Part I Quantifying the World

Thinking of the world as data

In today's world, everyone is collecting data. It's everywhere. Some even say we are innundated with data, so much so that we cannot keep up with the amount of data we can generate and collect. With this in mind, consider the following definition of **data**:

Data: Information extracted from real-world contexts that has been organized for analysis in forms that can be used for making decisions.

Given this definition, who among the following are more likely to think of the world as data in their professional work?

- Mathematicians?
- Scientists?
- Reporters?
- Detectives?
- Business managers?

We can be fairly safe in saying that mathematicians do not see the world as data in their day-to-day work. Only a relatively few mathematicians deal with the real world at all in their professional work. While they may construct mathematical models that others (such as scientists or business managers) may find very useful in making sense of real-world data, mathematicians themselves are often quite unconcerned about the real-world usefulness of their work.

Scientists, on the other hand, use data extensively in their everyday work, but they use it under carefully controlled circumstances. They are interested in data in terms of its experimental reproducibility. They tend to think of the world in terms of patterns of data that occur and reoccur under certain specified conditions. They tend to think of real-world data in terms of how it conforms to predictable scientific laws.

Reporters think of the world as stories. Not rambling stories, but stories told in a certain way so as to communicate a lot of information in a short space. They efficiently extract information from the cacophony of life's events by using the five W's (though not necessarily in this order:

- Who,
- What,
- Where,
- When, and
- Why).

Depending on the nature of the story, experienced reporters usually try to work the answers to the 5-W's into the first paragraph or so of the story. This enables them to accurately convey the context and gist of the story as soon as possible, so that anything else further down the column is merely an elaboration of what is already known. The point is that without the 5-W's approach news reporting becomes less focused, more meandering, and results in less accurate information transmitted for the amount of print expended. But do reporters see the world as data in the sense we have defined it above? They certainly see the world as story based on information, but as data?-probably not. Even if a reporter were writing a financial story, for example, and even if that story contained numerical information that was organized in a form that could be analyzed in some way (for example, graphs or charts), that data would not be specific enough or numerous enough to be of much use to a bank or stock brokerage firm for decision making. Indeed, such businesses would probably have their own data analysis staff anyway or would contract out such services. Nevertheless, the 5-W tool for extracting and organizing information from the world is a useful one from which managers can profit. You will get the opportunity to try it out for yourself in this first unit.

Do detectives see the world as data? "Nothing but the facts, ma'am," says Joe Friday, the laconic police investigator of that ancient TV show Dragnet. Clearly, detectives think of the world as data. Not management-type data, but certainly as information that is organized for analysis in forms that can be used for making that one bottom-line decision - whodunnit? Of course, there are a host of decisions that precede this big one. The detective makes these decisions by drawing inferences from evidence, which is another way of saying "by analyzing the data." So while the data that detectives work with is quite different from the data that managers compile, there is a similarity in what the two do with the data, the way they marshal compelling evidence and draw inferences from that evidence as they argue their case. Everyone knows that detectives cannot make judgments or decisions that will hold up in court without the proper supporting evidence. So it is with business managers. They likewise must present their arguments based on proper supporting evidence. We will be concerned with what constitutes proper evidence and how to present it in almost all of the homework problems.

Because business managers have to constantly make decisions in less-than-certain circumstances, it is to their advantage to think of the world as data, almost to the extent that it becomes second nature to them, a way of seeing. While it is true that certain aspects of business occur with regularity, such as manufacturing processes or financial dealings, it is also true that many important aspects of business, such as sales trends or employee equity issues, are not reducible to known scientific laws. Then too, all aspects of business eventually come down to that one irreducible basic fact, the bottom line. For example, here is a list of bottom-line questions that a manager has to answer on a day-to-day basis that should make clear the case for thinking of the world as data:

- How are we performing?
- Do we have a problem? If so, what is it?
- What can we expect will happen in the future if we continue doing what we're doing now?

• What will happen in the future if we make some key changes?

Putting the case plainly: Would you place a person in a management position requiring answers to these kinds of bottom-line questionsif they could not see the world as data? This raises another question: Does this mean that managers have to be statisticians?

You may have noticed that the list of professions above does not include statisticians. To be sure, they are the real data professionals and data is their bread and butter. But statisticians are, in a sense, generalists. While they probably do see the world as data in a way that few others do, chances are that they do not see your particular business world as you do. As a business manager, you are in a position of responsibility and you are the one who has to make those bottom-line decisions that often have far-reaching consequences. Nevertheless, you do need to think of the world as data.

