

# Boost Your Career by Writing Articles and Technical Papers

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Publishing articles and technical papers provides value to your career and employer. Learn how to select a topic, follow the rules of good writing, and organize a manuscript to create a compelling paper.

Writing articles and technical papers builds your résumé, increases your value to current and prospective employers, and helps further your career and enhance your profile. Creating a quality manuscript can be a daunting task; developing a better understanding of the writing process can improve the quality of your work. Professional development plans often include publishing articles and technical papers. For example, in my experience as an engineering consultant, I assisted a client by coauthoring an article so he could qualify for a promotion. Perhaps the most important outcome is that the process of taking your ideas from a rough outline to publication helps you develop a deeper understanding of technical issues, improves the quality of your writing, and hones your presentation skills.

The simplest option is to self-publish by writing a whitepaper and posting the document on your website, LinkedIn profile, or your member profile on a professional society's website. This method requires less effort, but it lacks the

audience of a formal publication. In addition, self-publishing does not provide an opportunity to work with a professional editor or increase your credibility from peer reviewers.

Another way to share your work is through trade magazines, such as *CEP* or *Hydrocarbon Processing*, that publish many articles from working engineers who are knowledgeable in a specific discipline. Conferences such as the AIChE Spring Meeting and Global Congress on Process Safety (GCPS), the International Water Conference, or other conferences sponsored by technical societies such as the American Society of Mechanical Engineers (ASME) accept technical papers and expect authors to present them at the conference. Reviewing published articles and conference papers can provide examples of topics, as well as the typical job titles and company affiliations of authors. The publication's advertising materials provide information about the demographics of the audience.

Note that this article pertains primarily to engineers and other technical professionals in the industrial work-

force. Engineering researchers and technical professionals working in academia have a completely different set of guidelines and formats for publishing in technical journals.

This article gives practical advice about the process of writing articles and technical papers from the perspective of an experienced author. It will demonstrate the hallmarks of quality writing that editors and conference program chairs expect through step-by-step instructions and useful examples.

### Article vs. technical paper

The primary differences between an article and a technical paper are the scope and format (Table 1). For example, the scope of an article focuses on practical information and fundamentals, the format is shorter than a technical paper, and the publication's editor reviews the manuscript. An article could explain the engineering fundamentals of specific technologies or convey practical information such as design, operation, troubleshooting, and regulatory issues.

Examples of a technical paper's scope include an in-depth discussion of a subject, the results of an experiment or field study, a review of a new technology or product, or a review of a failure investigation or other problem. Additional elements of technical papers include discussion of experimental design and hardware and in-depth analyses of the data. A technical paper usually includes a list of references — previously published information and literature that support the conclusions in the manuscript. A technical paper requires review by an editor or conference chair and often requires a review by a professional who is knowledgeable about the subject (*i.e.*, peer review).

Because the scope and depth of articles and technical papers are very different, your knowledge of the topic that you select and your objective as an author will determine the type of manuscript.

Table 1. The primary differences between articles and technical papers are the scope, format, audience, citations, and review process.

Attribute	Article	Technical Paper
Scope	<ul style="list-style-type: none"> <li>• Fundamentals</li> <li>• Practical information</li> </ul>	<ul style="list-style-type: none"> <li>• Detailed data and analysis</li> <li>• In-depth discussion</li> </ul>
Format	<ul style="list-style-type: none"> <li>• 2,500–6,000 words</li> <li>• 3–8 pages</li> </ul>	<ul style="list-style-type: none"> <li>• 6,000–12,000 words</li> <li>• 6–15 pages</li> </ul>
Audience	<ul style="list-style-type: none"> <li>• Non-expert</li> <li>• Early-career professionals</li> <li>• Working engineers</li> </ul>	<ul style="list-style-type: none"> <li>• Experts</li> <li>• Experienced professionals</li> </ul>
Citations	<ul style="list-style-type: none"> <li>• Footnotes</li> <li>• References</li> </ul>	<ul style="list-style-type: none"> <li>• Comprehensive list of references</li> </ul>
Review	<ul style="list-style-type: none"> <li>• Publication's editor</li> </ul>	<ul style="list-style-type: none"> <li>• Peer review</li> </ul>

### Define the topic

Selecting a topic is the first step. Think about new developments, recent problems, or a topic about which you have significant knowledge. Imagine that you are an editor; what are the trending topics? Examples of emerging issues or technologies include sustainability, artificial intelligence (AI), and decarbonization. Research current developments and identify any gaps in your knowledge; investigate sources such as trade and scientific publications. Talking to editors and reviewing topics of past conference sessions helps you understand the level of interest from professionals in your field. When you have completed this research and decided on a topic, write a concise statement of the main point of your paper, *i.e.*, a thesis statement.

### Define the audience

Before you can write your paper, you will need to identify an audience interested in your subject. Some of the most important demographics of the audience include industry affiliation, technology, role and responsibility within the organization, career stage, education, and geographic location. This data will help you find the right publication or conference for your article or technical paper. Organizations like AIChE that have an annual meeting as well as a monthly trade publication may provide an opportunity to publish selected papers in their trade publication or allow publication in other journals, thereby increasing your visibility.

