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Formal Analytical Reports

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“Our clients make investment decisions based on feasibility and strategy for marketing new products. Our job is to research consumer interest in these potential products (for example, a new brand of low-calorie chocolate). In designing surveys, I have to translate the client’s information needs into precise questions. I have to be certain that the respondents are answering exactly the question I had in mind, and not inventing their own version of the question. Then I have to analyze these data and translate them into accurate interpretations and recommendations for our clients.”

—James North, Senior Project Manager,
market research firm

LEARNING OBJECTIVES FOR THIS CHAPTER

- ▶ Understand the role of audience and purpose in formal reports
- ▶ Identify three major types of analyses: causal, comparative, and feasibility
- ▶ Describe the elements of an effective analysis
- ▶ Follow an introduction/body/conclusion structure in a formal report
- ▶ Identify the front and end matter elements that accompany a formal report
- ▶ Write a formal analytical report

The formal analytical report, like the shorter versions discussed in Chapter 20, usually leads to recommendations. The formal report replaces the memo when the topic requires lengthy discussion. Formal reports generally include a title page, table of contents, a system of headings, a list of references or works cited, and other front-matter and end-matter supplements discussed on pages 514–15.

An essential component of workplace problem solving, analytical reports are designed to answer these questions:

- Based on the information gathered about this issue, what do we know?
- What conclusions can we draw?
- What should we do or not do?

What readers of an analytical report want to know

Assume, for example, that you receive this assignment from your supervisor:

Recommend the best method for removing the heavy-metal contamination from our company dump site.

A typical analytical problem

First, you will have to learn all you can about the problem. Then you will compare the advantages and disadvantages of various options based on the criteria you are using to assess feasibility: say, cost-effectiveness, time required versus time available for completion, potential risk to the public and the environment. For example, the cheapest option might also pose the greatest environmental risk and could result in heavy fines or criminal charges. But the safest option might simply be too expensive for this struggling company to afford. Or perhaps the Environmental Protection Agency has imposed a legal deadline for the cleanup. In making your recommendation, you will need to weigh all the criteria (cost, safety, time) very carefully, or you could land in jail.

Recommendations have legal and ethical implications

The above situation calls for critical thinking (Chapter 9) and research (Chapters 7–9). Besides interviewing legal and environmental experts, you might

search the literature and the Web. From these sources you can discover whether anyone has been able to solve a problem like yours, or learn about the newest technologies for toxic waste cleanup. Then you will have to decide how much, if any, of what others have done applies to your situation. (For more on analytical reasoning, see pages 497–503.)

CONSIDERING AUDIENCE AND PURPOSE

► Understand the role of audience and purpose in formal reports

Using analysis on the job

On the job, you may be assigned to evaluate a new assembly technique on the production line, or to locate and purchase the best equipment at the best price. You might have to identify the cause behind a monthly drop in sales, the reasons for low employee morale, the causes of an accident, or the reasons for equipment failure. You might need to assess the feasibility of a proposal for a company's expansion or merger or investment. You will present your findings in a formal report.

Audience considerations

Because of their major impact on the decision-making process, formal reports are almost always written for an audience of decision makers such as government officials or corporate managers. You need to know whom you are writing for and whether the report will be read primarily by an individual, a team, or a series of individuals with differing roles in the company.

Purpose considerations

To determine the purpose of the report, consider what question or questions it will ultimately answer. Also, consider why this particular topic is timely and useful to the intended audience. Use the Audience and Use Profile Sheet on page 56 to begin mapping out your audience and purpose for the report.

TYPICAL ANALYTICAL PROBLEMS

► Identify three major types of analyses: causal, comparative, and feasibility

Far more than an encyclopedic presentation of information, the analytical report traces your inquiry, your evidence, and your reasoning to show exactly how you arrived at your conclusions and recommendations.

Workplace problem solving calls for skills in three broad categories: *causal analysis*, *comparative analysis*, and *feasibility analysis*. Each approach relies on its own type of reasoning.

Causal Analysis: “Why Does X Happen?”

Designed to reveal a problem at its source, the causal analysis answers questions such as this: *Why do so many apparently healthy people have sudden heart attacks?*

CASE The Reasoning Process in Causal Analysis

Medical researchers at the world-renowned Hanford Health Institute found that 20 to 30 percent of deaths from sudden heart attacks occur in people who have none of the established risk factors (weight gain, smoking, diabetes, lack of exercise, high blood pressure, or family history).

To better identify people at risk, researchers are now tracking down new and powerful risk factors such as bacteria, viruses, genes, stress, anger, and depression.

Once researchers identify these factors and their mechanisms, they can recommend preventive steps such as careful monitoring, lifestyle and diet changes, drug treatment, or psychotherapy (H. Lewis 39–43).

Identify the problem

Examine possible causes

Recommend solutions

A different version of causal analysis employs reasoning from effect to cause, to answer questions such as: *What are the health effects of exposure to electromagnetic radiation?* For more on causal reasoning, see pages 156–58.

NOTE Keep in mind that faulty causal reasoning is extremely common, especially when we ignore other possible causes or we confuse correlation with causation (page 160).

Comparative Analysis: “Is X OR Y Better for Our Needs?”

Designed to rate competing items on the basis of specific criteria, the comparative analysis answers questions such as: *Which type of security (firewall/encryption) program should we install on our company’s computer system?*

CASE The Reasoning Process in Comparative Analysis

XYZ Corporation needs to identify exactly what information (personnel files, financial records) or functions (in-house communication, file transfer) it wants to protect from whom. Does it need both virus and tamper protection? Does it wish to restrict network access or encrypt email and computer files so they become unreadable to unauthorized persons? Does it wish to restrict access to or from the Web? In addition to the level of protection, how important are ease of maintenance and user friendliness?

After identifying their specific criteria, XYZ decision makers need to rank them in order of importance (for example, 1. tamper protection, 2. user-friendliness, 3. secure financial records, and so on).

On the basis of these ranked criteria, XYZ will assess relative strengths and weaknesses of competing security programs and recommend the best one (Schafer 93–94).

Identify the criteria

Rank the criteria

Compare items according to the criteria, and recommend the best one

For more on comparative analysis, see page 531.

Feasibility Analysis: “Is This a Good Idea?”

Designed to assess the practicality of an idea or a plan, the feasibility analysis answers questions such as this: *Should healthy young adults be encouraged to receive genetic testing to measure their susceptibility to various diseases?*

CASE The Reasoning Process in Feasibility Analysis

As a step toward “[translating] genetic research into health care,” a National Institutes of Health (NIH) study is investigating the feasibility of offering genetic testing to healthy young adults at little or no cost. The testing focuses on diseases such as melanoma, diabetes, heart disease, and lung cancer. This study will measure not only the target audience’s interest but also how those people tested “will interpret and use the results in making their own health care decisions in the future.”

Arguments in favor of testing include the following:

- Young people with a higher risk for a particular disorder might consider preventive treatments.
- Early diagnosis and treatment could be “personalized,” tailored to an individual’s genetic profile.
- Low-risk test results might “inspire healthy people to stay healthy” by taking precautions such as limiting sun exposure or changing their dietary, exercise, and smoking habits.

Arguments against testing include the following:

- The benefits of early diagnosis and treatment for a small population might not justify the expense of testing the population at large.
- False positive results are always traumatic, and false negative results could be disastrous.
- Any positive result could potentially subject a currently healthy person to disqualification for disability insurance or life insurance (National Institutes of Health; Notkins 74, 79).

After assessing the benefits and drawbacks of testing in this situation, NIH decision makers can make the appropriate recommendations.

Consider the strength of supporting reasons

Consider the strength of opposing reasons

Weigh the pros and cons, and recommend a course of action

For more on feasibility analysis, see page 532.

Combining Types of Analysis

Analytical categories overlap considerably. Any one study may in fact require answers to two or more of the previous questions. The sample report on pages 519–30 is both a feasibility analysis and a comparative analysis. It is designed to answer these questions: *Is technical marketing the right career for me? If so, which is my best option for entering the field?*

ELEMENTS OF AN EFFECTIVE ANALYSIS

► Describe the elements of an effective analysis

The formal analytical report incorporates many elements from documents in earlier chapters, along with the suggestions that follow.

Clearly Identified Problem or Purpose

To solve any problem or achieve any goal, you must first identify the issues precisely. Always begin by defining the main questions and thinking through any subordinate questions they may imply. Only then can you determine what to look for, where to look, and how much information you will need.

Your employer, for example, might pose this question: Will a low-impact aerobics program significantly reduce stress among my employees? The aerobics question obviously requires answers to three other questions: What are the therapeutic claims for aerobics? Are they valid? Will aerobics work in this situation? With the main questions identified, you can formulate an audience and purpose statement:

| My goal is to examine and evaluate claims about the therapeutic benefits of low-impact aerobic exercise and to recommend a course of action to my employer.

Define your
purpose

Audience and
purpose statement

Words such as *examine* and *evaluate* (or *compare*, *identify*, *determine*, *measure*, *describe*, and so on) help readers understand the specific analytical activity that forms the subject of the report. (For more on asking the right questions, see pages 494–96.)

Adequate but Not Excessive Data

A superficial analysis is basically worthless. Worthwhile analysis, in contrast, examines an issue in depth. In reporting on your analysis, however, you filter that material for the audience's understanding, deciding what to include and what to leave out. "Do decision makers in this situation need a closer look or am I presenting excessive detail when only general information is needed?" Is it possible to have too much information? In some cases, yes—as behavioral expert Dietrich Dorner explains:

| The more we know, the more clearly we realize what we don't know. This probably explains why . . . organizations tend to [separate] their information-gathering and decision-making branches. A business executive has an office manager; presidents have . . . advisers; military commanders have chiefs of staff. The point of this separation may well be to provide decision makers with only the bare outlines of all the available information so they will not be hobbled by excessive detail when they are obliged to render decisions. Anyone who is fully informed will see much more than the bare outlines and will therefore find it extremely difficult to reach a clear decision. (99)

Decide how much
is enough

Excessive
information
hampers decision
making

When you might consult an abstract or summary instead of the complete work

Confusing the issue with excessive information is no better than recommending hasty action on the basis of inadequate information (Dorner 104).

