



Studienfakultät
Forstwissenschaft und
Ressourcenmanagement



Wissenschaftszentrum Weihenstephan für
Ernährung, Landnutzung und Umwelt



Technische Universität München

Guidelines

“How to Write a Scientific Paper”

Edition: October 6th, 2015

Corresponding Lecturer

Gabriele Weber-Blaschke

Chair of Wood Science
weber-blaschke@hfm.tum.de
www.hfm.tum.de

Based on the Book “How to Write and Publish a Scientific Paper”
by Robert Day and Barbara Gastel,
7th edition, 2012, Cambridge University Press, pp. 300

Outlined for the course “Scientific Writing”
according to the requirements of the Master’s Program “Sustainable Resource Management”
at the School of Forest Science and Resource Management

Annotation:

The guidelines are based on the book by the authors Robert Day and Barbara Gastel and sum up the most important issues presented in this book. The supplementary recommendations are based on my experiences as author in and reviewer for international journals. Thus, I learned from many persons, from my academic teachers and colleagues as well as from unknown reviewers, to all of whom I would like to express my thanks and gratitude. Additionally, my thanks go to Ms. Elizabeth A. Hamzi-Schmidt for the English proof-reading, and to all the SRM students who have already written a scientific paper and gone through my review process in my course over the last few years. This has enabled me to find the pitfalls and difficulties in writing scientific papers.

Hopefully, the guidelines will be helpful and useful for our students at the beginning of their studies as far as the successful writing of scientific papers is concerned.

Any recommendations and remarks for improving the guidelines would be welcome.

Content

1. Requirements for Scientific Writing	3
1.1 General Remarks.....	3
1.2 Why “Scientific Writing” in the 1st Semester of SRM?	4
1.3 What is Scientific Writing?	4
1.4 What is a Scientific Paper?.....	5
1.5 Ethics in Scientific Writing	6
2. How to Prepare and Write a Scientific Paper (Original Research Paper)	7
2.1 How to Proceed with Scientific Writing	7
2.1.1 The Process of Writing.....	7
2.1.2 How to Reach Text Clarity	8
2.1.3 How the Readers Read a Paper/Report.....	8
2.2 How to Structure a Scientific Paper	9
2.2.1 The Extended IMRAD Approach	9
2.2.2 Instructions for Authors.....	10
2.3 How to Write the Different Chapters	10
2.3.1 How to Prepare the Title	11
2.3.2 How to List the Authors and Addresses.....	11
2.3.3 How to Prepare the Abstract	11
2.3.4 How to Write the Introduction.....	12
2.3.5 How to Write the Methods.....	13
2.3.6 How to Write the Results.....	13
2.3.7 How to Write the Discussion	14
2.3.8 How to Write the Conclusion.....	15
2.3.9 How to State the Acknowledgements.....	15
2.3.10 How to Cite the References.....	15
3. How to Write a Review Paper	17
3.1 What is a Review Paper	17
3.2 How to Structure a Review Paper	17
3.3 How to Write the Special Review Chapters	18
3.3.1 Title, Authors, Abstract, Key words	18
3.3.2 Introduction.....	18
3.3.3 Methods	18
3.3.4 Adapted “Results and Discussion” = “Analysis and Evaluation”	19
3.3.5 Conclusion.....	19
3.3.6 Acknowledgements, References	19
4. How to Look for and to Select Literature	19
5. How to Design the Scientific Paper	21

1. Requirements for Scientific Writing

1.1 General Remarks

Scientific Writing is not easy and a challenge for everyone, for beginners as well as for advanced researchers.

The guidelines will give a short overview about the most important issues and pitfalls according to Day and Gastel (2012) for beginning writers, e.g. students who have to write assignments, projects and excursions reports as well as Bachelor or Master's Theses or scientific articles. The recommendations can be transferred to all cases of writing scientific papers in general.

However, each discipline as well as each supervisor has different foci and different specific requirements. For this special information it is important to follow the instructions for authors of the respective scientific journals or of the respective supervisors.

The **most important pitfalls** are (see Recommendations in Chapter 2):

- Logical structure
- Coming quickly to the point
- Citation of literature
- Timing of Writing.

Additionally, there is a **great responsibility for all authors** when publishing research results (or writing assignments, etc.) (see Information in Chapter 1.5) considering the following issues:

- Writing the truth
- Avoiding (intentional) plagiarizing
- Listing the authors.