Which brings us to this point: is this then a statistics text for business managers? The answer is "no, not really." While you will gain experience in dealing with those all-important bottom-line questions listed above by using some rather basic techniques, it would indeed take a lot of statistical background to be able to answer them the way a statistician would. But companies do not, as a rule, hire statisticians as their managers. Similarly, this book is not written for prospective statisticians, but rather prospective managers who will have learned enough from the text to not only appreciate the value of data but also to be able to manage its collection and analysis. This means that they will be expected to understand the technical language of professional data analysts, at least enough to effectively communicate with them, and then to make sense of it all for both their employees and their supervisors. This book takes seriously the assumption that you will be involved either as managers or as team members of a group of professional data analysts in projects similar to those presented in the memo homework problems. This is why the book begins with a unit on thinking of the world as data.

Key Thinking Strategy: Thinking of the world as data.

How does one even begin to recognize and then collect the necessary data that will enable us to first define the problem and then to analyze it? Restated: How does one go about isolating what is relevant to the problem and what is not relevant from the undifferentiated flow of activities or actions or states of existence that we confront in a real-life situation?

One of the easiest and most effective ways to think of the world as data is from the reporter's point of view. The job of a reporter is to tell a story, a story based on facts. The reporter collects facts mostly by asking questions. This an excellent starting point for the business manager as well. In this unit we will use the 5 W's-plus one extra - as a strategy to help us see the world as data: Who, what, when, where, why and how. Although we will be using the 5W's+H, or a selected subsets of them, as a thinking strategy throughout the book, they may take on different meanings and emphases in different sections of the book, depending on whether we are doing the initial work of defining the problem, or creating a plan and timeline to carry out the project or using a particular mathematical technique to analyze the data or writing a memo to convey the results of our analysis. The point is that while it is important to be able to roll the 5W's+H off the tongue, it is also important to be

aware that not only will we not always talk about all of them all the time but that even when we do we may not be thinking of them in quite the same way from situation to situation. Then too, the W's are not necessarily mutually exclusive, meaning that, for example, there may be situations in which it does not make sense to ask What? without asking Where? in the same breath or How? without asking When?

Chapter 1

Problem Solving By Asking Questions¹

Sometimes the data that is needed to solve a problem has already been gathered and is sitting in a data bank just waiting to be analyzed. Sometimes it is not. If this is the case, one of the first steps in solving the problem is to gather the necessary data. But exactly what data does one need? Clearly, that depends on the problem and that, in turn, assumes we know what the problem really is. This chapter is about letting go of our preconceived notions of what the problem is and then developing ways of getting at the data that will not only define the problem situation but also point to a solution.

- As a result of this chapter, students will learn
 - $\sqrt{}$ The importance of not making assumptions about a problem
 - $\sqrt{}$ To understand a problem within its context
 - \checkmark The importance of data
 - \checkmark What is involved in gathering data
- As a result of this chapter, students will be able to
 - $\sqrt{}$ Better understand how to read complex interrelated texts
 - $\sqrt{}$ Develop a plan for gathering data
 - $\sqrt{}$ Develop a rough timeline for a project
 - $\sqrt{}$ Write a memo in response to a problem

 $^{^1 @2011}$ Kris H. Green and W. Allen Emerson

1.1 Why Data?

One of the first things that an aspiring manager or consultant has to learn about solving a problem is that he or she is not being paid to provide unsubstantiated beliefs about what might or might not be a good solution. Rather, the successful manager or consultant is paid to propose solutions based upon pertinent data and a well-reasoned analysis of that data. The manager's feelings or guesswork or intuitions can be helpful in exploring a problem situation but they cannot by themselves be the basis for making sound and reliable decisions. Again, it is having a clear idea of how to define the problem and having a plan for collecting the relevant data that constitute the professional approach.

The first step to solving a problem is to define the problem. This is not as obvious or as simple as it sounds; there are numerous case studies showing how businesses have wasted large quantities of money trying to solve the wrong problem. Listed below are the other steps in the general problem solving process. Keep in mind that the process is usually not sequential. You will usually find yourself jumping steps and repeating steps in an attempt to refine your solution.