As you research the issue you may want to filter material for your own understanding as well. Your decision about whether to rely on the abstract or summary or to read the complete text of a specialized article or report depends on the question you're trying to answer and the level of technical detail your readers expect. If you are an expert in the field, writing for other experts, you probably want to read the entire document in order to assess the methods and reasoning behind a given study. But if you are less than expert, a summary or abstract of this study's findings might suffice. The fact sheet in Figure 21.1, for example, summarizes a detailed feasibility study for a general reading audience. Readers seeking more details, including nonclassified elements of the complete report, could visit the Transportation Security Administration's Web site.

NOTE *If you have relied merely on the abstract or summary instead of the full article, be sure to indicate this ("Abstract," "Press Release," or the like) when you cite the source in your report (as shown on pages 641, 659).*

Accurate and Balanced Data

Give readers all they need to make an informed judgment

Avoid stacking the evidence to support a preconceived point of view. Assume, for example, that you are asked to recommend the best chainsaw brand for a logging company. Reviewing test reports, you come across this information:

Of all six brands tested, the Bomarc chainsaw proved easiest to operate. However, this brand also offers the fewest safety features.

In citing these equivocal findings, you need to present both of them accurately, and not simply the first—even though the Bomarc brand may be your favorite. Then argue for the feature (ease of use or safety) you think should receive priority. (Refer to pages 123, 151 for more on exploring and presenting balanced and reasonable evidence.)

Fully Interpreted Data

Explain the significance of your data

Interpretation shows the audience "what is important and what is unimportant, what belongs together and what does not" (Dorner 44). For example, you might interpret the above chainsaw data in this way:

Explain the meaning of your evidence

Our logging crews often work suspended by harness, high above the ground. Also, much work is in remote areas. Safety features therefore should be our first requirement in a chainsaw. Despite its ease of operation, the Bomarc saw does not meet our safety needs.

By saying "therefore" you engage in analysis—not just information sharing. Don't merely list your findings, explain what they mean.

FACT SHEET: Train and Rail Inspection Pilot, Phase I

U.S. DEPARTMENT OF HOMELAND SECURITY
Transportation Security Administration
FOR IMMEDIATE RELEASE – June 7, 2014
TSA Press Office: (571) 227-2829

Objective:

Implement a pilot program to determine the feasibility of screening passengers, luggage and carry-on bags for explosives in the rail environment.

TRIP I Background:

- Homeland Security Secretary announced TRIP on March 22, 2014, to test new technologies and screening concepts.
- The program is conducted in partnership with the Department of Transportation, Amtrak, Maryland Rail Commuter, and Washington, D.C.'s Metro.
- The New Carrollton, MD, station was selected because it serves multiple types of rail operations and is located close to Washington, D.C.

TRIP I Facts:

- Screening for Phase I of TRIP began on May 4 and was completed on May 26, 2014.
- A total of 8,835 passengers and 9,875 pieces of baggage were screened during the test.
- The average time to wait in line and move through the screening process was less than 2 minutes.
- Customer Feedback cards reflect a 93 percent satisfaction rate with both the screening process and the professional demeanor of TSA personnel.

Lessons Learned:

- Results indicate efficient checkpoints throughout with minimal customer inconvenience.
- Passengers were overwhelmingly receptive to the screening process.
- Providing a customer service representative on-site during all screening operations helped Amtrak ensure passengers received outstanding customer service.
- Skilled TSA screeners from the agency's National Screening Force were able to quickly transition to screening in the rail environment.
- Most importantly, Phase I showed that currently available technology could be utilized to screen for explosives in the rail environment.

FIGURE 21.1 A Summary Description of a Feasibility Study Notice that the criteria for assessing feasibility include passenger wait times, passenger receptiveness to screening, and—most important—effectiveness of screening equipment in this environment.

Source: Transportation Security Administration.

Evaluate and interpret evidence impartially

Subordination of Personal Bias

To arrive at the *truth* of the matter (page 152), you need to see clearly. Don't let your biases fog up the real picture. Each stage of analysis requires decisions about what to record, what to exclude, and where to go next. You must evaluate your data (Is this reliable and important?), interpret your evidence (What does it mean?), and make recommendations (What action is needed?). An ethically sound analysis presents a balanced and reasonable assessment of the evidence. Do not force viewpoints that are not supported by dependable evidence. (Refer to page 153.)

Use visuals appropriately

Appropriate Visuals

Provide as much visual information as appropriate to make complex statistics and numeric data easy for readers to understand. Graphs are especially useful for analyzing trends (rising or falling sales, employment trends). Tables and charts are helpful for comparing data. Illustrations, diagrams, and photographs are excellent ways to show a component or special feature. Place the visual close to its accompanying text; be sure your text explains the visual in the context of the larger analysis.

NOTE *The simplicity of a visual such as the one used by writer Richard Larkin, on page 2 of his report (page 524 of this chapter), illustrates that a visual does not need to be overly fancy or complex, nor its story long and involved. Sometimes, less is more.*

Be clear about what the audience should think and do

Valid Conclusions and Recommendations

Along with the informative abstract (page 177), conclusions and recommendations are the sections of a long report that receive the most audience attention. The goal of analysis is to reach a valid conclusion—an overall judgment about what all the material means (that X is better than Y, that B failed because of C, that A is a good plan of action). The following example shows the conclusion of a report on the feasibility of installing an active solar heating system in a large building.

Offer a final judgment

1. Active solar space heating for our new research building is technically feasible because the site orientation will allow for a sloping roof facing due south, with plenty of unshaded space.
2. It is legally feasible because we are able to obtain an access easement on the adjoining property, to ensure that no buildings or trees will be permitted to shade the solar collectors once they are installed.
3. It is economically feasible because our sunny, cold climate means high fuel savings and faster payback (fifteen years maximum) with solar heating. The long-term fuel savings justify our short-term installation costs (already minimal because the solar system can be incorporated during the building's construction—without renovations).

Conclusions are valid when they are logically derived from accurate interpretations.

Having explained *what it all means*, you then recommend *what should be done*. Taking all possible alternatives into account, your recommendations urge the most feasible option (to invest in A instead of B, to replace C immediately, to follow plan A, or the like). Here are the recommendations based on the previous conclusions:

1. I recommend that we install an active solar heating system in our new research building.
2. We should arrange an immediate meeting with our architect, building contractor, and solar heating contractor. In this way, we can make all necessary design changes before construction begins in two weeks.
3. We should instruct our legal department to obtain the appropriate permits and easements immediately.

Tell what should
be done

Recommendations are valid when they propose an appropriate response to the problem or question.

Because they culminate your research and analysis, recommendations challenge your imagination, your creativity, and—above all—your critical thinking skills. What strikes one person as a brilliant suggestion might be seen by others as irresponsible, offensive, or dangerous. (Figure 21.2 depicts the kinds of decisions writers encounter in formulating, evaluating, and refining their recommendations.)

NOTE Keep in mind that solving one problem might create new and worse problems—or unintended consequences. For example, to prevent crop damage by rodents, an agriculture specialist might recommend trapping and poisoning. While rodent eradication may increase crop yield temporarily, it also increases the insects these rodents feed on—leading eventually to even greater crop damage. In short, before settling on any recommendation, try to anticipate its “side effects and long-term repercussions” (Dorner 15).

When you do achieve definite conclusions and recommendations, express them with assurance and authority. Unless you have reason to be unsure, avoid noncommittal statements (“It would seem that” or “It looks as if”). Be direct and assertive (“The earthquake danger at the reactor site is acute,” or “I recommend an immediate investment”). Announce where you stand.

Use a confident
tone to state your
conclusions

If, however, your analysis yields nothing definite, do not force a simplistic conclusion on your material. Instead, explain the limitations (“The contradictory responses to our consumer survey prevent me from reaching a definite conclusion. Before we make any decision about this product, I recommend a full-scale market analysis”). The wrong recommendation is far worse than no recommendation at all. (Chapter 8 offers helpful guidelines for evaluating and interpreting information.)

Self-Assessment

The more we are involved in a project, the larger our stake is in its outcome—making self-criticism less likely just when it is needed most! For example, it is