The formalism of writing a scientific paper is not an end in itself. It is internationally required and necessary to state clearly the content of research, to make the text readable as well as to state clearly the source where information was found.

Because I am not an English native speaker, the guidelines focus only on the procedure and content of scientific writing, but not on vocabulary. All non-English native speakers should attend such courses or at least use a service for English proof-reading of their papers. At TUM, there are many possibilities.

1.2 Why “Scientific Writing” in the 1st Semester of SRM?

In the 1st semester of the Master’s program “Sustainable Resource Management”, we offer the course “Scientific Writing”.

The purpose of the course is:

- To fulfill the requirements of the “Master of Science” degree
- To provide tools for writing scientific papers/reports which are required by your future employers: organizations, companies, research institutions, etc.

Therefore, the course provides:

- Basic knowledge about scientific writing = theory
- Training for its application = writing scientific papers with review process
- Preparation for different tasks within other SRM courses → assignments/master’s thesis.

1.3 What is Scientific Writing?

The purpose of scientific writing is **to communicate new scientific findings or knowledge**.

The most important aspect and key characteristic for scientific writing is the **need for clarity**.

Successful scientific research is the result of a clear mind. Therefore, you have

- first to start with a clearly stated problem (→ clear and specific research questions) and
- then based on your research you have to produce clearly stated conclusions (→ answers to the questions asked before).

During writing you have to consider that this is a two-way-process (writer – reader). The scientific paper (signal/information) must be received (published) and understood by the **intended audience**. Therefore,

- the words must be clear, clearly defined, simple, well-ordered and
- the words should have a certain meaning, without any ornamentation or ambiguity.

The **specific interests of the readers** have always to be addressed. Readers of scientific papers can be from different disciplines; they are, for instance,

- scientists with the same discipline as the author
- scientists from other disciplines than the author
- students embarking on their careers
- readers whose native language is not English.

The readers of reports can be, for example,

- members of companies
- members of administrations and agencies
- members of research and development institutes.

Therefore, the **language** of a scientific paper should be the appropriate language:

- for scientific papers: mostly English
- for reports and papers for applied journals: mother language of the sponsor/reader.

1.4 What is a Scientific Paper?

The scientific papers published in scientific (peer-reviewed) journals are classified as follows:

- Result-oriented papers:
 - **Original research article** (from a few pages up to 20 pages and more)
 - Letters/short communication (brief research papers: < 6 Pages)
 - Commentary/Forum (brief, debate-oriented discussion)
- Less result-oriented papers:
 - Letter to the editor (responses to earlier published papers)
 - **Review article** (critical survey or overview of recent research)
 - Book review (quite short, 1-2 pages)
 - Editorial (about recent discoveries, ethical concerns, 1 page).

If **scientific paper** is the term for an **original research article**, it is a written and published report describing original research results. An acceptable primary scientific publication must be first disclosure containing sufficient information to enable peers

- to assess observations,
- to repeat experiments and
- to evaluate intellectual processes.

A **review article/paper** may review almost anything; most typically, the recent work in a defined subject area or the work of a particular individual or group. Thus, the review paper is designed to summarize, analyze, evaluate, or synthesize information that has already been published. The problem of dual publication does not normally arise because the review nature of the work is usually obvious. From the best review papers come new syntheses, new ideas and theories, and even new paradigms.

The requirements of the **original research article** (Chapter 2) as well as of a **review article** (Chapters 2 and 3) are highlighted in these guidelines.

In addition to scientific articles specially published in scientific journals, there also exist other types of scientific papers, for instance,

- **(Technical) Reports:** a transitional form between book and article
- **Proposals:** technical document to apply for financial project support (see SRM course 3rd semester).

1.5 Ethics in Scientific Writing

Day & Gastel (2012) explain well and specify the most important basic ethical norms which are in general obvious; however, (not only) for students and beginners of doing research and writing scientific papers it is important to state them in such guidelines:

- **Authenticity**
 - Your research reported in a journal should actually have been done!
“Dry-labbing”, fabrication, fiction is unethical!
- **Accuracy**
 - You have to clearly interpret and present your reported data without omitting outlying points, preparing data in ways that accentuate the findings, etc.
- **Originality**
 - The findings in your scientific paper must be new (also in a review paper which is not only a summary of some already published articles (see Chapter 3)!
 - You must submit your paper only to one journal at the same time; if it is not accepted by this journal, then you can submit it to another journal.
- **Credit**
 - **If your paper includes information or ideas that are not your own, be sure to cite the source** (see Chapter 2.3.10)!
“Copy & paste” is unethical and forbidden; your paper will be rejected (by the journal, by the examiner ...) and you have to bear the consequences (ban of publishing, failing the examination, exclusion from universities ...)!
→ **List as an author of your paper everyone who qualifies for authorship** (see Chapter 2.3.2).
However, be aware that every author has actually to contribute to the research and paper and is responsible for the whole content!
 - Include in the acknowledgement those sources of help or other support that should be listed (see Chapter 2.3.9).