- 1. Problem formulation stage
 - (a) Define the problem
 - (b) Identify possible causes and their effects
 - (c) Determine data to be collected
- 2. Data collection stage
 - (a) Determine what the variables are and how they will be coded
 - (b) Construct data collection forms
 - (c) Construct the database for analysis
- 3. Solution development stage
 - (a) Interrogate the data
 - (b) Determine a root cause for the problem
 - (c) Develop possible solutions
 - (d) Use the data to select the best solution
- 4. Refinement stage
 - (a) Test the solution with sample data
 - (b) Modify the solution based on the tests
- 5. Implementation stage
 - (a) Present your findings and your plan
 - (b) Put your solution into practice

- (c) Collect data as to the effectiveness of the solution
- (d) Modify the solution as needed, based on data

One of the reasons that it is vitally important to define the problem you are studying is because real-world problems are often multifaceted. Their causes may be well hidden, and what you observe - the **perceived problem** - may mask the real problem's causes. Part of your job in studying a problem is to think of possible causes for the perceived problem, then determine ways to investigate the situation by collecting data that can sort through these causes. Making this even more difficult is the fact that a single cause can have multiple effects, each of which may generate more effects of its own, some of which may overlap. Identifying this **chain of cause and effect** is really what understanding the problem is all about.

1.1.1 Definitions and Formulas

- **Data** Information extracted from real-world contexts that has been organized for analysis in forms that can be used to inform decision-making.
- **Consultant/Business Manager** A person who is paid to propose solutions that are based upon the collection and analysis of pertinent data.
- **Perceived problem** What the supervisor or employee or customer or client thinks is happening, which may or may not be the actual problem.
- **Problem situation** The circumstances in which a problem takes place and that give rise to the problem
- **Cause** The cause of a problem is often very unclear. The cause is what is really keeping your situation from being ideal. Very often, you will need to brainstorm possible causes and then collect data in order to rule out one or more of them.
- **Effect or symptom** This is the real problem, the result of the cause of the problem. It may be something obvious like lost revenue, and there may be several effects from a single cause.
- Chain of cause and effect Very often, a single root cause will "ripple" through the situation, leading to an intermediate effect, which itself becomes the cause of another problem, which has an effect, which causes another problem, and so on. Identification of the real problem and its cause then becomes more difficult because you are forced to backtrack from the obvious problem all the way to the root cause in order to most effectively solve the problem. For example, you may be experiencing the symptom of abdominal pain. In order for the doctor to help you, she must determine why you have the pain (the cause): it could be something you ate, an ulcer, a broken rib, a bruise, or something even more serious. Each possible cause has a very different solution. However, if the cause of the pain is, say, an ulcer, what is causing the ulcer? Stress? Spicy food? Poison?

1.1.2 Worked Examples

Example 1.1. A Problem at Gamma Technologies

Consider the memo below, from the CEO of Gamma Technologies, a firm that makes electronic sensors and filters for medical imaging equipment. The company is fairly large, has been around for many years, and has a varied and diverse workforce. To: All department managersFrom: CEO, Gamma TechnologiesDate: May 1, 2008Re: Working environment at Gamma

I have received a number of complaints that the working environment at Gamma is unfriendly to older workers. As a result, it is believed that older workers are leaving the company in such numbers that they are drastically underrepresented in the company. What should we do about this?

Excerpts from the responses of three managers, X, Y, and Z, are given below. These excerpts are followed by critiques in which some of these managers' unsubstantiated beliefs and assumptions are pointed out.

How Manager X Responded (an excerpt): "...Age discrimination is clearly a problem in today's workforce and it will become even more so in the immediate future as babyboomers begin retiring later in life than previous generations of workers, either by choice or because of the increasing difficulty of accumulating a sufficient nest egg. Attitudes toward and perceptions of aging workers must be addressed head on. I recommend that a requiredattendance series of sensitivity training classes be inaugurated immediately..."

How Manager Y Responded (an excerpt): "...Underrepresentation, whether regards to gender, race, or age, is a serious matter and puts Gamma at risk of a major class-action discrimination law suit. I recommend that management immediately establish 1) a secure hotline to handle complaints and 2) a review board that will investigate such complaints and 3) a set of procedures that establish clearly what actions will be taken upon the review board's conclusions..."

How Manager Z Responded (an excerpt): "...It is difficult to say with certainty how much of the underrepresentation of older workers is due to an unfriendly environment and how much to other factors, such as wanting a career change or having accumulated sufficient financial resources for early retirement.."