Assess your
analysis
continuously

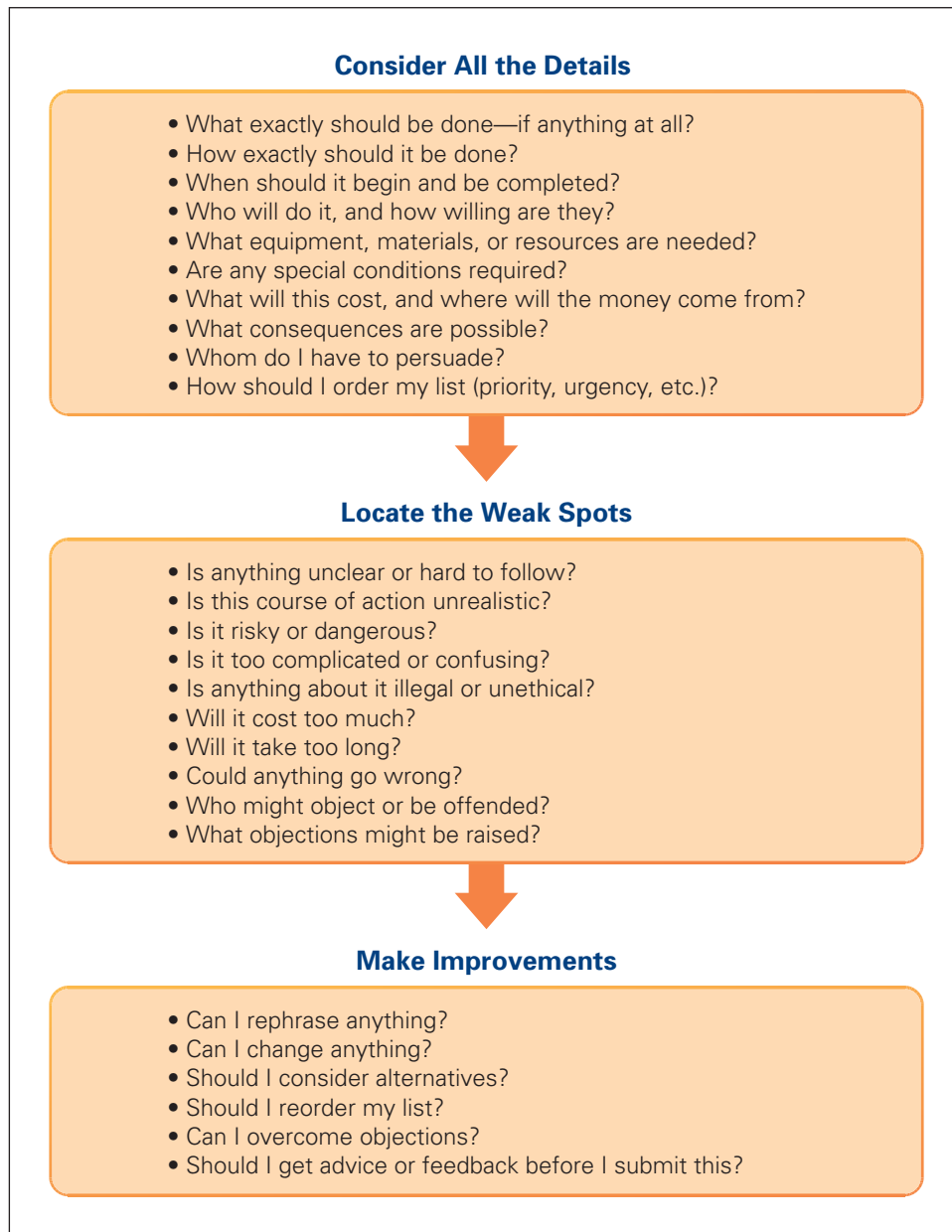


FIGURE 21.2 How to Think Critically about Your Recommendations

Source: Ruggiero, Vincent R. *The Art of Thinking: A Guide to Critical and Creative Thought*, 8th Ed., (c) 2007, 188–89. Adapted and Electronically reproduced by permission of Pearson Education, Inc., Upper Saddle River, New Jersey.

hard to admit that we might need to backtrack, or even start over, in instances like these (Dorner 46):

- During research you find that your goal isn't clear enough to indicate exactly what information you need.
- As you review your findings, you discover that the information you have is not the information you need.
- After making a recommendation, you discover that what seemed like the right course of action turns out to be the wrong one.

Things that might go wrong with your analysis

If you meet such obstacles, acknowledge them immediately, and revise your approach as needed.

AN OUTLINE AND MODEL FOR ANALYTICAL REPORTS

► Follow an introduction/body/conclusion structure in a formal report

Whether you outline earlier or later, the finished report depends on a good outline. This model outline can be adapted to most analytical reports.

I. Introduction

- Definition, Description, and Background
- Purpose of the Report, and Intended Audience
- Method of Inquiry
- Limitations of the Study
- Working Definitions (here or in a glossary)
- Scope of the Inquiry (topics listed in logical order)
- Conclusion(s) of the Inquiry (briefly stated)

II. Collected Data

- First Topic for Investigation
 - Definition
 - Findings
 - Interpretation of findings
- Second Topic for Investigation
 - First subtopic
 - Definition
 - Findings
 - Interpretation of findings
 - Second subtopic (and so on)

III. Conclusion

- Summary of Findings
- Overall Interpretation of Findings (as needed)
- Recommendations (as needed and feasible)

(This outline is only tentative. Modify the components as necessary.)

Two sample reports in this chapter follow the model outline. The first one, “Children Exposed to Electromagnetic Radiation: A Risk Assessment” (minus the front matter and end matter that ordinarily accompany a long report), begins below. The second report, “Feasibility Analysis of a Career in Technical Marketing,” appears in Figure 21.3.

Each report responds to slightly different questions. The first tackles these questions: *What are the effects of X and what should we do about them?* The second tackles two questions: *Is X feasible, and which version of X is better for my purposes?* At least one of these reports should serve as a model for your own analysis.

Introduction

The introduction engages and orients the audience, and provides background as briefly as possible for the situation. Often, writers are tempted to write long introductions because they have a lot of background knowledge. But readers generally don’t need long history lessons on the subject.

Identify your topic’s origin and significance, define or describe the problem or issue, and explain the report’s purpose. (Generally, stipulate your audience only in the version your instructor will read and only if you don’t attach an audience and use profile.) Briefly identify your research methods (interviews, literature searches, and so on) and explain any limitations or omissions (person unavailable for interview, research still in progress, and so on). List working definitions, but if you have more than two or three, use a glossary. List the topics you have researched. Finally, briefly preview your conclusion; don’t make readers wade through the entire report to find out what you recommend or advise.

NOTE Not all reports require every component. Give readers only what they need and expect.

As you read the following introduction, think about the elements designed to engage and orient the audience (i.e., local citizens), and evaluate their effectiveness. (Review page 122 for the situation that gave rise to this report.)

CHILDREN EXPOSED TO ELECTROMAGNETIC RADIATION: A RISK ASSESSMENT

LAURIE A. SIMONEAU

INTRODUCTION

Wherever electricity flows—through the largest transmission line or the smallest appliance—it emits varying intensities of charged waves: an *electromagnetic field* (EMF). Some medical studies have linked human exposure to EMFs with definite physiologic changes and possible illness including cancer, miscarriage, and depression.

Experts disagree over the health risk, if any, from EMFs. Some question whether EMF risk is greater from high-voltage transmission lines, the smaller distribution lines

Definition and
background of the
problem

strung on utility poles, or household appliances. Conclusive research may take years; meanwhile, concerned citizens worry about avoiding potential risks.	
In Bocaville, four sets of transmission lines—two at 115 Kilovolts (kV) and two at 500 kV—cross residential neighborhoods and public property. The Adams elementary school is less than 100 feet from this power line corridor. EMF risks—whatever they may be—are thought to increase with proximity.	Description of the problem
Based on a review of key research as well as interviews with local authorities, this report assesses whether potential health risks from EMFs seem significant enough for Bocaville to (a) increase public awareness, (b) divert the transmission lines that run adjacent to the elementary school, and (c) implement widespread precautions in the transmission and distribution of electrical power throughout Bocaville.	Purpose and methods of this inquiry
This report covers five major topics: what we know about various EMF sources, what research indicates about physiologic and health effects, how experts differ in evaluating the research, what the power industry and the public have to say, and what actions are being taken locally and nationwide to avoid risk.	Scope of this inquiry
The report concludes by acknowledging the ongoing conflict among EMF research findings and by recommending immediate and inexpensive precautionary steps for our community.	Conclusions of the inquiry (briefly stated)

Body

The body section (or data section) describes and explains your findings. Present a clear and detailed picture of the evidence, interpretations, and reasoning on which you will base your conclusion. Divide topics into subtopics, and use informative headings as aids to navigation.

NOTE Remember your ethical responsibility for presenting a fair and balanced treatment of the material, instead of “loading” the report with only those findings that support your viewpoint. Also, keep in mind the body section can have many variations, depending on the audience, topic, purpose, and situation.

As you read the following section, evaluate how effectively it informs readers, keeps them on track, reveals a clear line of reasoning, and presents an impartial analysis.

DATA SECTION	
Sources of EMF Exposure	First major topic
Electromagnetic intensity is measured in <i>milligauss</i> (mG), a unit of electrical measurement. The higher the mG reading, the stronger the field. Studies suggest that consistent exposure above 1–2 mG may increase cancer risk significantly, but no scientific evidence concludes that exposure even below 2.5 mG is safe.	Definition
Table 1 gives the EMF intensities from electric power lines at varying distances during average and peak usage.	Findings

Table 1 EMF Emissions from Power Lines (in milligauss)

Types of Transmission Lines	Maximum on Right-of-Way	Distance from lines			
		50'	100'	200'	300'
115 Kilovolts (kV)					
Average usage	30	7	2	0.4	0.2
Peak usage	63	14	4	0.9	0.4
230 Kilovolts (kV)					
Average usage	58	20	7	1.8	0.8
Peak usage	118	40	15	3.6	1.6
500 Kilovolts (kV)					
Average usage	87	29	13	3.2	1.4
Peak usage	183	62	27	6.7	3.0

Source: United States, Environmental Protection Agency, Office of Radiation and Indoor Air. *EMF in Your Environment*. Government Printing Office, 1992, p. 24.

Interpretation

As Table 1 indicates, EMF intensity drops substantially as distance from the power lines increases.

Although the EMF controversy has focused on 2 million miles of power lines crisscrossing the country, potentially harmful waves are also emitted by household wiring, appliances, computer terminals—and even from the earth's natural magnetic field. The background magnetic field (at a safe distance from any electrical appliance) in the average American home varies from 0.5 to 4.0 mG (United States, Environmental Protection Agency, Office of Radiation and Indoor Air 10). Table 2 compares intensities of various sources.

Interpretation

EMF intensity from certain appliances tends to be higher than from transmission lines because of the amount of current involved.

Table 2 EMF Emissions from Selected Sources (in milligauss)

Source	Range ^{a,b}
Earth's magnetic field	0.1–2.5
Blowdryer	60–1,400
Four in. from TV screen	40–100
Four ft. from TV screen	0.7–9
Fluorescent lights	10–12
Electric razor.....	1,200–1,600
Electric blanket.....	2–25
Computer terminal (12 inches away)	3–15
Toaster	10–60

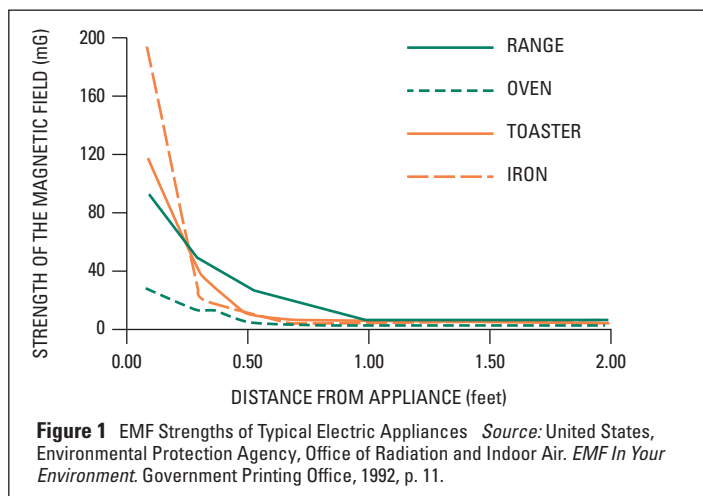
^aData from Miltane, John. Personal Interview. 5 Apr. 2013.; United States, National Institutes of Health, National Institute of Environmental Health Sciences. *EMF Electric and Magnetic Fields Associated with the Use of Electric Power*. Government Printing Office, 2002, pp. 32–35.