2. How to Prepare and Write a Scientific Paper (Original Research Paper)

The procedure of scientific writing and maintaining the logical thread within a scientific paper, which are described in this chapter, can be applied to original research papers as well as to review papers. Special requirements for review papers are explained in Chapter 3.

2.1 How to Proceed with Scientific Writing

2.1.1 The Process of Writing

Very important is the schedule for the process of writing to be in time for special submission deadlines to avoid stress.

In general, the journals do not have any submission deadlines except when a call for a special issue (with a special topic) is announced, but they do have deadlines for revising the papers.

However, deadlines exist for the submission of assignments, bachelor's, master's, and PhD theses (the latter usually because the funding runs out). Therefore, the process of writing should be known and combined with a precise schedule:

- **Preparation**
 - Idea of the topic
 - Decision on writing
- **Planning**
 - Concept of the paper
 - Clarity of the target group (audience/readers)
 - Rough structure
- **Elaboration**
 - Elaboration of the single chapters, paragraphs (text)
 - Design of figures, tables
- **Verification**
 - Optimization of the structure
 - Optimization of the text (clarity, simplicity, etc.)
- **Revision**
 - Final corrections (errors in orthography, grammar, faults in design, etc.)

Our Recommendations:

You have to plan **when to start with the process of writing**: at the beginning, during or at the end of the research work. Therefore, you need a schedule combining research work and writing! Additionally, consider that also the time for the verification and the revision stage **should not be underestimated**.

2.1.2 How to Reach Text Clarity

The text of a scientific paper should be well-structured, fast to read and easy to understand. The clarity which was stated as highly important before (see Chapter 1.3) can be achieved by considering the following main components:

- **Structure** (importance very high ++)
 - Headlines
 - Paragraphs
 - Enumeration points
- **Simplicity** (importance high +)
 - Short, clear words
 - Explained special terms
- **Relevance/significance** (importance middle-high 0-+)
 - Concentrated, logical content
 - Coming quickly to the point
- **Reading stimulation** (importance middle-high 0-+)
 - Examples, case studies
 - Figures, tables, comparisons.

2.1.3 How the Readers Read a Paper/Report

For the planning of the scientific paper, it is useful to consider how the readers (or you) will read a paper. The readers do not intend to start at the beginning and to read the whole paper, because they are always under time-pressure. They want only to know the most important findings and read **mostly from the back to the front**.

Thus, they tend to read only the following parts:

- Abstract (~100-200 words; cited in literature databanks)
- List of content (if available, e. g. in reports, not in articles)
- Summary (~1-3 pages, only in reports/theses, not in articles)
- Conclusions
- Special interesting facts about results (presented, for example, in tables, figures)
- Special interesting facts about methods.

2.2 How to Structure a Scientific Paper

2.2.1 The Extended IMRAD Approach

According to Day and Gastel (2012), a scientific paper is organized to meet the needs of valid publication. The most common labeling of the component parts (chapters/sections) in the basic sciences is: Introduction, **M**ethods, **R**esults **A**nd **D**iscussion; hence the acronym **IMRAD**. These parts are the core of the papers; however, some other parts are also necessary. Thus, the paper should be structured in the following order:

- Title
- Authors
- Abstract (~ 100-250 words; cited in literature databanks!)
- Key words (~ 6)
- [Pre-word with acknowledgements at the beginning (only in reports/master's thesis, ...)]
- List of content (not in articles for journals, but necessary in reports/thesis!)
- Introduction (→ objectives, questions!)
- Methods
- Results
- Discussion
- Conclusions (→ answers!)
- Summary (not in articles for journals, but in reports/master's thesis ~ 1-3 pages!)]
- Acknowledgements (only in articles)
- References!
- [Appendix/Appendices (only if necessary, often CD-ROMs attached)]

The **logic of IMRAD** can be defined in question form:

- “Introduction”: What problem was studied?
- “Methods”: How was the problem studied?
- “Results”: What were the findings?
- “Discussion”: What do these findings mean?