Example 1.2. Critique of the Beliefs and Assumptions of the Managers

- Manager X
 - 1. Belief: Age discrimination is clearly a problem in today's workforce. Critique: While this may be true, X has not presented any evidence (data) to support this belief.
 - 2. Assumption: Younger workers at Gamma have an attitude problem (unfriendliness) toward older workers. Critique: How do we know this is true? X does not present any evidence (data) to support this assumption.
 - 3. Assumption: Gamma's unfriendliness to older workers is due to age discrimination. Critique: If there is unfriendliness to older workers (which has yet to be established), there is no evidence (data) that this unfriendliness is due to the age

of the worker and not to some other characteristic. Moreover, if there is indeed an unfriendly environment at Gamma, perhaps it is due to the unfriendly attitude of older workers to younger workers, not the other way around.

- 4. Belief: Sensitivity training effectively curbs discrimination. Critique: There is no evidence presented that such is the case. Even if X had presented data supporting the effectiveness of sensitivity training based on studies conducted at other companies, X would have to demonstrate that Gamma fits the profiles of these other companies.
- Manager Y:
 - 1. Assumption: There is an under representation of older workers at Gamma. Critique: There is no evidence (data) as to what the representation of older workers actually is at Gamma or how it compares to that of similar companies.
 - 2. Assumption: Gamma is at imminent risk of a class-action law suit. Critique: If there is under representation of older workers at Gamma, how do we know it is of sufficient proportion to precipitate a class-action law suit?
- Manager Z:
 - 1. Assumption: The under representation of older workers at Gamma may be attributed to reasons other than just an unfriendly environment. Critique: While not providing any supporting evidence that Gamma's older workers are indeed underrepresented, Z does properly question whether any such under representation can be attributed to age alone. This demonstrates a degree of analytic sophistication not found in the other manager' responses.

Example 1.3. The Common Assumption: There is a problem at Gamma.

Critique: All of the managers took as a given that what the CEO says is a problem is indeed a problem. A good manager or consultant understands that there is a perceived problem (what the boss or employee or customer or client perceives to be the problem) but also understands that the person being consulted should not propose solutions to bogus problems. The client's view of the problem will almost certainly be stated in terms of one or more assumptions and beliefs. This is to be expected, since if the client/customer knew what the situation really was, he or she would not need a consultant. It is the consultant's job to use the client's perceptions as a first approximation, a way of framing the problem, but to not buy into these perceptions unless analysis of the data supports them.

A Serious Misstep: Managers X and Y are recommending solutions to a perceived problem. That is, they are proposing solutions before knowing what the problem is and without gathering data to understand its dimensions.

While it is true that the manager/consultant is not paid for his or her unsubstantiated beliefs about what might or might not be a good solution (even to a genuine problem), one's beliefs or intuitions can be useful tools for figuring out what data should be gathered. It may turn out that some of the assumptions managers X, Y, and Z made are, in fact, true and can be supported by the gathering and analysis of appropriate data.

1.1.3 Exploration 1A: Assumptions get in the way

The beliefs and assumptions underlying the managers' responses to the CEO's directive at Gamma are all plausible, but they are not grounded in an analysis of data. We can use assumptions like these, however, to help us determine what kinds of data we need to gather in order to explore as many dimensions of a situation as we can without assuming we know the answers. The managers' "solutions" were likewise plausible but were proposed at the final stage of the problem-solving process instead of at the problem formulation stage where they could be most useful. In similar situations, we can use our imagined solutions as a way of testing whether we have thought of all the data we need to gather in order to adequately support them.

Briefly describe how you would gather the data needed to test the assumptions/beliefs of X, Y, and Z.

NOTE: If a particular belief or assumption does not seem to be particularly helpful for collecting the kind of data you need, explain briefly why not and move on to the next one.

Manager	Belief or Assumption	Data Needed or Explanation
Х	Age discrimination is a	
	problem	
	Young workers are un-	
	friendly toward older	
	workers	
	Unfriendliness is due to age	
	discrimination	
	Sensitivity training curbs	
	age discrimination	
Y	Older workers are under-	
	represented at Gamma	
	Gamma is at risk of a law-	
	suit	
Ζ	Under-representation may	
	be due to more than just un-	
	friendliness	

Explain below why you think that the data you listed above will help you gather enough data to assure that you have gotten beneath the perceived problem to the real problem (they may be one and the same, of course).

1.1.4 How To Guide

Writing business memos and reports

All solutions to memo problems should be written so as to "stand alone." That is, any reader should be able to pick up your solution and read it without knowing anything else about the problem (but might need to know something about the content). In other words, you must think objectively about your response to the memo. Ask yourself, "What if I got this on my desk and knew nothing about the project? Would I understand the memo?" If the answer is no, then your response needs more information.