^bReadings are made with a gaussmeter, and vary with technique, proximity of gaussmeter to source, its direction of aim, and other random factors.

Voltage measures the speed and pressure of electricity in wires, but *current* measures the volume of electricity passing through wires. Current (measured in *amperage*) is what produces electromagnetic fields. The current flowing through a transmission line typically ranges from 200 to 400 amps. Most homes have a 200-amp service, which means that if every electrical item in the house were turned on at the same time, the house could run about 200 amps—almost as high as the transmission line. Consumers then have the ability to put 200 amps of current-flow into their homes, while transmission lines carrying 200 to 400 amps are at least 50 feet away (Miltane).

Proximity and duration of exposure, however, are other risk factors. People are exposed to EMFs from home appliances at close proximity, but appliances run only periodically: exposure is therefore sporadic, and intensity diminishes sharply within a few feet (Figure 1).

As Figure 1 indicates, EMF intensity drops dramatically over very short distances from the typical appliance.



Power line exposure, on the other hand, is at a greater distance (usually 50 feet or more), but it is constant. Moreover, its intensity can remain strong well beyond 100 feet (Miltane).

Research has yet to determine which type of exposure might be more harmful: briefly, to higher intensities or constantly, to lower intensities. In any case, proximity seems most significant because EMF intensity drops rapidly with distance.

Physiologic Effects and Health Risks from EMF Exposure

Research on EMF exposure falls into two categories: epidemiologic studies and laboratory studies. The findings are sometimes controversial and inconclusive, but also disturbing.

Epidemiologic Studies. Epidemiologic studies look for statistical correlations between EMF exposure and human illness or disorders. Of 77 such studies in recent

Definitions

Finding

Finding

Interpretation

Second major topic

First subtopic Definition

General findings

decades, over 70 percent suggest that EMF exposure increases the incidence of the following conditions (Pinsky 155-215):

- cancer, especially leukemia and brain tumors
- miscarriage
- stress and depression
- learning disabilities
- heart attacks

Following, for example, are summaries of several noted epidemiologic studies implicating EMFs in occurrences of cancer.

Detailed findings

A Landmark Study of the EMF/Cancer Connection. A 1979 Denver study by Wertheimer and Leeper was the first to implicate EMFs as a cause of cancer. Researchers compared hundreds of homes in which children had developed cancer with similar homes in which children were cancer free. Victims were two to three times as likely to live in “high-current homes” (within 130 feet of a transmission line or 50 feet of a distribution line).

Critiques of findings

This study has been criticized because (1) it was not “blind” (researchers knew which homes cancer victims were living in), and (2) researchers never took gaussmeter readings to verify their designation of “high-current” homes (Pinsky 160-62; Taubes 96).

Detailed findings

Follow-up Studies. Since then, several major studies of the EMF/cancer connection have confirmed Wertheimer’s findings:

- In 1988, Savitz studied hundreds of Denver houses and found that children with cancer were 1.7 times as likely to live in high-current homes. Unlike his predecessors, Savitz did not know whether a cancer victim lived in the home being measured, and he took gaussmeter readings to verify that houses could be designated “high-current” (Pinsky 162-63).
- In 1990, London and Peters found that Los Angeles children had 2.5 times more risk of leukemia if they lived near power lines (Brodeur 115).
- In 1992, a massive Swedish study found that children in houses with average intensities greater than 1 mG had twice the normal leukemia risk; at greater than 2 mG, the risk nearly tripled; at greater than 3 mG, it nearly quadrupled (Brodeur 115).
- In 2002, British researchers evaluated findings from 34 studies of power line EMF effects (a *meta-analysis*). This study found “a degree of consistency in the evidence suggesting adverse health effects of living near high voltage power lines” (Henshaw et al. 1).

Workplace Studies. More than 80 percent of 51 studies over a 13 year period—most notably a landmark 1992 Swedish study—concluded that electricians, electrical engineers, and power line workers constantly exposed to an average of 1.5 to 4.0 mG had a significantly elevated cancer risk (Brodeur 115; Pinsky 177-209).

Two additional workplace studies seem to support or even amplify the above findings.

- A University of North Carolina study of 138,905 electric utility workers concluded that occupational EMF exposure roughly doubles brain cancer risk. This study, however, found no increased leukemia risk (Cavanaugh 8; Moore 16).
- A Canadian study of electrical-power employees indicates that those who had worked in strong electric fields for more than 20 years had “an eight- to tenfold increase in the risk of leukemia,” along with a significantly elevated risk of lymphoma (“Strong Electric Fields” 1-2).

Although none of the above studies can be said to “prove” a direct cause-effect relationship, their strikingly similar results suggest a conceivable link between prolonged EMF exposure and illness.

Interpretation

Laboratory Studies. Laboratory studies assess cellular, metabolic, and behavioral effects of EMFs on humans and animals. EMFs directly cause the following physiologic changes (Brodeur 88; Pinsky 24-29; Raloff, “EMFs” 30):

Second subtopic

- reduced heart rate
- altered brain waves
- impaired immune system
- interference with the synthesis of genetic material
- disrupted regulation of cell growth
- interaction with the biochemistry of cancer cells
- altered hormonal activity
- disrupted sleep patterns

General findings

These changes are documented in the following summaries of several significant laboratory studies.

EMF Effects on Cell Chemistry. Other studies have demonstrated previously unrecognized effects on cell growth and division. Most notably, a study by Michigan State University found that EMFs equal to the intensity that occurs “within a few feet” of outdoor power lines caused cells with cancer-related genetic mutations to multiply rapidly (Sivitz 196).

Detailed findings

EMF Effects on Hormones. Studies have found that EMF exposure (for example, from an electric blanket) inhibits production of melatonin, a hormone that fights cancer and depression, stimulates the immune system, and regulates bodily rhythms. A study at the Lawrence National Laboratory found that EMF exposure can suppress both melatonin and the hormone-like, anticancer drug Tamoxifen (Raloff, “EMFs” 30). Similarly, physiologist Charles Graham found that EMFs elevate female estrogen levels and depress male testosterone levels—hormone alterations associated with risk of breast or testicular cancer, respectively (Raloff, “EMFs” 30).

Interpretation

Although laboratory studies seem more conclusive than the epidemiologic studies, what these findings *mean* is debatable.

Third major topic

Debate over Quality, Cost, and Status of EMF Research

Experts differ over the meaning of EMF research findings largely because of the following limitations attributed to various studies.

First subtopic

Limitations of Various EMF Studies. Epidemiologic studies are criticized for overstating evidence. For example, some critics claim that so-called EMF-cancer links are produced by “data dredging” (making countless comparisons between cancers and EMF sources until random correlations appear) (Taubes 99). Other critics argue that news media distort the issue by publicizing positive findings while often ignoring negative or ambiguous findings (Goodman). Some studies are also accused of mistaking *coincidence* for *correlation*, without exploring “confounding factors” (e.g., exposure to toxins or to other adverse conditions—including the earth’s natural magnetic field) (Moore 16).

Response to critiques

Supporters of EMF research respond that the sheer volume of epidemiologic evidence seems overwhelming (Kirkpatrick 81, 83). Moreover, the Swedish studies cited earlier seem to invalidate the above criticisms (Brodeur 115).

Critiques of lab studies

Laboratory studies are criticized—even by scientists who conduct them—because effects on an isolated culture of cells or on experimental animals do not always equal effects on the total human organism (Jauchem 190-94).

Response to critiques

Until recently critics argued that no scientist had offered a reasonable hypothesis to explain the possible health effects of EMFs (Palfreman 26). However, a University of Washington study showed that a weak electromagnetic field can break DNA strands and lead to brain cell death in rats, presumably because of cell-damaging agents known as free radicals (Lai and Singh).

Cost objections

Costs of EMF Research. Critics claim that research and publicity about EMFs are becoming a profit venture, spawning “a new growth industry among researchers, as well as marketers of EMF monitors” (“Electrophobia” 1). Environmental expert Keith Florig identifies adverse economic effects of the EMF debate that include decreased property values, frivolous lawsuits, expensive but needless “low field” consumer appliances, and costly modifications to schools and public buildings (Monmonier 190).

Conflicting scientific opinions

Present Status of EMF Research. In July 1998, an editor at *The New England Journal of Medicine* called for the ending of EMF/cancer research. He cited studies from the National Cancer Institute and other respected sources that showed “little evidence” of any causal connection. In a parallel development, federal and industry funding for EMF research has been reduced drastically (Stix 33). But, in August 1998, experts from the Energy Department and the National Institute of Environmental Health Sciences (NIEHS) proposed that EMFs should be officially designated a “possible human carcinogen” (Gross 30).

However, one year later, in a report based on its seven-year review of EMF research, NIEHS concluded that “the scientific evidence suggesting that...EMF exposures pose any health risk is weak.” But the report also conceded that such exposure “cannot be recognized at this time as entirely safe” (United States, National Institutes of Health, National Institute of Environmental Health Sciences, *Health* 1-2). In 2005, the National Cancer Institute fueled the controversy, concluding that the EMF–cancer connection is supported by only “limited evidence” and “inconsistent associations” (“Magnetic”). In a 2009 update, NIEHS announced “that the overall pattern of results suggests a weak association between exposure to EMFs and increased risk of childhood leukemia” (“Electric”). Recently, noted epidemiologist Daniel Wartenberg has testified in support of the “Precautionary Principle,” arguing that policy decisions should be based on “the possibility of risk.” Specifically, Wartenberg advocates “prudently lowering exposures of greatest concern [i.e., of children] in case the possible risk is shown eventually to be true” (6).

In short, after more than twenty-five years of study, the EMF/illness debate continues, even among respected experts. While most scientists agree that EMFs exert measurable effects on the human body, they disagree about whether a real hazard exists. Given the drastic cuts in research funding, definite answers are unlikely to appear any time soon.