Our Recommendations:

This simple logical format is **often the best choice**, especially in natural or technical science, but often also in socio-economic science. It can be applied to all topics where data is collected, analyzed and evaluated by the means of laboratory and experimental work, field surveys, case studies, literature review, questionnaires, etc.

Of course, there are also exceptions. However, even in descriptive papers, review articles, etc. the same logical progression from problem to solution can be transferred to such publications with an adaptation of the titles for the chapter headings.

In special cases, depending on the topic, “Methods and Results”, “Results and Discussion”, or “Discussion and Conclusions” are combined in one chapter. However, the different parts should be identifiable and kept apart by the readers.

In summary, the **simple logic of IMRAD helps you to organize and write the manuscript**, and provide an easy road-map for reviewers and readers to follow in reading the paper or thesis.

2.2.2 Instructions for Authors

For learning about the organization and structure of scientific papers, you should have a look at the instructions for authors publishing in international journals with review process (see homepages via internet). You have to follow these guidelines precisely, if you want to publish in the respective journals. Here are some examples:

- Publisher: Elsevier: <http://www.elsevier.com/> >> books & journals
 → **“Guide for Authors”**
 → Journals, e.g. “Ecological Economics”, “Resources, Conservation and Recycling”,
 “Biomass & Bioenergy”
- Publisher: Springer: <http://www.springer.com> >> subject/search
 → **“Instructions for Authors”**
 → Journals, e.g.: “International Journal of Life Cycle Assessment”, “European Journal
 of Forest Research”, “European Journal of Wood and Wood Products”.

Another possibility for you to learn is to analyze similar papers as you want to write, for instance,

- papers about the same topic in the journal in which you intend to publish,
- Master’s Theses at the same institution (from the same supervisor) where (and with whom) you intend to write your Master Thesis.

2.3 How to Write the Different Chapters

It is not only important to have the right structure and chapter headlines, but also to write the right content in the corresponding chapters.

In the following sections, a short synopsis will be given of how the text should be prepared. For further details, read through the book written by Day and Gastel (2012) carefully and take notes on particularly useful advice (you would like to remember).

2.3.1 How to Prepare the Title

- Importance of the title
 - fewest possible words that adequately describe the contents of the paper
- Length of the title
 - not too short and not too long
- Need for specific titles
 - not too general
- Importance of syntax
 - look at the right word order
- The title as a label
 - simpler as a sentence
- Abbreviations and jargon
 - never!

2.3.2 How to List the Authors and Addresses

- The order of the names
 - no generally accepted conventions
 - but modern trend: first author = senior author and primary progenitor of the work,
last author = director of the laboratory or institute
- **Definition of authorship**
 - **only those researchers directly involved, not colleagues**
 - **Authors are responsible for the results!**
- Proper naming and consistent form
 - First name, middle initial, last name (usual in USA)
- Listing the addresses
 - Name and address of the laboratory in which the work was done,
the new address of an author is to be indicated in a footnote “present address”
 - Mailing address!

2.3.3 How to Prepare the Abstract

- Definition
 - Mini-version of the paper
 - brief summary of each of the main sections of the paper

- Preparation
 - < 250 words (depending on the journals, some abstracts with up to 400 words)
 - single paragraph
 - no citation of references
- Purpose
 - Information for the reader indicating that the entire paper is worth reading
 - Input for literature databanks

☒ **Our Recommendation:**

Write 1-2 sentences for the following sections: introduction (with problem statement and objectives), methods, most interesting results, most important conclusions.

2.3.4 How to Write the Introduction

- Supply of sufficient background information
 - Definition of the (general) problem
 - State of knowledge about the problem (in detail)
 - Carving out the gap of research and development
- Objectives of the work/paper
 - Overall purpose/goal: to fill the gap in R&D
 - Stating specific objectives: as objectives,
as hypotheses or
as research questions.

☒ **Our Recommendations:**

Begin the chapter “Introduction” with the **problem statement**. Set the context of your research and capture the reader's attention. Explain the background of your study, starting from a broad perspective narrowing it down to your own research goal. Go into more detail when presenting the **state of knowledge to date**. Review what is known about your research topic as far as it is relevant. Then, develop the **research or development gap** from the existing knowledge. This is an important part, because your research work starts with the “gap” and should result in new knowledge or new findings. Therefore, the **goal** of your research work is to close the gap which you have discovered. Then, specify your **objectives**. The easiest way is to set some **special research questions**, which you will directly answer later in the respective chapter “Conclusion”. Thus, you do not mix up/confuse this part with working steps. For example, “to make life cycle assessment”, “to make soil analysis” are working steps, and not objectives as such.