Conference organizers and owners of trade publications can provide detailed information about their audience. The primary users of this information are advertisers; however, this information is very helpful for authors. For example, if you are writing about a highly technical topic, you can find the percentage of engineers, scientists, and researchers who subscribe to a specific publication.

### Find the publisher

Finding the right publisher starts with planning. Editors require an abstract to be submitted four to six months before publication for unsolicited articles. Conference program committees require a similar timeline.

The next step is to evaluate the content of past conferences and trade publications. If you want to write a technical paper for a conference, review the titles and abstracts of the papers, the authors, and the authors' companies. Read through the list of papers and the keynote speaker(s) to identify topics and emerging trends in your expertise. After using the content from past conferences to generate a topic of your own, contact the program chair to confirm that your subject is consistent with the topics defined by the current conference committee. Remember that many conferences will increase your visibility by selling your technical paper.

If you are considering submitting an article to a trade

magazine, start by reviewing the current editorial calendar. If your expertise and experience match the topics in the editorial calendar or you are knowledgeable about a trending topic, the likelihood of acceptance of your article dramatically increases. Review past issues of trade publications to understand the featured subjects and articles; you don't want to write about the same topic unless you have something new to contribute or different to discuss. The next step is to speak with an editor to understand their needs and preferred topics. Ask the editor about the most popular or emerging topics and whether the publication periodically dedicates an issue to a specific subject.

As you research previously published technical papers and articles in a specific trade magazine or from a conference, conduct some research on the authors and their companies. If you are an employee, look for authors from your company's competitors. If you are a consultant, look for authors from prospective clients as well as your competitors.

### Structuring your manuscript

Articles and technical papers have a similar high-level structure: introduction, discussion, and conclusion. However, the differences in audience, length, and depth of the subject matter change the content of each section. For example, technical papers have a greater relevance for professionals with a deep knowledge of specific scientific and engineering principles, whereas the target audience for articles is professionals whose work involves the practical application of scientific and engineering principles. The structure of an article or technical paper includes the following sections:

- **Abstract.** In a technical paper, the abstract is a brief summary that includes the key ideas or problems, the impact or solution, and the main results of the study. In an article, an abstract can take many forms: a brief statement of the article's content to intrigue readers, a longer abstract resembling that of a technical paper, or no abstract.

- **Introduction.** This section provides background information about the topic and includes the thesis statement. Background information may include an explanation of the context or importance of the subject matter (e.g., advancing knowledge, solving a specific problem).

- **Body.** The body is the main part of the manuscript, and it often includes subsections to organize the content of the paper. In an article, each subsection might describe different aspects of the article's topic. For technical papers, subsections might discuss the results of an experiment using common subheadings such as "Materials and Methods," "Experimental Design," "Results," and "Discussion of Results." These subsections will provide the reader with information about the equipment and design of an experiment, specific details about the analytical procedures for test results, statistical analyses of the data to validate the researcher's conclusions,

and a list of reference publications that provide information that supports the researcher's conclusions.

- **Conclusion.** The conclusion section is a summary of the main points of the paper and a restatement of the thesis statement.

- **References.** The sources cited in the article or technical paper should appear in a list at the end of the manuscript. A technical paper includes a comprehensive literature cited section. Articles are often more flexible and can include anything from a comprehensive list to no references. Articles that have little or no data may have fewer or no references; however, the article may use citations noting the source of specific information.

The next step is to use this structure to create an outline. List your thoughts and organize them in a logical sequence. Make notes to add relevant figures, photographs, or tables. Remember that using graphs and tables to illustrate your key points makes complex datasets easier to understand. Similarly, photographs provide invaluable information.

### Good writing

Even for experienced writers, creating a high-quality narrative is challenging. Many engineers have deep technical knowledge; however, their managers, their peers, and the audience reading their article or listening to the presentation of a technical paper at a conference are rarely experts. The mark of a good writer is the ability to explain complex technical topics to non-experts. Your aptitude in communicating to a broader audience increases your credibility and your visibility. This skill can result in career opportunities within your own organization or with future employers.

Good writing requires practice and a willingness to follow some fundamental rules: good grammar, no passive voice, no colloquialisms, precise language, and concise sentences. Technical manuscripts also require an objective and unbiased perspective. Other tips include using strong verbs

### What to do when you have missed a conference deadline?

In my work studying *Legionella*, I finished a field trial of a novel technology to kill the bacteria in evaporative cooling water systems. I wrote a manuscript describing this research but missed the deadline to present the paper at a conference. When I called the conference program chair, she said it could be a standby paper. I also called the editor of the conference's trade magazine, and he was very interested in publishing my paper in the issue that would be released a month before the conference. Shortly before the conference, the program chair notified me that there was an opening to present my paper. The key takeaway: ask anyway. You never know who might be interested in your manuscript or when a conference spot might be available.

to engage the reader and clearly explaining complex ideas. Consider using an online tool like Grammarly that integrates with Microsoft Word to improve your grammar.