Writing is one of the most (if not THE MOST) important aspects of a career - any career, but especially one in business. Writing is a way of seeing, understanding, explaining, and envisioning the world around you. Managers with good communication skills will never be outsourced.

In this course, you will be preparing two types of responses to memos. The first type of response you will produce is an informal, routine type of memo (see the sample in Example 1 (page 10) - problem at Gamma). In a routine memo, you should:

- Use an informative subject line that summarizes the purpose of the memo.
- State the purpose of your memo in a direct manner in your introduction.
- Organize the body of your memo for readability, using visual cues, bulleted lists, and tables.
- Summarize your analysis, findings, or recommendations, as appropriate in your closing paragraph.
- DO NOT include a closing (like "Sincerely, John")

The second type of response you will be preparing is really what would be called a Business Report. In this type of response, you should include the following sections:

- 1. The Executive Summary (1 2 paragraphs)
 - (a) Introduction. Tell the reader what the problem is about. Briefly tell the reader what data has been collected. Explain what you want to determine or find out.
 - (b) Preview. Then tell the reader what you are planning to do and give him/her an idea about how the analysis of the data will flow. Explain what the structure of the memo is.
 - (c) Conclusions of the Analysis. Briefly describe the conclusions, if possible.
- 2. Analysis (the bulk of the report)
 - (a) Steps to Reach the Conclusion. Explain what you did; explain all the steps and the reasoning that led to each step.

- (b) Supporting Evidence. Provide all the supporting evidence graphs, tables, charts, etc. Labe leach item appropriately and refer to it by name in the text of the response. Organize the evidence and the explanation so the reader can follow the argument.
- 3. Conclusion (1 2 paragraphs)
 - (a) Summary of results. Provide a summary of the results of the analysis, collected into a convenient form (like a table).
 - (b) Context. Put your solution into context and explain what the results actually mean for the situation you are analyzing. Interpret the results so the reader does not have to guess.
 - (c) Sensitivity. How accurate are your results? How much are they likely to change as a result of changes in the underlying data? Give the reader a sense of what the limits are to your analysis, so that he/she knows how much to rely on these results.
 - (d) Advice. If the original assignment/memo called for a decision, be sure you provide a clearly stated response to that requirement, and clearly connect your evidence and process to the decision you are advocating.

Another helpful hint is to use headings in the memo to improve both the visual and logical organization. These may take many different visual formats (bold type, underlining, larger font, etc.) but should match with the structure provided in the introduction of the memo, so that an interested reader can easily locate the information he or she needs. This helps with your overall goal in writing a good memo: Make your thought process transparent for both your reader and yourself. After all, you may need to come back to this project in six months or a year; a good memo now will save you a lot of time later.

Elements Of An Effective Memo

- \checkmark Writing is competent (grammar, spelling and sentence structure are correct and clear)
- $\sqrt{}$ Directed at the right person (your audience)
- $\sqrt{}$ Fully addresses the problem
- $\sqrt{}$ Margins are clean
- \checkmark Organized and focused so it can quickly be read and understood
- $\sqrt{}$ Sufficient analytic detail to justify all conclusions
- $\sqrt{}$ No charts or tables split across page breaks
- $\sqrt{}$ Charts and tables are labeled and referred to by these labels in the text
- \checkmark Evidence (charts and tables) is embedded in the report, somewhat near the discussion about it (integration of text and graphics)
- $\sqrt{}$ Charts and tables are all legible
- $\sqrt{}$ Document sections are in order and not fragmented
- $\sqrt{}$ Introduction provides an overview of the memo and its structure
- \checkmark Introduction reminds the reader (briefly) of what the problem context is and what you have been asked to do

Elements of an Exceptional Memo

- $\sqrt{}$ Additional tables used to organize all conclusions and make comparisons easier
- $\sqrt{}$ Features like bold text, shading, and headings used to highlight important information
- $\sqrt{}$ Conclusion summarizes the analysis
- $\sqrt{}$ Report includes an analysis of accuracy and possible errors

The 5W+H Strategy

- \checkmark Who writes? To whom?
- $\sqrt{}$ What do they write about?
- $\sqrt{}$ When should you write?
- \checkmark Where should you write?
- \checkmark Why should you write?