- Citations and abbreviations
 - Citation of literature which relates closely to this paper
 - = in “problem statement” and “state of knowledge” you do not write about your own work, but report about already published results, thus you have to cite the sources!
 - Definition of any specialized terms or abbreviations which are intended to be used.

2.3.5 How to Write the Methods

- Purpose of the section
 - Description of the experimental design in detail
 - = Repetition must be possible
- Materials and methods
 - Exact technical specifications, quantities and sources
 - Chronological order, if possible
 - Correct form and grammar = past tense
- Measurements and Analysis
 - Precise description of all relevant details
 - Citation of literature about published methods
 - Description of the statistical analyses

☒ **Our Recommendations:**

For writing this chapter “Methods” in an understandable, descriptive, clear, and repetitive way, a **good structure** will help:

- **Sub-headings** like in the chapter Results = Consistency
- Presentation in **tabular form**, e.g. of variants, numbers, specifications
- Presentation using **flow charts, figures/graphs, photos**, e.g. of procedures, processes, technologies.

2.3.6 How to Write the Results

- Content of the Results’ Section
 - Presentation and description (interpretation) of the data (only the new, own results)
 - Use of Past tense
 - Representative data, not repetitive data
- How to handle data
 - One or only little data = text
 - Repetitive determinations = tables or graphs

- Strive for clarity
→ Short, clear, simple
- Avoid redundancy
→ no repetition in words, if results are apparent in figures and tables.

☒ **Our Recommendations:**

This chapter “Results” can be written concisely and simply if the data are presented by **tables and graphs**. One dataset has to be presented either by a table **or** a graph, not a table **and** a graph! If specific values need to be presented you should use the table form; if e.g. different variants should be compared, the reader often gets a better overview by looking at figures. Figures could also be helpful, if a large amount of data should be summarized.

As far as “How to design effective graphs/figures and tables?” is concerned, look in journals specific to your topic or follow the advice given by Day and Gastel (2012) in the respective chapter in their book.

2.3.7 How to Write the Discussion

- Assessment of the results
→ Comparison of your own results with the results of other studies
= Citation of already published literature!
- Components
→ Principles, relationships, generalizations shown by the results
= Discussion, not recapitulation of the results
→ Exceptions, lack of correlation, open points
→ Referring to published work:
= Results and interpretations in agreement with or in contrast to your results

☒ **Our Recommendations:**

The writing of the chapter “Discussion” is the most difficult one. **Compare** your own data/results with the results from other already published papers (and cite them!). Outline the discussion part in a similar way to that in the Results section = consistency. Evaluate whether your results are **in agreement with or in contrast to** existing knowledge **to date**. You can describe why or where the differences occur, e.g. in methods, in sites, in special conditions, etc.

Sometimes it is difficult to discuss results without repetition from the chapter “Results”. Then, there is the possibility to combine the “Results” and “Discussion” sections into one chapter. However, in your presentation you have to classify clearly which are your own results and which are taken from other studies. For beginners, it is often easier to separate these sections.

2.3.8 How to Write the Conclusion

- Answers to the questions formulated in the chapter Introduction
 - Same order as the questions
- Recommendations
 - Theoretical implications
 - Possible practical applications
 - = Including the significance of the work
 - = Defining scientific truth
- Outlook
 - Further research
 - further possible practical, political, socio-economic developments

☒ **Our Recommendations:**

For the chapter “Conclusion” it is important to make the **link to the questions** asked at the beginning of the paper in the “Introduction” chapter. Every question should be answered as a corresponding conclusion based on the evaluated results (i.e. based on the Results and Discussion section(s)).

The following **recommendations** can often be valid for both **scientific work and practical implementation/application**.

During the research, possibly new questions occur which could not be solved within the limited time period of the current project. Thus, an **outlook for further research needs** can be drawn.

2.3.9 How to State the Acknowledgements

The support provided by any others that are not the actual authors should be stated in this chapter. Thanks go to:

- Institutions which support the research by funding it,
- Persons who give technical support (in the laboratory, in the field, ...)
- Persons who provide proof-reading.