Interpretation

Views from the Power Industry and the Public

Fourth major topic

While the experts continue their debate, other viewpoints are worth considering as well.

The Power Industry’s Views. The Electrical Power Research Institute (EPRI), the research arm of the nation’s electric utilities, claims that recent EMF studies have provided valuable but inconclusive data that warrant further study (Moore 17). What does our local power company think about the alleged EMF risk? Marianne Halloran-Barney, Energy Service Advisor for County Electric, expressed this view in an email correspondence:

First subtopic

There are definitely some links, but we don’t know, really, what the effects are or what to do about them.... There are so many variables in EMF research that it’s a question of whether the studies were even done correctly.... Maybe in a few years there will be really definite answers.

Findings

Echoing Halloran-Barney’s views, John Miltane, Chief Engineer for County Electric, added this political insight:

The public needs and demands electricity, but in regard to the negative effects of generation and transmission, the pervasive attitude seems to be “not in my back yard!” Utilities in general are scared to death of the EMF issue, but at County Electric we’re trying to do the best job we can while providing reliable electricity to 24,000 customers.

Miltane stresses that County Electric takes the EMF issue very seriously: Whenever possible, new distribution lines are run underground and configured to diminish EMF intensity.

Second subtopic

Public Perception. Industry views seem to parallel the national perspective among the broader population: Informed people are genuinely concerned, but remain unsure about what level of anxiety is warranted or what exactly should be done. A survey by the Edison Electric Institute did reveal that EMFs are considered a serious health threat by 33 percent of the American public (Stix 33).

Fifth major topic

Risk-Avoidance Measures Being Taken

Although conclusive answers may require decades of research, concerned citizens are already taking action against potential EMF hazards.

First subtopic

Risk Avoidance Nationwide. Following are examples of steps taken by various communities to protect schoolchildren from EMF exposure:

Findings

- Hundreds of individuals and community groups have taken legal action to block proposed construction of new power lines. A single Washington law firm has defended roughly 140 utilities in cases related to EMFs (Dana and Turner 32).
- Houston schools “forced a utility company to remove a transmission line that ran within 300 feet of three schools. Cost: \$8 million” (Kirkpatrick 85).
- California parents and teachers are pressuring reluctant school and public health officials to investigate cancer rates in the roughly 1,000 schools located within 300 feet of transmission lines, and to close at least one school (within 100 feet) in which cancer rates far exceed normal (Brodeur 118).

Although critics argue that the questionable risks fail to justify the costs of such measures, widespread concern about EMF exposure continues to grow.

Second subtopic

Risk Avoidance Locally. Local awareness of the EMF issue seems low. The main public concern seems to be with property values. According to Halloran-Barney, County Electric receives one or two calls monthly from concerned customers, including people buying homes near power lines. The lack of public awareness adds another dimension to the EMF problem: People can’t avoid a health threat that they don’t know exists.

Interpretation

Before risk avoidance can be considered on a broader community level, the public must first be informed about EMFs and the associated risks of exposure.

Conclusion

The conclusion is likely to interest readers most because it answers the questions that originally sparked the analysis.

NOTE Many workplace reports are submitted with the conclusion preceding the introduction and body sections.

In the conclusion, you summarize, interpret, and recommend. Although you have interpreted evidence at each stage of your analysis, your conclusion presents a broad interpretation and suggests a course of action, where appropriate. The summary and interpretations should lead logically to your recommendations.

- The summary accurately reflects the body of the report.
- The overall interpretation is consistent with the findings in the summary.
- The recommendations are consistent with the purpose of the report, the evidence presented, and the interpretations given.

Elements of a
logical conclusion

NOTE Don't introduce any new facts, ideas, or statistics in the conclusion.

As you read the following conclusion, evaluate how effectively it provides a clear and consistent perspective on the whole document.

CONCLUSION

Summary and Overall Interpretation of Findings

Electromagnetic fields exist wherever electricity flows; the stronger the current, the higher the EMF intensity. While no "safe" EMF level has been identified, long-term exposure to intensities greater than 2.5 milligauss is considered dangerous. Although home appliances can generate high EMFs during use, power lines can generate constant EMFs, typically at 2 to 3 milligauss in buildings within 150 feet. Our elementary school is less than 100 feet from a high-voltage power line corridor.

Notable epidemiologic studies implicate EMFs in increased rates of medical disorders such as cancer, miscarriage, stress, depression, and learning disabilities—all directly related to intensity and duration of exposure. Laboratory studies show that EMFs cause the kinds of cellular and metabolic changes that could produce these disorders.

Though still controversial and inconclusive, most of the various findings are strikingly similar and they underscore the need for more research and for risk avoidance, especially as far as children are concerned.

Concerned citizens nationwide have begun to prevail over resistant school and health officials and utility companies in reducing EMF risk to schoolchildren. And even though our local power company is taking reasonable risk-avoidance steps, our community can do more to learn about the issues and diminish potential risk.

Recommendations

In light of the conflicting evidence and interpretations, any type of government regulation any time soon seems unlikely. Also, considering the limitations of what we know, drastic and enormously expensive actions (such as burying all the town's

Review of major
findings

An overall
judgment about
what the findings
mean

Feasible and realistic course of action

power lines or increasing the height of utility towers) seem inadvisable. In fact, these might turn out to be the wrong actions.

Despite this climate of uncertainty, however, our community still can take some immediate and inexpensive steps to address possible EMF risk. Please consider the following recommendations:

- Relocate the school playground to the side of the school most distant from the power lines.
- Discourage children from playing near any power lines.
- Distribute a version of this report to all Bocaville residents.
- Ask our school board to hire a licensed contractor to take milligauss readings throughout the elementary school, to determine the extent of the problem, and to suggest reasonable corrective measures.
- Ask our Town Council to meet with County Electric Company representatives to explore options and costs for rerouting or burying the segment of the power lines near the school.
- Hold a town meeting to answer citizens' questions and to solicit opinions.
- Appoint a committee (consisting of at least one physician, one engineer, and other experts) to review emerging research as it relates to our school and town.

A call to action

As we await conclusive answers, we need to learn all we can about the EMF issue, and to do all we can to diminish this potentially significant health issue.

WORKS CITED

[The Works Cited section for the preceding report appears in A Quick Guide to Documentation (Part 5, pages 649–50). This author uses MLA documentation style.]

FRONT MATTER AND END MATTER SUPPLEMENTS

- Identify the front and end matter elements that accompany a formal report

Most formal reports or proposals consist of the front matter, the text of the report or proposal, and the end matter. (Some parts of the front and end matter may be optional.) Submit your completed document with these supplements, in this order:

Front matter precedes the report

- letter of transmittal
- title page
- table of contents
- list of tables and figures
- abstract
- text of the report (introduction, body, conclusion)

- glossary (as needed)
- appendices (as needed)
- Works Cited page (or alphabetical or numbered list of references)

End matter follows
the report

For discussion of the above supplements, see below. For examples in a formal report or proposal, see Figures 21.3 and 22.4.

Front Matter

Preceding the text of the report is the front matter: letter of transmittal, title page, table of contents, list of tables and figures (if appropriate), and abstract or executive summary.

Letter of Transmittal

Many formal reports or proposals include a letter of transmittal, addressed to a specific reader or readers, which precedes the document. This letter might acknowledge people that helped with the document, refer readers to sections of special interest, discuss any limitations of the study or any problems in gathering data, offer personal (or off-the-record) observations, or urge readers to take immediate action. See page 519 for a sample letter of transmittal.

Title Page. The title page provides the document title, the names of all authors and their affiliations (and/or the name of the organization that commissioned the report), and the date the report was submitted. The title announces the report's purpose and subject by using descriptive words such as *analysis*, *comparison*, *feasibility*, or *recommendation*. Be sure the title fully describes your report, but avoid an overly long and involved title. Make the title the most prominent item, highest on the page, followed by the name of the recipient(s), the author(s), and the date of submission. See page 520 for a sample title page.

Table of Contents. For any long document, the table of contents helps readers by listing the page number for each major section, including any front matter that falls after the table of contents. (Do not include the letter of transmittal, title page, or the table of contents itself, but do include the list of tables and figures, along with the abstract or executive summary.)

Indicate page numbers for front matter in lowercase Roman numerals (i, ii, iii). Note that the title page, though not numbered itself or listed on the table of contents, is counted as page i. Number the report text pages using Arabic numerals (1, 2, 3), starting with the first page of the report. Number end matter using Arabic numerals continuing from the end of the report's text.

Make sure headings and subheadings in the table of contents match exactly the headings and subheadings in the document. Indicate headings of different

levels (a-level, b-level, c-level) using different type styles or indentations. Use *leader lines* (.....) to connect headings with their page numbers. For a sample table of contents, see page 521.

List of Tables and Figures. On a separate page following the table of contents (or at the end of the table of contents, if it fits), list the tables and figures in the report. If the report contains only one or two tables and figures, you may skip this list. For a sample list, see page 521.

Abstract or Executive Summary. Instead of reading an entire formal report, readers interested only in the big picture may consult the abstract or executive summary that commonly precedes the report proper (see Chapter 9). The purpose of this summary is to explain the issue, describe how you researched it, and state your conclusions (and, in the case of an executive summary, indicate what action the conclusions suggest). Busy readers can then flip through the document to locate sections important to them.

Make the abstract or executive summary as brief as possible. Summarize the report without adding new information or leaving out crucial information. Write for a general audience and follow a sequence that moves from the reason the report was written to the report's major findings, to conclusions and recommendations. For a sample abstract, see page 522.

Text of the Report

The text of the report consists of the introduction, the body, and the conclusion, as discussed and illustrated on pages 522–30.

End Matter

Following the report text (as needed) is the end matter, which may include a glossary, appendices, and/or a list of references cited in your report. Readers can refer to any of these supplements or skip them altogether, according to their needs.

Glossary. Use a glossary if your report contains more than five technical terms that may not be understood by all intended readers. If five or fewer terms need defining, place them in the report's introduction as working definitions, or use footnote definitions. If you do include a separate glossary, announce its location when you introduce technical terms defined there ("see the glossary at the end of this report"). Page 409 shows a glossary.

