The Information Matrix: Taking the Trouble out of Technical Writing

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Any type of technical document, whether a paper summarizing a research project or a long final report, must be written clearly and concisely. To achieve clarity, an organizational plan must connect and present all the main facts the writer wishes to convey in a logical order. Finding an organizational plan that works, especially when multiple authors are involved, is often difficult. But writing a technical document need not be burdensome. In addition to establishing a format for such things as grammar, many people suggest an outline. Our suggestion is a matrix, a simple, yet complete organizational plan to assist you in preparing and presenting technical topics.

The proposed matrix minimizes the amount of detailed outlining, but provides checks and balances to help you produce coherent documents. The matrix provides a framework that helps you accomplish three important objectives:

1) First, capture the reader's attention. The title, the abstract, and the introduction should accomplish this.

2) Next, present the paper's foundation, or body of information. The foundation begins with a statement of purpose that leads into the development of the work. After the topic has been sufficiently developed, present the results.

3) Finally, credit the sources used and highlight the facts that others can use in the future.

The information matrix can help you achieve all these objectives.

Technical papers generally can be divided into nine information blocks: title, abstract, introduction, purpose, development, results, conclusions, summary, and references. The writing matrix (figure 1) is made up of these nine blocks or information groups.

1—Capturing the Reader's Attention

The Title. In any document, your first goal is to grasp the attention of the reader. A well-written title can do the job. To make sure that the title explains what the document is about, first list the most important words or phrases, Next, list any modifiers or restrictions necessary to produce a clear meaning of the phrases or words. With this information, several versions of the title can be written in the simplest and clearest manner. This step is especially important since some technical publishers restrict the number of words a title may contain. After several titles have been developed, select the most precise and eye-catching one.

The Abstract. The abstract is the second place where you may capture, or lose, the reader's interest. It should be as simple and non-technical as possible, yet reveal the main purpose and content of the document (left). State briefly what was done and explain any limitations on the work. Also explain how the work was evaluated and with what results. Finally, state how the work can be used by others. Since most abstracts are short (generally less than 250 words for papers), each of the points just described must be made with one or, at most, two sentences. The key is to present a complete overview
of the document without excessive technical information.

The Introduction. Your last chance to capture the reader's attention is in the introduction. Along with a statement of the overall subject, the reader needs to know the specific problem or component to be addressed. In short technical documents, such as a paper, the introduction includes a brief literature review and an examination of the facts to determine if they are in agreement or contradictory. Each fact should be analyzed in a separate paragraph. After evaluating the literature, identify missing information, and, if possible, explain why the information is missing. The introduction, which will be relatively short compared to the foundation of the document, should prove to the reader that you are qualified to write about the subject.

If the document is a final report on a major research project, or a thesis, the introduction is usually divided into two chapters. The first gives an overview of the problem, and the second contains the literature review. Such an introduction is more extensive, telling the reader about the subject matter in more detail. All the main facts are listed and analyzed within general topic areas that explain their relationship. A separate subsection should be devoted to each general topic area.

2—Foundation of the Paper

The Purpose. Once the reader is convinced that you have expertise in the subject area, explain the purpose of the work. This is accomplished by writing the specific objective(s), such as development of a theory, data collection, or data collection to prove a theory. You should also state any restrictions that may be imposed on the objective. The objective of the work should be linked to the information learned from the literature. This section lays the groundwork for the foundation of the document, and persuades the reader to continue reading.

The Development. The second level of foundation building is the development of the work. Since the work may be theoretical, experimental, or both, this section must be written in detail. If you are describing a theoretical development, list the steps including the starting point and any natural laws of science, observations, dimensionless analysis, or any other approach used. After describing each step, verify the theory to prove its significance.