*Example of poor grammar.* Sometimes it's easier to learn how to write when you study the difference between good and poor grammar. The sentence "This also would help the reader's understanding of why chlorine dioxide is so good at removing biofilm" is an example of a sentence with poor grammar. The indications of poor grammar in this example include a vague subject, extraneous information, and an imprecise adjective:

- the subject, "This," is vague; an example of a clear subject is "reaction mechanism"
- the addition of "the reader's understanding" is not necessary
- the adjective "good" is vague; "effective" would be a better, more precise choice.

After improving the grammar, the sentence reads: "This reaction mechanism explains why chlorine dioxide is so effective at removing biofilm."

*Passive vs. active voice.* Passive voice is often awkward and ambiguous due to the grammatical construction of the sentence. While you may see examples of passive voice in technical papers and articles, active voice is a better choice for these types of manuscripts. Active voice is more concise and easier to understand than passive voice.

Learning the difference between active and passive voice can be challenging. In the following two sentences, notice the absence of the subject in the passive voice example, making it impossible to identify "who" or "what" is the subject. In contrast, the subject of the active voice example, "water treatment supplier," is clear.

- *Passive voice.* "To eliminate the biofilm and metal oxidation, a chloramine biocide program was proposed."
- *Active voice.* "The water treatment supplier proposed a chloramine biocide program to eliminate the biofilm and metal oxidation."

*Common mistakes.* Other frequent challenges for new authors include the use of colloquialisms, acronyms, or jargon unique to a specific application or niche discipline. An

example of two common colloquialisms that could create confusion, especially for an international audience, is "ball-park" and "back of the envelope" when used to describe the concept of an estimated value. Acronyms are ubiquitous; the first time that you use a term that has an acronym, use this format: fluid catalytic cracker (FCC). All other references to this term can use the acronym.

When jargon is necessary, use this technique: the first time that you use the term, include an explanation to allow the audience to easily understand the concept. An example of jargon from my experience would be ClarAtor. ClarAtor is a trade name for an influent clarifier; however, plant staff converted it to ClarAtor as a nickname for their clarifier. In most cases, jargon is not appropriate in published manuscripts; however, jargon may be important if the document is a report for a client or customer. To minimize commercial content, editors and conference program staff have strict rules regarding the use of a trade name in an article or technical paper such as "allow the first mention to use the trade name; all subsequent references will use a generic term."

### Preparing the manuscript

After you have completed the previous steps and understand the fundamental structure of articles and technical papers, it's time to write your first draft based on your outline. The primary goal in creating the rough draft is to document your thoughts about the topic; you can temporarily ignore grammar, sentence structure, and a logical sequence of ideas. After completing the first draft, the best practice is to wait a few days before you start editing your draft.

If you find it difficult to create that first draft, consider looking at websites, published technical papers, and articles with topics similar to yours to understand the organization of information or to find resources and references.

For the second draft, the goal is good writing. This is the time to create a narrative with a logical flow and good organization. Check your grammar, word choice, and spelling. Continue to edit the second draft, converting passive voice to active voice, properly documenting acronyms, correcting inaccurate information, eliminating jargon and trade names as appropriate, and removing personal opinions or beliefs.

Now is the time to have someone else review your paper. Think about your audience: If your topic is highly technical, find a colleague or a professor to review your manuscript. For less-technical topics, ask a peer or a friend to review your paper. Tell your reviewer about any specific concerns, such as the quality of your writing or the clarity of the data that supports your conclusion. You may consider giving your reviewer explicit permission to edit your grammar, correct misstatements, and identify missing information.

Consider the value of asking someone who knows nothing about the subject to read your manuscript. Ask

### What if this is my first time authoring an article?

If you are just getting started, consider writing a short piece. Trade publications often have departments or columns dedicated to specific topics; typically, the length of these works is one or two pages. For example, *CEP* has a short "Spotlight on Safety" column that describes the fundamentals of safety applications in chemical engineering. If the editor of the publication likes your work, they are more likely to accept future articles.

them to summarize the key points. If this person can follow your explanations, then your organization and language are clear. In all cases, ask the reviewer to provide constructive critiques and examples of information and revisions that will improve the quality of your paper.

Before you submit your paper to the editor or conference program chair, set the paper aside for at least a day. Then, proofread your paper and submit your manuscript — *i.e.*, the third or more draft of your paper — for review. After submission and acceptance, expect one or more round of

editing. You will need to incorporate any revisions from your editor or reviewer. If you disagree with the revisions, communicate by email or a short conference call to gain mutual agreement. Remember that the role of an editor or reviewer is to improve the quality of your writing; your role is to ensure the accuracy of the technical aspects. If you are presenting your technical paper at a conference, use your outline and any photos or graphics to structure your slides.

### In conclusion

By publishing your manuscript, you have advanced technological understanding and created a small measure of immortality; future engineers and scientists will read and cite your work. This accomplishment required a significant amount of research about your subject matter and effort to write a high-quality manuscript. If you choose to present a technical paper at a conference, you will have a new challenge: learning platform skills and honing your ability to answer questions from the audience. All of these skills — from honing your technical expertise to writing to presenting to communicating complicated information — will help you build your career.

CEP

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