Appendices. If you have large blocks of material or other documents that are relevant but will bog readers down, place these in an appendix. For example, if your report on the cost of electricity at your company refers to another report issued

by the local utility company, you may wish to include this second report as an appendix. Other items that belong in an appendix include complex formulas, interview questions and responses, maps, photographs, questionnaires and tabulated responses, and texts of laws and regulations.

Do not stuff appendices with needless information or use them to bury bad or embarrassing news that belongs in the report itself. Title each appendix clearly: “Appendix A: Projected Costs.” Mention the appendices early in the introduction, and refer to them at appropriate points in the report: (“see Appendix A”). The sample proposal in Figure 22.4 includes an appendix on page 569.

References or Works Cited List. If you have used outside sources in your report (and typically you should), you must provide a list of References (per APA style) or of Works Cited (per MLA style). For detailed advice on documenting sources using APA or MLA style, see A Quick Guide to Documentation. The report in Figure 21.3 uses APA style and includes a References list, which appears in A Quick Guide to Documentation (Part 5), page 663. The report shown on pages 504–14 uses MLA style and includes a Works Cited list, which is shown in Part 5, pages 649–50.

A SITUATION REQUIRING AN ANALYTICAL REPORT

► Write a formal analytical report

The formal report that follows, patterned after the model outline (page 503), combines a feasibility analysis with a comparative analysis.

A Formal Report

The Situation. Richard Larkin, author of the following report, has a work-study job fifteen hours weekly in his school’s placement office. His boss, John Fitton (placement director), likes to keep up with trends in various fields. Larkin, an engineering major, has developed an interest in technical marketing and sales. Needing a report topic for his writing course, Larkin offers to analyze the feasibility of a technical marketing and sales career, both for his own decision making and for technical and science graduates in general. Fitton accepts Larkin’s offer, looking forward to having the final report in his reference file for use by students choosing careers. Larkin wants his report to be useful in three ways: (1) to satisfy a course requirement, (2) to help him in choosing his own career, and (3) to help other students with their career choices.

With his topic approved, Larkin begins gathering his primary data, using interviews, letters of inquiry, telephone inquiries, and lecture notes. He supplements these primary sources with articles in recent publications. He will document his findings in APA (author-date) style.

As a guide for designing his final report (Figure 21.3), Larkin completes the following audience and use profile (based on the worksheet on page 30).

Audience and Use Profile. The primary audience consists of John Fitton, Placement Director, and the students who will refer to the report. The secondary audience is the writing instructor.

Because he is familiar with the marketing field, Fitton will need very little background to understand the report. Many student readers, however, will have questions like these:

- What, exactly, is technical marketing and sales?
- What are the requirements for this career?
- What are the pros and cons of this career?
- Could this be the right career for me?
- How do I enter the field?

Readers affected by this document are primarily students making career choices. Readers' attitudes likely will vary:

- Some readers should have a good deal of interest, especially those seeking a people-oriented career.
- Others might be only casually interested as they investigate a range of possible careers.
- Some readers might be skeptical about something written by a fellow student instead of by some expert. To connect with all these people, this report needs to persuade them that its conclusions are based on reliable information and careful reasoning.

All readers expect things spelled out, but concisely. Visuals will help compress and emphasize material throughout.

Essential information will include an expanded definition of technical marketing and sales, the skills and attitudes needed for success, the career's advantages and drawbacks, and a description of various paths for entering the career.

This report combines feasibility and comparative analysis, so the structure of the report must reveal a clear line of reasoning: in the feasibility section, reasons for and reasons against; in the comparison section, a block structure and a table that compares the four entry paths point by point. The report will close with recommendations based on solid conclusions.

For various readers who might not wish to read the entire report, an informative abstract will be included.

NOTE This report's end matter (list of references) is shown and discussed on pages 662, 663.

165 Hammond Way
Hyannis, MA 02457

April 29, 2015

John Fitton
Placement Director
University of Massachusetts
North Dartmouth, MA 02747

Dear Mr. Fitton:

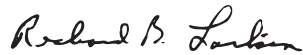
Here is my report, Feasibility Analysis of a Career in Technical Marketing. In preparing this report, I've learned a great deal about the requirements and modes of access to this career, and I believe my information will help other students as well. Thank you for your guidance and encouragement throughout this process.

Although committed to their specialties, some technical and science graduates seem interested in careers in which they can apply their technical knowledge to customer and business problems. Technical marketing may be an attractive choice of career for those who know their field, who can relate to different personalities, and who communicate well.

Technical marketing is competitive and demanding, but highly rewarding. In fact, it is an excellent route to upper-management and executive positions. Specifically, marketing work enables one to develop a sound technical knowledge of a company's products, to understand how these products fit into the marketplace, and to perfect sales techniques and interpersonal skills. This is precisely the kind of background that paves the way to top-level jobs.

I've enjoyed my work on this project, and would be happy to answer any questions. Please phone at 690-555-1122 or email at larkin@com.net anytime.

Sincerely,



Richard B. Larkin, Jr.

← Letter of transmittal targets and thanks specific reader and provides additional context

FIGURE 21.3 A Formal Report

Running head is named here and will appear on each page of the report

Running head: FEASIBILITY ANALYSIS

Title is clear and encompasses entire focus of the report

Feasibility Analysis of a Career in Technical Marketing

Name and affiliation of intended recipient is given

for
Professor J. M. Lannon
Technical Writing Instructor
University of Massachusetts
North Dartmouth, Massachusetts

Author provides name and affiliation

by
Richard B. Larkin, Jr.
English 266 Student

Distribution date of the report appears on the title page

May 1, 2015

FIGURE 21.3 *(Continued)*

FEASIBILITY ANALYSIS

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Table of contents helps readers find information and visualize the structure of the report

This section makes visuals easy to locate

FIGURE 21.3 (Continued)

Abstract fully summarizes the content of the report

FEASIBILITY ANALYSIS

iii

Abstract

The feasibility of technical marketing as a career is based on a college graduate's interests, abilities, and expectations, as well as on possible entry options.

Technical marketing is a feasible career for anyone who is motivated, who can communicate well, and who knows how to get along. Although this career offers job diversity and potential for excellent income, it entails almost constant travel, competition, and stress.

College graduates enter technical marketing through one of four options: entry-level positions that offer hands-on experience, formal training programs in large companies, prior experience in one's specialty, or graduate programs. The relative advantages and disadvantages of each option can be measured in resulting immediacy of income, rapidity of advancement, and long-term potential.

Anyone considering a technical marketing career should follow these recommendations:

- Speak with people who work in the field.
- Weigh the implications of each entry option carefully.
- Consider combining two or more options.
- Choose options for personal as well as professional benefits.

FIGURE 21.3 (Continued)

FEASIBILITY ANALYSIS

1

Introduction

In today's global business climate, graduates in science and engineering face narrowing career opportunities because of "offshoring" of hi-tech jobs to low-wage countries. Government research indicates that more than two-thirds of the 40 occupations "most prone to offshoring" are in science and engineering (Bureau of Labor Statistics [BLS], 2006, p. 14). Experts Hira and Hira have suggested that the offshoring situation threatens the livelihood of some of the best-paid workers in America (2005, p. 12). University career counselor Troy Behrens offers the disturbing fact that the U.S. graduated 30,000 engineers in 2006, whereas India and China graduated 3 million (cited in Jacobs, 2007).

← Introduction identifies the problem

Given such bleak prospects, graduates might consider alternative careers. Technical marketing is one field that combines science and engineering expertise with "people skills"—those least likely to be offshored (BLS, 2006, p. 12). Engineers, for example, might seek jobs as *sales engineers*, specially trained professionals who market and sell highly technical products and services (BLS, 2009a, p. 1).

← Proposes a possible solution

What specific type of work do technical marketers perform? *The Occupational Outlook Handbook* offers this job description:

They [technical marketing specialists] possess extensive knowledge of [technologically and scientifically advanced] products, including...the components, functions, and scientific processes that make them work. They use their technical skills to explain the benefit of their products to potential customers and to demonstrate how their products are better than the products of their competitors. Often they modify and adjust products to meet customers' specific needs (BLS, 2009a, p.1).

← Definition

(For a more detailed job description, refer to "The Technical Marketing Process," on page 2.)

Undergraduates interested in technical marketing need answers to the following basic questions:

- *Is this the right career for me?*
- *If so, how do I enter the field?*

← Clear purpose statement leads into the body of the report

To help answer these questions, this report analyzes information gathered from professionals as well as from the literature. After defining *technical marketing*, the analysis examines employment outlook, required skills and personal qualities, career benefits and drawbacks, and entry options.

FIGURE 21.3 (Continued)

FEASIBILITY ANALYSIS

2

Data Section

Key Factors in a Technical Marketing Career

Anyone considering technical marketing needs to assess whether this career fits his or her interests, abilities, and aspirations.

The technical marketing process. The classic process (identifying, reaching, and selling to customers) entails six key activities (Cornelius & Lewis, 1983, p. 44):

1. *Market research:* assessing size and character of the target market.
2. *Product development and management:* producing the goods to fill a need.
3. *Cost determination and pricing:* measuring every expense in the product's production, distribution, advertising, and sales to determine its price.
4. *Advertising and promotion:* developing strategies for reaching customers.
5. *Product distribution:* coordinating all elements of a technical product or service, from conception through final delivery to the customer.
6. *Sales and technical support:* creating and maintaining customer accounts, and servicing and upgrading products.

Engaged in all these activities, the technical marketing professional gains detailed understanding of the industry, the product, and the customer's needs (Figure 1).