If the development is experimental, give the purpose of the experi-

<table>
<thead>
<tr>
<th>The Matrix</th>
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<tbody>
<tr>
<td><strong>TITLE</strong></td>
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<tr>
<td>Use a few key words and a key thought.</td>
</tr>
<tr>
<td><strong>PURPOSE</strong></td>
</tr>
<tr>
<td>Tell why you did the work.</td>
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<tr>
<td><strong>CONCLUSIONS</strong></td>
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<tr>
<td>Explain what the reader should learn from the work.</td>
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<tr>
<td><strong>Do conclusions reveal that the purpose was achieved?</strong></td>
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<td>(Checkpoints)</td>
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Figure 1. Nine information blocks make up the 3 x 3 information matrix that can serve as a guide to writing technical documents.

The top row of the matrix includes the title, abstract, and introduction. Their purpose is to introduce the subject and capture the reader's attention. The next group is the body—the foundation—and includes the statement of purpose, the development, and the results of the work. The conclusions, summary, and references make up the third group, and includes information you think others might want to reference in the future, as well as a listing of references used in the paper.

The matrix format provides a system of checks and balances. Horizontal sections of the matrix reflect the three overall objectives discussed above. The vertical sections give you three ways to check your paper's coherence and organization.

The first vertical group—title, purpose, and conclusions—can be used to make sure the title and conclusions match the stated purpose. The second vertical group can be used to check that information given in several ways is consistent and presents a reinforced thesis. The abstract provides a nontechnical overview, the development explains the work in detail, and the summary, while lacking the detail of the main body, contains technical content. The final vertical group shows your work's approach to the overall problem and connects it to previous work reported in the literature. The results must coincide with the specific objectives in the introduction, and a comparison of the results with those found by previous researchers should explain the advances made in your work.
If the results of the work were significant, a description of how the findings could be used, as well as who might use them, would prove beneficial.

ment. Explain how or what is to be evaluated, and whether it is an evaluation of a concept, design, or theory. Give sufficient detail of the test procedures to facilitate independent verification. Include the experimental plan, which describes all test treatments that were required.

For a longer document, such as a thesis, more detailed treatment should be given to all the specifics of the experiment, including the specific equipment used. In a paper, only a brief synopsis of the procedure and equipment should be provided. If the work was accomplished in conjunction with other work, or any other information is needed to fully understand the work, it should also be clearly explained, reducing the chance that unanswered questions might discredit the current work’s validity.

Results. This section should include all significant facts gained from the tests. If any differences were found in the treatments, the results should be displayed in such a way that the significance of each test is fully explained. Describe any interactions that may have occurred and, if required, include statistical information concerning these findings for validation purposes.

If the results of the work were significant, a description of how the findings could be used, as well as who might use them, would prove beneficial.

3—Conclusions, Summary, and References

Conclusions. Now that the work has been sufficiently described to the reader, the main facts should be reiterated. The conclusions should prove that the purpose was achieved. Outline the results, explaining how they complete the objectives. Since not all questions of a topic can be answered at one time, the results may provide insight into work yet to be performed. A list of alternative tasks that may provide more answers could direct other researchers in follow-up work.

Summary. Providing a summary can enhance the reader’s memory of the significant facts found in the work. This is especially true in a thesis or final research project report, where the goal is to fully understand and remember the main facts. In the case of a paper, the summary and conclusion sections are usually combined to provide a more condensed version of the work.

References. The last section of a technical document, the references, lists all literature used during the project.

Advantages of the Matrix

Since more than one information block can be worked on at the same time, multiple authors can work independently by dividing the writing task by vertical groups and then merging their results. A single author can list ideas under the appropriate block as they occur, even while working on another block. The ideas can then be incorporated when that block receives its final writing. This technique is especially helpful when using a word processor.

Using the writing matrix, a document can be drafted in any order. Personal preferences vary, but a good starting point is the purpose. Next, write the conclusions to be sure they match the objectives. The document will then automatically have a proper ending. The next step could be to use the objectives to list key words and form a title that agrees with the overall objectives. By this time, all of the document’s main ideas have been addressed and can be developed. The results follow naturally. When using a word processor, the references can be listed in the reference section immediately so that they are not overlooked later. You can save the summary and abstract for last.

Some blocks, such as the introduction and statement of purpose, or the development and results, can be combined. No matter how you approach writing technical documents, using the 3 x 3 matrix can be a great help.