar with reheat, addition of HP regenerative feedwater preheater can increase the efficiency further.

References

- Each reference must include the names of all authors (in the same sequence in which they appear in the research proposal or thesis), the article and journal title, book title, volume number, page numbers, and year of publication.
- The exact format for depicting references within the body of the text and as well as the end of the research proposal varies from one discipline to another
- The information you give in the reference list must be enough for readers to find the books and papers in the library or a database.

References

- *Science moves forward by building on the research work of others, so it is important to appropriately cite previous work* ***to acknowledge your sources, underpin your hypothesis, show that you are familiar with the relevant field, and give credit to the work of others, as well as avoid being charged with plagiarism.***
- *Correct citations will allow readers to get an overview of the main work done previously within the field (the web).*

References

- If you have several references that back up a specific statement, choose the one you think is most appropriate. Consider choosing the reference which

1. Provides the highest level of evidence,
2. Is open-access available,
3. Has been most recently published, or
4. Has been published in the journal to which you are submitting your manuscript.

- The latter will demonstrate to editors that you know and read their journal (which you should anyway, if you want to successfully publish with them).

References

Checklist for citing and references

- *Use reference management software at all times.*
- *Find the requested output style in the author instructions of the target journal and adhere to it 100%.*
- *Always cite the original source behind a statement.*
- *Use your own words to describe facts derived from references, never copy paste sentences.*
- *If you need to choose among several references, select one by considering the level of evidence, open-access, year of publication, and published in the target journal.*
- *Meticulously check the final reference list for errors.*

Examples

Ethiopia, one of the few countries with geothermal potential in Africa, is endowed with a substantial amount of this energy system which is found scattered along the Ethiopian Rift Valley and the Danakil Depression (Minissale et al., 2017). Since the late 1970's, geo-

- Minissale, A., Corti, G., Tassi, F., Darrah, T.H., Vaselli, O., Montanari, D., Montegrossi, G., Yirgu, G., Selmo, E., Teclu, A., 2017. Geothermal potential and origin of natural thermal fluids in the northern Lake Abaya area, Main Ethiopian Rift, East Africa. J. Volcanol. Geotherm. Res. 336, 1–18, http://dx.doi.org/10.1016/j.jvolgeores.2017. 01.012.

Thank you !!!