Email protocols for professional communication

You are probably used to sending and reading emails. You probably even have multiple email accounts to manage. Since all systems are slightly different, we want to talk about something more important to the general concept of sending emails, whether you are sending them to your course instructors, your family, your boss, or your friends.

Personal Information. It is critical that several things appear in any email message.

- Your name. It may seem redundant; after all, the recipient has your email address. But consider this. Many usernames are not clearly connected to to your name. When someone receives an email from abC1434, they don't usually have time to think about everyone they know that might have that as a username. They really don't know who sent the message. If you aren't willing to sign your actual name to the message, you should really think about whether it is a message you should be sending.
- Your job title and address
- Maybe even a phone number.

If your e-mail system allows signature files, it probably will let you create several different ones. You could have a signature file for professional communications and a separate one for personal communications, with different information in each.

Subject Line. Be sure that you put something meaningful in the subject line of your messages. With the thousands of junk email messages that most people receive each week, the subject line will often be the deciding factor in whether your email gets read or not. If your email is to a course instructor, for instance, your instructor will appreciate it if the subject line contains the course number (like MSTI 130) as the first part of the subject line. In the business world, many people will automatically delete messages with inappropriate subject lines or without a subject altogether, not to mention that many spam filters will automatically remove messages without subject lines before the intended recipient every gets an opportunity to examine them.

Be Professional. Make sure that you do a little proofreading in your emails. They may be short, but don't be sloppy. Grammar, punctuation, and spelling are all important in emails. Very often, this may be your only chance to make a first impression, so make it good.

1.2 Defining the Problem

More often than not, the most important step in solving a real-life problem is finding out exactly what the problem is. Obvious - and sometimes not so obvious. There are times when you will be called on to work with supervisors or clients who come to you for a solution but who don't really have a clear idea of what the problem is, and it will be your job to get to the bottom of the situation by gathering the data that define the problem and that provide all that will be needed to solve the problem once it is identified. Defining the problem and coming up with a plan for gathering the appropriate data to think about the problem go hand in hand.

But how, for any given problem situation, do we recognize what data will enable us to first define the problem accurately and then later to analyze it? We need to learn how to isolate what is relevant to the problem from what is not relevant to it. We will see in the Examples and Exploration how to use the 5W+H thinking strategy to recognize and isolate relevant information from a problem situation. In most cases, the strategy must be applied twice: once to the **problem context**, in order to understand what is going on and how one might resolve it, and once to the **communicative context**, in order to understand the purpose for solving the problem and how the results are to be shared.

In the problem context, we ask questions to help understand the perception of the problem, the causes of the problem, and the consequences of the problem. In other words, they help us develop an accurate picture of chain of cause and effect involved in the problem. If the perceived problem is "poor customer service" at your fast food restaurant, one needs to know a great deal more before trying to solve the problem. Who is complaining about the customer service? Is it a particular type of customer, customers placing a particular order, or something else? When are the complaints occurring? Are they around the clock, only at certain times of day/night, or are they connected to a particular staffing arrangement? Where are the complaints centered? Are they at the counter, drive-through, or both? What do the customer complaints even mean? Are they in regards to waiting too long for food, lack of friendliness, lack of cleanliness, or some other aspect of customer service? Why have these complaints just been brought up? Has something changed about the customer service? By first asking these questions, and then systematically collecting data to answer them, one can develop a better picture of the problem context. One can then attempt to resolve the problem as it actually exists. Without relevant data in the restaurant example, a manager might be tempted to push her employees to work faster, trying to minimize service times, when the real issue is that no one is keeping the dining area clean. Solving the wrong problem is often costly in time and money, and it still leaves the original problem unsolved.

Capturing the needed information in analyzable forms, however, is not always easy. Here are four ways to collect data that you might consider when defining the problem:

- Observations
- Survey Questionnaires
- Interviews
- Archives

We will use observations and survey questionnaires in later sections. You might consider, however, using any or all of these methods of data collection when doing the memo problem at the end of this chapter.