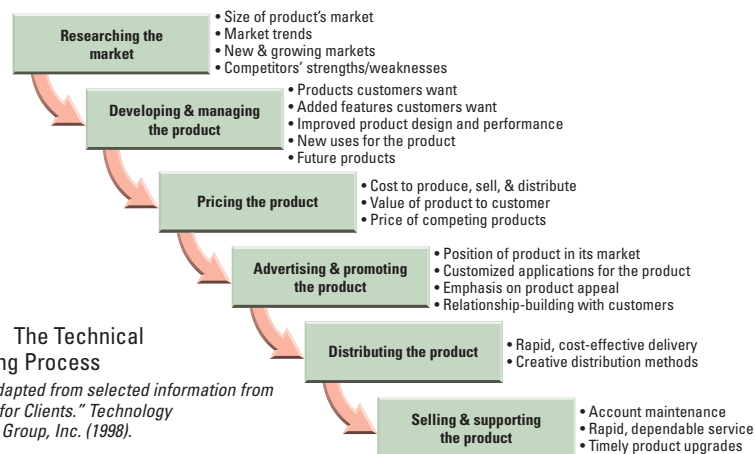


Figure 1 The Technical Marketing Process

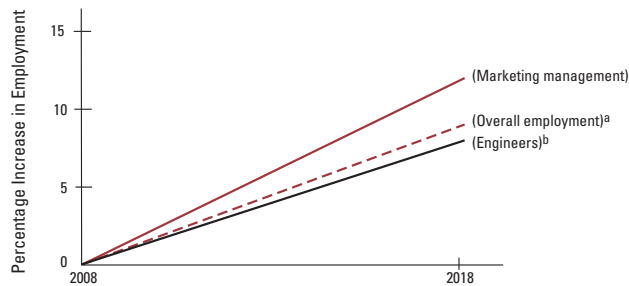
Source: Adapted from selected information from "Services for Clients." Technology Marketing Group, Inc. (1998).

FIGURE 21.3 (Continued)

FEASIBILITY ANALYSIS

3

Employment outlook. For graduates with the right combination of technical and personal qualifications, the outlook for technical marketing (and management) is excellent. Most engineering jobs will increase at less than average for jobs requiring a Bachelor's degree, while marketing and marketing management jobs will exceed the average rate (Figure 2).



Visual provides instant comparison

Figure 2 The Employment Outlook for Technical Marketing

^aJobs requiring a Bachelor's degree.

^bExcluding outlying rates for specialties at the positive end of the spectrum (environmental engineers: +31%; biomedical: +72%; civil: +24%; petroleum: +18%).

Source: Data from U.S. Department of Labor. Bureau of Labor Statistics. (2009). <http://www.bls.gov/oco/ocos027.htm>

Although highly competitive, these marketing positions call for the very kinds of technical, analytical, and problem-solving skills that engineers can offer—especially in an automated environment.

Technical skills required. Interactive Web sites and social media marketing will increasingly influence the way products are advertised and sold. Also, marketing representatives increasingly work from a “virtual office.” Using laptops, smartphones, and other such devices, representatives out in the field have real-time access to digital catalogs of product lines, multimedia presentations, pricing for customized products, inventory data, product distribution channels, and sales contacts (Tolland, 2013).

With their rich background in computer, technical, and problem-solving skills, engineering graduates are ideally suited for (a) working in automated environments, and (b) implementing and troubleshooting these complex and often sensitive electronic systems.

FIGURE 21.3 (Continued)

FEASIBILITY ANALYSIS

4

Other skills and qualities required. *Business Week's* Peter Coy offers this distinction between routine versus non routine work:

The jobs that will pay well in the future will be ones that are hard to reduce to a recipe. These attractive jobs—from factory floor management to sales to teaching to the professions—require flexibility, creativity, and lifelong learning. They generally also require subtle and frequent interactions with other people, often face to face. (2004, p. 50)

Technical marketing is just such a job: it involves few “cookbook-type” tasks and requires “people skills.” Besides a strong technical background, success in this field calls for a generous blend of those traits summarized in Figure 3.

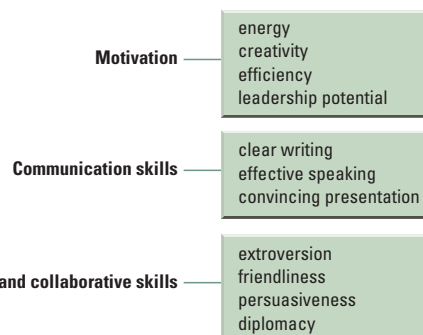


Figure 3 Required People Skills for a Technical Marketing Career

Motivation is essential in marketing. Professionals must be energetic and able to function with minimal supervision. Career counselor Phil Hawkins describes the ideal candidates as people who can plan and program their own tasks, can manage their time, and have no fear of hard work (personal interview, February 11, 2013). Leadership potential, as demonstrated by extracurricular activities, is an asset.

Motivation alone, however, provides no guarantee of success. Marketing professionals are paid to communicate the value of their products and services, orally, online, on paper, and face to face. They routinely prepare such documents as sales proposals, product descriptions, and user manuals. Successful job candidates typically have taken courses in advertising, public speaking, technical communication, and—increasingly— foreign language (BLS, 2009a, pp. 2-3).

For emphasis, select sources are quoted directly

Report is based on primary as well as secondary research

FIGURE 21.3 (Continued)

FEASIBILITY ANALYSIS

5

Skilled oral presentation is vital to any sales effort, as Phil Hawkins points out. Technical marketing professionals need to speak confidently and persuasively—to represent their products and services in the best light (personal interview, February 11, 2013). Sales presentations often involve public speaking at conventions and trade shows.

The ultimate requirement for success in marketing is interpersonal and collaborative skills: “tact, good judgement, and exceptional ability to establish and maintain relationships with supervisory and professional staff and client firms” (BLS, 2009b, p. 4).

Advantages of the career. As shown in Figure 1, technical marketing offers experience in every phase of a company’s operation, from a product’s design to its sales and service. Such broad exposure provides excellent preparation for upper-management positions. In fact, experienced sales engineers often open their own businesses as freelance “manufacturers’ agents” representing a variety of companies who have no marketing staff. In effect their own bosses, manufacturers’ agents are free to choose, from among many offers, the products they wish to represent (Tolland, 2013).

Another career benefit is the attractive salary. In addition to typically receiving a base pay plus commissions, marketing professionals are reimbursed for business expenses. Other employee benefits often include health insurance, a pension plan, and a company car. In 2008, the median annual earnings for sales engineers was \$83,100. The highest 10 percent earned more than \$136,000 annually (BLS, 2008, p.1).

The interpersonal and communication skills that marketing professionals develop are highly portable. This is vital in our rapidly shifting economy, in which job security is disappearing in the face of more and more temporary positions (Tolland, 2013).

Drawbacks of the career. Technical marketing is by no means a career for every engineer or technology professional. Sales engineer Roger Cayer cautions that personnel might spend most of their time traveling to meet potential customers. Success requires hard work over long hours, evenings, and occasional weekends. Above all, the job entails constant pressure to meet sales quotas (phone interview, February 8, 2013). Anyone considering this career should be able to work and thrive in a competitive environment. The Bureau of Labor Statistics (2009a, p. 2) adds that the expanding global economy means that “international travel, to secure contracts with foreign customers, is becoming more common”—placing more pressure on an already hectic schedule.

Offers balanced coverage: advantages versus drawbacks (below)

Provides a realistic view

FIGURE 21.3 (Continued)

FEASIBILITY ANALYSIS

6

A Comparison of Entry Options

Engineers and other technical graduates enter this field through one of four options. Some join small companies and learn their trade directly on the job. Others join companies that offer formal training programs. Some begin by getting experience in their technical specialty. Others earn a graduate degree beforehand. These options are compared below.

Option 1: Entry-level marketing with on-the-job training. Smaller manufacturers offer marketing positions in which people learn on the job. Elaine Carto, president of ABCO Electronics, believes small companies offer a unique opportunity; entry-level salespersons learn about all facets of an organization, and often enjoy rapid advancement (personal interview, February 10, 2013). Career counselor Phil Hawkins says, "It's all a matter of whether you prefer to be a big fish in a small pond or a small fish in a big pond" (personal interview, February 11, 2013).

Entry-level marketing offers immediate income and a chance for early promotion. But one disadvantage might be the loss of any technical edge acquired in college.

Option 2: A marketing and sales training program. Formal training programs offer the most popular entry. Larger companies offer two formats: (a) a product-specific program, focused on a particular product or product line, or (b) a rotational program, in which trainees learn about an array of products and work in the various positions outlined in Figure 1. Programs last from weeks to months. Intel Corporation, for example, offers 30-month training programs titled "Sales and Marketing Rotation," to prepare new graduates for positions as technical sales engineer, marketing technical engineer, and technical applications engineer.

Like direct entry, this option offers the advantage of immediate income and early promotion. With no chance to practice in their specialty, however, trainees might eventually find their technical expertise compromised.

Option 3: Prior experience in one's technical specialty. Instead of directly entering marketing, some candidates first gain experience in their specialty. This option combines direct exposure to the workplace with the chance to sharpen technical skills in practical applications. In addition, some companies, such as Roger Cayer's, will offer marketing and sales positions to outstanding staff engineers as a step toward upper management (phone interview, February 8, 2013).

Each option in the comparison is previewed

Here and below, interpretations clarify the pros and cons of each entry option

FIGURE 21.3 (Continued)

FEASIBILITY ANALYSIS

7

Although the prior-experience option delays entry into technical marketing, industry experts consider direct workplace and technical experience key assets for career growth in any field. Also, work experience becomes an asset for applicants to top MBA programs (Shelley, 1997, pp. 30–31).

Option 4: Graduate program. Instead of direct entry, some people choose to pursue an MS in their specialty or an MBA. According to engineering professor Mary McClane, MS degrees are usually unnecessary for technical marketing unless the particular products are highly complex (personal interview, April 2, 2013).

In general, jobseekers with an MBA have a competitive advantage. Also, new MBAs with a technical bachelor's degree and one to two years of experience command salaries from 10 to 30 percent higher than MBAs who lack work experience and a technical bachelor's degree. In fact, no more than 3 percent of candidates offer a "techno-MBA" specialty, making this unique group highly desirable to employers (Shelley, 1997, p. 30). A motivated student might combine graduate degrees. Dora Anson, president of Susimo Systems, sees the MS/MBA combination as ideal preparation for technical marketing (2013).

One disadvantage of a full-time graduate program is lost salary, compounded by school expenses. These costs must be weighed against the prospect of promotion and monetary rewards later in one's career.

An overall comparison by relative advantage. Table 1 compares the four entry options on the basis of three criteria: immediate income, rate of advancement, and long-term potential.