2.3.10 How to Cite the References

- Rules to follow
 - Only significant, published references
 - **All references cited in the text must be listed in the chapter References.**
 - **All references listed in the chapter References must be cited in the text.**

- Reference style (System)
 - **Different systems depending on the journals (and supervisors)**
 - = Name and year system (alphabetical order in the reference list)
 - ⇒ often in natural science
 - = Alphabet-number system
 - = Citation order system
 - (numbering system without alphabetical order in reference list)
 - ⇒ often in engineering science
- Citation
 - Complete citation to be recommended (author, year, title, source)
 - = Reader can decide by title, whether the reference could be interesting
 - Inclusive pagination (first and last page numbers)
 - = Reader knows length of the paper
 - Journal abbreviation (now existing standard system)
 - Citation in the text: e.g. “Smith (1997) studied”
e.g. “....” (Smith 1997).
 - Citation with different numbers of authors in the text:
 - = 1 author: Smith (1997)
 - = 2 authors: Smith and Jones (1997)
 - = 3 and more authors: Smith et al. (1997)

☒ **Our Recommendations:**

The “**Name and year system**” for “Citation” is often used. I personally prefer this system, because 1) in the text there is information about authors and years in short form, and 2) in the reference list the references can be easily found by the alphabetical order. To find the literature easily, the **precise citation** of literature in the reference list is extremely important.

Do not forget the **complete, right and precise citation** to avoid the risk of plagiarism with serious consequences for the author.

For special requirements of the citation follow the **instructions for authors** in the journals or from your supervisor.

3. How to Write a Review Paper

3.1 What is a Review Paper

A review paper is not an original publication. The purpose of a review paper is to review previously published literature and put it into some kind of perspective. The really good review papers are much more than just summaries of the annotated literature in a sequence. They offer **critical evaluation of the published literature** and provide **important conclusions** based on that literature.

3.2 How to Structure a Review Paper

The organization of a review paper usually differs from that of a research paper. The introduction, materials and methods, results, and discussion arrangement is generally not used for review papers. However, some review papers are composed more or less according to the IMRAD format.

Thus, the review article could be structured in the following order:

- Title
- Authors
- Abstract
- Key words
- Introduction (→ objectives, questions!)
- Methods
- Combined chapter with respective sub-chapters concerning the analysis (“results”) and evaluation (“discussion”) of the literature on the special topic and including special issues
- Conclusions (→ answers!)
- Acknowledgements
- References!

☒ **Our Recommendations:**

For beginners I would recommend to **transfer the logical thread of the IMRAD** approach to a review paper. However, you have to **adapt your chapter titles** to the content of your critical evaluation. Additionally, the contents of the chapters “Introduction”, “Methods”, “Results and Discussion” also have to be adapted to the review format, see special advice in Chapter 3.3. However, the logical thread still remains.

3.3 How to Write the Special Review Chapters

3.3.1 Title, Authors, Abstract, Key words

The advice to the parts “Title”, “Authors”, “Abstract”, and “Key Words” given for original research articles in the Chapter 2.3.1 to 2.3.3 are **also valid** for review articles.

3.3.2 Introduction

☒ **Our Recommendations:**

The introduction of the original research article is generally sub-divided into the parts: problem statement, state of knowledge, research gap and objectives (see Chapter 2.3.4). In the review article, however, the part “**state of knowledge**” is the core of the paper. Thus, this part belongs now to the “Results and Discussion” section of the review, however, with more depth and more clearly specified (see Chapter 3.3.4).

Therefore, I recommend you define in this chapter “Introduction” the **problem** you want to address, and describe the **background to this particular problem**.

Then, you should describe the **gap of knowledge**, in spite of the existing literature, in respect to the special topic. Possibly, many unclear points exist because of many published papers which are, for instance, in contrast to each other.

The **goal** of your review paper is to close this gap, by evaluating the existing literature based on special criteria. Specific **research questions**, which you want to answer in the later chapter “Conclusion”, would precise your objectives.

3.3.3 Methods

☒ **Our Recommendations:**

In many review articles, the chapter “Methods” is missing.

However, it has become more and more usual to describe the procedure of literature choice and analysis as method of a review very carefully. This is useful 1) because of the large amount of existing literature and information which you have to select, and 2) because of the complex survey which you have to organize well.