1.2.1 Definitions and Formulas

- 5W+H Strategy A method for making sure that you have considered as many different aspects of the problem situation as possible by asking six essential questions: Who? What? When? Where? Why? and How?
- **Problem Context** This is the situation giving rise to the problem. It includes everything about the situation. For example, if there are complaints about a restautant's service times, then the food preparation process, the layout of the store, the menu, the customers, and everything else involved in placing and picking up an order can be considered part of the problem context.
- **Communicative Context** This is an additional aspect of solving a problem that is often ignored. The problem context describes the situation; the communicative context helps one to understand the purpose and goals for solving the problem. Typically, this is because your boss has contacted you and given you deadlines and goals for the project.
- **Observation** Either a person or some sort of mechanical process (or combination) records the occurrence of some pertinent event, usually recorded in a format specially prepared for this purpose, e.g. keeping tallies on a lined paper form or noting times in one-hour blocks or an electric eye keeping tallies and times of the traffic flow through a gate.
- Survey Questionnaire A form (paper or electronic) filled out by customers, usually requires some sort of short answer or circle (check mark) of possible responses, e.g. Check: Male/Female; On a Likert scale of 1 (most liked) to 5 (least liked), circle one of the following, etc.
- Interview Either structured (the interviewer asks all interviewees exactly the same questions) or semi-structured (the interviewer asks each interviewee the same basic questions but "goes with the flow," according to how the interviewee responds). Structured interviews lend themselves most readily to quantitative analysis and often are somewhat like a questionnaire, except they are usually longer and have certain advantages, such as the interviewer making sure that all the questions are answered and understood.
- Archival Data Data that is compiled from already-existing sources, e.g. company data banks, government reports, or trade/industry tables that are available in print form, on CDs or that can be downloaded from the web.
- **Timeline** A schedule of the events or tasks needed to complete a project along with the length of time each task will require and, usually, the personnel needed for each task.
- **RFP** A request for a proposal. A business solicits proposals from other companies to undertake a project. The business will evaluate all submitted proposals on a competitive basis with regard to how well the proposals address the task or problem at hand and at what cost. The business will then award a contract to the company submitting the best proposal.

1.2.2 Worked Examples

These examples start with a memo from a regional manager of a fast-food chain to you, the manager of a local restaurant in the chain. This is followed by some notes on how you might respond to the memo. and a sample response memo to critique. The subsequent exploration begins with the response from the regional manager to your memo and gives you the opportunity to explore how you might address the regional manager's concerns.

Example 1.4. A Problem at Beef n' Buns

To: Local Manager, Beef n' Buns
From: Chad R. Chez, Regional Manager, Beef n' Buns
Date: May 8, 2008
Re: Customer Service

I seem to be getting a lot of complaints from across the region that our Beef n' Buns service is lousy. I want each of you to send me a detailed plan and a rough timeline for addressing this problem. I will review them and get back to you.

My Notes Toward a Reply There seems to be a lot going on with this memo, so I'm going to deal with it on two levels:

- 1. How should I deal with my boss in the context of the memo?
- 2. How can I come up with what he wants?

The Memo Context. This will help ensure that I do everything the boss wants in the way that he has asked for it to be done. While it doesn't resolve the problem itself, it will probably help me understand the boss better, and it will certainly help me keep my job.

- WHO? My boss, the Regional Manager
- WHAT? Wants me to devise a plan and a timeline for addressing the perceived problem. I'll send my response as a well-thought out memo
- WHEN? ASAP (if I know what's good for me!), then I'll wait for his comments to see when I will actually have to do put the plan into action
- WHERE? Sent to him
 - WHY? Perceived Problem: Lousy-service complaints. Whether I feel these complaints are justified or not, I am responsible for addressing his concern
 - HOW? Send him a memo with two things: A plan and a timeline. I think I'll also send along some idea of what the project will cost, just to let him know that such things don't come free.

The Problem Situation. This is where I find out about the causes of the problem and hopefully find some ways to fix it.

WHO? My customers

WHAT? Perceived problem: lousy service.

- WHERE? At the drive-up window? At the walk-in service counter? In the kitchen? In the dining area?
 - WHEN? Does the time of day matter? Is it tied to a particular set of staff members?
 - WHY? To see if my restaurant has a problem with service times. Are lousy-service complaints justified at my business? Is it related to something other than service times (like cleanliness, friendliness or something else?)

HOW? How can I and my staff go about gathering data to find out about service times?

PLAN: I don't know what the problem really is. I need to find out if it's a matter of unacceptably long service times at the drive-up and/or the walk-in counter. I'll need to collect data on both. I (or my staff) will have to observe, time, and record the service-time data and do some analysis of the data.

OBSERVATIONS: Where should I position my observers? When should they be there? How will they actually do it? Over what period of time should we collect data?