Table 1 Relative Advantages Among Four Technical-Marketing Entry Options

Option	Relative Advantages		
	Early, immediate income	Greatest advancement in marketing	Long-term potential
Entry level, no experience	yes	yes	no
Training program	yes	yes	no
Practical experience	yes	no	yes
Graduate program	no	no	yes

Interprets evidence impartially

Table summarizes the prior information, for instant comparisons

FIGURE 21.3 (Continued)

FEASIBILITY ANALYSIS

8

Conclusion

Summary accurately and concisely reflects the report's body section

Summary of Findings

Technical marketing and sales requires solid technical background, motivation, communication skills, and interpersonal skills. This career offers job diversity and excellent income potential, balanced against relentless pressure to perform.

Graduates interested in this field confront four entry options: (1) direct entry with on-the-job training, (2) a formal training program, (3) prior technical experience, and (4) graduate programs. Each option has benefits and drawbacks based on immediacy of income, rate of advancement, and long-term potential.

Overall interpretation explains what the findings mean

Interpretation of Findings

For graduates with strong technical backgrounds and the right skills and motivation, technical marketing offers attractive prospects. Anyone contemplating this career, however, needs to enjoy customer contact and thrive in a competitive environment.

Those who decide that technical marketing is for them have various entry options:

- For hands-on experience, direct entry is the logical option.
- For intensive sales training, a formal program with a large company is best.
- For sharpening technical skills, prior work in one's specialty is invaluable.
- If immediate income is not vital, graduate school is an attractive option.

Recommendations are clear about what the audience should think and do

Recommendations

If your interests and abilities match the requirements, consider these suggestions:

1. For a firsthand view, seek the advice and opinions of people in the field. You might begin by contacting professional organizations such as the Manufacturers' Agents National Association at www.manaonline.org.
2. Before settling on an entry option, consider its benefits and drawbacks and decide whether this option best coincides with your career goals.
3. When making any career decision, consider career counselor Phil Hawkins' s advice: "Listen to your brain and your heart" (personal interview, February 11, 2013). Seek not only professional advancement but also personal satisfaction.

References

[The complete list of references is shown and discussed on pages 676, 677.]

FIGURE 21.3 (Continued)



GUIDELINES for Reasoning through an Analytical Problem

Audiences approach an analytical report with this basic question:

| *Is this analysis based on sound reasoning?*

Whether your report documents a causal, comparative, or feasibility analysis (or some combination), you need to trace your line of reasoning so that readers can follow it clearly. As you prepare your report, observe the following guidelines:

For Causal Analysis

1. **Be sure the cause fits the effect.** Keep in mind that faulty causal reasoning is extremely common, especially when we ignore other possible causes or when we confuse mere coincidence with causation. For more on this topic, refer to pages 156–58.
2. **Make the links between effect and cause clear.** Identify the immediate cause (the one most closely related to the effect) as well as the distant cause(s) (the ones that often precede the immediate cause). For example, the immediate cause of a particular airplane crash might be a fuel-tank explosion, caused by a short circuit in frayed wiring, caused by faulty design or poor quality control by the airplane manufacturer. Discussing only the immediate cause often just scratches the surface of the problem.
3. **Clearly distinguish between possible, probable, and definite causes.** Unless the cause is obvious, limit your assertions by using *perhaps*, *probably*, *maybe*, *most likely*, *could*, *seems to*, *appears to*, or similar qualifiers that prevent you from making an insupportable claim. Keep in mind that “certainty” is elusive, especially in causal relationships.

For Comparative Analysis

1. **Rest the comparison on clear and definite criteria: costs, uses, benefits/drawbacks, appearance, results.** In evaluating the merits of competing items, identify your specific criteria (cost, ease of use, durability, and so on) and rank these criteria in order of importance.
2. **Give each item balanced treatment.** Discuss points of comparison for each item in identical order.
3. **Support and clarify the comparison or contrast through credible examples.** Use research, if necessary, for examples that readers can visualize.



GUIDELINES *continued*

4. **Follow either a block pattern or a point-by-point pattern.** In the block pattern, first one item is discussed fully, then the next. Choose a block pattern when the overall picture is more important than the individual points.

In the point-by-point pattern, one point about both items is discussed, then the next point, and so on. Choose a point-by-point pattern when specific points might be hard to remember unless placed side by side.

Block pattern

Item A

first point

second point, etc.

Item B

first point

second point, etc.

Point-by-point pattern

first point of A/first point of B, etc.

second point of A/second point of B, etc.

5. **Order your points for greatest emphasis.** Try ordering your points from least to most important or dramatic or useful or reasonable. Placing the most striking point last emphasizes it best.
6. **In an evaluative comparison (“X is better than Y”), offer your final judgment.** Base your judgment squarely on the criteria presented.

For Feasibility Analysis

1. **Consider the strength of supporting reasons.** Choose the best reasons for supporting the action or decision being considered—based on your collected evidence.
2. **Consider the strength of opposing reasons.** Remember that people—including ourselves—usually see only what they want to see. Avoid the temptation to overlook or downplay opposing reasons, especially for an action or decision that you have been promoting. Consider alternate points of view; examine and evaluate all the evidence.
3. **Recommend a realistic course of action.** After weighing all the pros and cons, make your recommendation—but be prepared to reconsider if you discover that what seemed like the right course of action turns out to be the wrong one.

**CHECKLIST: Analytical Reports**

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For evaluating your research methods and reasoning, refer also to the checklist on page 166. (Numbers in parentheses refer to the first page of discussion.)

Content

- ☐ Does the report address a clearly identified problem or purpose? (497)
- ☐ Are the report's length and detail appropriate for the subject? (497)
- ☐ Is there enough information for readers to make an informed decision? (498)
- ☐ Are all limitations of the analysis clearly acknowledged? (498)
- ☐ Is the information accurate, unbiased, and complete? (500)
- ☐ Are visuals used whenever possible to aid communication? (500)
- ☐ Are all data fully interpreted? (498)
- ☐ Are the conclusions logically derived from accurate interpretation? (500)
- ☐ Do the recommendations constitute an appropriate and reasonable response to the question or problem? (501)
- ☐ Is each source and contribution properly cited? (517)
- ☐ Are all needed front and end matter supplements included? (514)

Arrangement

- ☐ Is there a distinct introduction, body, and conclusion? (503)
- ☐ Does the introduction provide sufficient orientation to the issue or problem? (504)
- ☐ Does the body section present a clear picture of the evidence and reasoning? (505)
- ☐ Does the conclusion answer the question that originally sparked the analysis? (512)
- ☐ Are there clear transitions between related ideas? (685)

Style and Page Design

- ☐ Is the level of technicality appropriate for the primary audience? (19)
- ☐ Are headings informative and adequate? (297)
- ☐ Is the writing clear, concise, and fluent? (203)
- ☐ Is the language precise, and informative? (217)
- ☐ Is the report grammatical? (664)
- ☐ Is the page design inviting and accessible? (283)



Projects

MyWritingLab™

GENERAL

Prepare an analytical report, using this procedure:

- a. Choose a problem or question for analysis from your major or a subject of interest.
- b. Restate the main question as a declarative sentence in your audience and purpose statement.
- c. Identify an audience—other than your instructor—who will use your information for a specific purpose.
- d. Hold a private brainstorming session to generate major topics and subtopics.
- e. Use the topics to make a working outline based on the model outline in this chapter.
- f. Make a tentative list of all sources (primary and secondary) that you will investigate. Verify that adequate sources are available.
- g. In a proposal memo to your instructor (page 543), describe the topic and your plan for analysis. Attach a tentative bibliography.
- h. Use your working outline as a guide to research.
- i. Submit a progress report (page 476) to your instructor describing work completed, problems encountered, and work remaining.
- j. Compose an audience and use profile. (See page 30.)
- k. Write the report for your stated audience. Work from a clear statement of audience and purpose, and be sure that your reasoning is shown clearly. Verify that your evidence, conclusions, and recommendations are consistent. Be especially careful that your recommendations observe the critical-thinking guidelines in Figure 21.2.
- l. After writing your first draft, make any needed changes in the outline and revise your report

according to the revision checklist. Include front matter and end matter.

- m. Exchange reports with a classmate for further suggestions for revision.
- n. Prepare an oral report of your findings for the class as a whole.

TEAM

1. Divide into small groups. Choose a topic for group analysis—preferably a campus issue—and brainstorm. Draw up a working outline that could be used as an analytical report on this subject.
2. In the workplace, it is common for reports to be written in teams. Think of an idea for a report for this class that might be a team project. How would you divide the tasks and ensure that the work was being done fairly? What are the advantages and disadvantages of a team approach to a report? In groups of two to three, discuss these issues. If your instructor indicates that your report is to be team-based, write a memo (as a team) to your instructor indicating the role of each team member and the timeline.

DIGITAL AND SOCIAL MEDIA

Many reports, particularly government reports, are turned into PDF documents and are available on the Web. When you have a draft of your report, turn it into a PDF file. (Use the “Save As” function in Microsoft Word.) Now open the file using Adobe Acrobat (you can download a free version) and read the report on a computer. Are there places in the report where you might consider adding links to external Web sites, so readers can obtain more information? How would you decide where and when to add links? Make some notes about this and discuss with at

least one other student. Write a brief memo to your classmates explaining your observations.

GLOBAL

Many formal analytical reports are written in English but for readers who speak many different languages and come from many different countries and cultures. Go online and find Web sites for organizations that have an international audience. Organizations of interest might include the following (you can add to this list with other organizations related to your major or career):

- Association of Computing Machinery (ACM)
- Doctors Without Borders
- Institute of Electrical and Electronics Engineers (IEEE)
- International Association for Bridge and Structural Engineering

- Society for Technical Communication (STC)
- United Nations
- World Health Organization (WHO)

Look for the “publications” tab or other links that give you access to the organization’s published reports. Select several reports, and analyze these based on the material from this chapter. Can you determine the type of analysis (causal; comparative; feasibility; some combination)? Why do you think the writer(s) chose this approach for an international audience? In addition, analyze the report for features such as structure and organization, word choice, formatting, use of visuals, levels of politeness, and media format (PDF, hyperlinked Web page, or other).

Write a memo to your instructor with your findings. What conclusions can you draw about effective writing and design practices for formal reports that have an international audience?



Visit Chapter 21, *Formal Analytical Reports*, in MyWritingLab to complete this chapter’s applications, to explore this chapter’s overview, checklist, and flashcards, and to test your understanding of the chapter objectives.