▪ **Literature Selection:**

Here you can describe which **sources** you have looked through, which **criteria** you have chosen for the selection, e.g. from which time period, from which region, which special issues have been addressed, etc. Consider that you may well affect your review result by the selection of the literature.

- **Method of Literature Analysis:**

Here you have to decide carefully by which means and by which **criteria** you intend to analyze the literature. These criteria will also help you to outline the review parts “Analysis” and “Evaluation”.

3.3.4 Adapted “Results and Discussion” = “Analysis and Evaluation”

- ☒ **Our Recommendations:**

This chapter is the core of the review article. Here you have to create special titles for the chapter and sub-chapters. The criteria which you set for the analysis of the literature will help to outline this part. Thus, you should have more than a sequence of summaries. A **comparison of the studies concerning the defined issues and criteria** will also help, preferably with **descriptive tables** (or figures).

3.3.5 Conclusion

- ☒ **Our Recommendations:**

As recommended for the original research paper in Chapter 2.3.8, also for the review paper the **linkage to the questions** asked at the beginning of the paper in the chapter “Introduction” is important. Every question should be answered as a corresponding conclusion based on the literature which you have analyzed and evaluated.

The **outlook** of the review paper should end in **new hypotheses, new ideas** or new paradigms and possibly in **new research needs** which can be clearly specified.

3.3.6 Acknowledgements, References

The advice for the parts “Acknowledgements” and “References” given for original research articles in Chapter 2.3 are **also valid** for review articles.

4. How to Look for and to Select Literature

For almost all scientific work, the selection and use of appropriate literature is of paramount importance. Whenever available for your subject, the use of articles published in peer-reviewed scientific journals is a prerequisite of scientific work. As a rule, textbooks, lecture notes, practitioner journals are less appropriate.

Research papers/reports can be published in different written media. They are often **classified as primary, secondary, and other literature:**

- Primary literature: well-recognized, reviewed journals, (edited books)
 - = high quality → generally peer-reviewed,
 - = high value → impact factor → important for ranking in the scientific community,
 - = because of the doi (=Digital Object Identifier) available forever in the internet.

- Secondary literature: e. g. conference proceedings, etc.
= low to high quality
 - with and without review process, sometimes only abstracts and not full papers published,
 - source often only found on web page of the conference, future availability not guaranteed
- Other literature: local bulletins, newsletters, web pages
= source and quality mostly unknown,
 - source often only found on web page of the conference, future availability not guaranteed,
 - in the **www** often too much information: time needed to evaluate information, setting priorities,
 - difficult to judge about the quality of the information.

At TUM, **library tours** are provided to supervise you in this literature work. Here are some hints on **how you can find the respective literature**:

- Primary literature
 - Books
 - Bavarian Library Network: <http://gateway-bayern.de/>
 >> Sprachauswahl englisch
 - University Library of TUM: <http://www.ub.tum.de/en>
 >> Search & Find >> Online-Catalogues, databases, e-journals, etc.
 - **Scientific papers**
 - Electronic Journals Library of TUM:
 <http://rzblx1.uni-regensburg.de/ezeit/ezb.phtml?bibid=TUM&colors=7&lang=en>
 - Scopus: <http://www.scopus.com/>
 - Science direct: <http://www.sciencedirect.com/>
 - PubMed: <http://www.ncbi.nlm.nih.gov/pubmed>
- Secondary and other literature
 - Web pages
 - google scholar: <http://scholar.google.com/>
 = more scientifically focused
 = search with key words
 - Homepages of agencies and research institutes, etc.
 - = research studies (which are not yet published in peer-reviewed journals)
 - = search by links/key words
 - Conference proceedings
 - = sometimes scientific papers, not only abstracts (on CDs or online).

5. How to Design the Scientific Paper

☒ **Our Recommendations:**

Every **journal** has its own requirements. Follow the instructions for authors carefully.

For writing **assignments or theses**, ask your supervisor for special requirements.

The following **pieces of advice** could help you:

- Layout: A 4 paper, one or double-sided printing
- Margins: Left - 2.5 cm and right - 2.5 cm or inside - 3 cm and outside - 2 cm,
Top - 2.5 cm, at the bottom - 2.5 cm.
- Font type and size: Arial 12 pt (minimum 11 pt) or Times New Roman 12 pt.
- Line spacing: 1.3 to 1.5 line spacing between the lines
- Passage spacing: e.g. 6 pt spacing between different passages
- Tables/figures: Font type Arial, not smaller than 10 pt.