TIMELINE: I don't need a definite starting date for my project at this point, but I do need some kind of estimate of how long each of the tasks in my plan will take. Trying to set up a timeline really points out the missing pieces of my plan, and that is helpful. For example, who will carry out all these tasks? Seeing the overall project laid out like this also gives me an idea of the extra personnel cost and personnel scheduling problems I will encounter in carrying out the study–I will want to at least mention these things in my memo. Part of the timeline should include the time required to analyze the data. All in all, it is important to show the Regional Manager that I have thought about some of the ins and outs and that I have a realistic picture of the whole.

Example 1.5. A Proposed Plan and Timeline for Beef n' Buns

To:	Chad R. Chez, Regional Manager, Beef n' Buns
From:	Local Manager, Beef n' Buns
Date:	May 8, 2008
Re:	Customer Service

This is in response to your request for a plan and timeline for determining if customers are receiving poor service at my location.

Plan My staff and I will collect service wait times at the two venues, the drive-up window and the walk-in counter. One of us will record the time each order has taken from the moment it is placed to when the completed order is delivered to the customer. We will gather the wait times during a continuous one-hour interval for the periods we are busiest, that is, breakfast, lunch, and at dinner. Here is my timeline for the project:

Task	Time	Personnel
1. Create detailed plan for data collection	1 week	1 me
2. Actual data collection	2 weeks	2 people for 3 hrs/day
3. Analysis of data	2 weeks	1 me + consultant
4. Writing of report	1 week	1 me

Although there may be some additional expenses, most of the cost of the project will come from filling the slots vacated by the observers during the period of data collection and the hours the consultant puts in. I have identified a reputable statistical consultant at our local university who charges \$50/hr and would be interested in the project.

Cost Estimate:

2 people x 3 hrs/day x 14 days $@$ \$10.00/h	nr = \$840
1 Statistical consultant x 4 hrs x $50/hr$	= \$200
Miscellaneous expense (forms, etc)	= \$100
Total	=\$1140

I await your reply as to when to begin and how I should take care of the accounting.

1.2.3 Exploration 1B: Beef N' Buns Service

Consider the following response from your boss:

To: Local Manager, Beef n' Buns
From: Chad R. Chez, Regional Manager, Beef n' Buns
Date: May 11, 2008
Re: Customer Service

You are definitely headed in the right direction. Here are some things I would like you to think about for your revision.

I'm thinking that the type of order might have something to do with the wait time. We might find that some items or combination of items take longer than others. What might make one order take a significantly longer time than another? Just the size? Is there some way of comparing all these different combinations? If so, we could pinpoint the problem items and figure out ways to cut down their prep or processing times. Also, should the drive-up data be kept separate from the walk-in data or is it sufficient just to identify which is which in the same data base?

Collecting data during certain times of the day seems reasonable. Have you thought about the day of the week as a variable as well?

Have you considered that the complaints might mean something other than too-long wait times? What about customer relations? You know-friendliness, courtesy? Is there a way of getting at this possibility?

I think your timeline ought to include something about the time it is going to take to design the data collection forms and also maybe a training period for your observers. Shouldn't there be some trial runs to catch any bugs and then some time to make any necessary modifications to the collection forms? Also, what about the time it will take to enter the data into spreadsheets? Considering the amount of data you will be collecting, entry time might be significant enough to figure in the timeline. Much of the data can be captured and stored by the computer as the orders are placed and so your observers need not write down everything at the moment.

I am pleased that you thought to include the services of a statistical consultant in this project because so many of my local managers did not. I suspect that either they didn't even think of a consultant or were afraid that they didn't know enough to deal with one. As a matter of fact, I think that you might consider bringing in the consultant at other times in the process, instead of just for the data analysis.

Anyway, give me a revision of your plan and timeline ASAP. I will let you know how we will deal with the cost and the accounting of the project later on.

1.2. DEFINING THE PROBLEM

Make some notes as to how you would modify your plan based on the regional manager's memo and then create an expanded timeline to include his suggestions.

Notes on how to deal with the differences in orders:

Notes on collecting data on customer relations:

Revised timeline:

1.2.4 How To Guide

Format of computer information in this text

This textbook contains three kinds of computer information to help you. Each will be formatted a little differently, so we have included a brief overview of each to help you.

Excel Information

Excel information will be presented with a brief set up of how the spreadsheet should be organized and what the new tool will do. Step-by-step instructions will follow. Any formulas in the format below show the syntax of formulas to be typed into Excel.

=FormulaName(argument 1, argument 2, etc.)

Any formulas shown in this format, with specific cells or cell ranges in the formula, should be typed exactly as shown, assuming that your spreadsheet is set up as described in the information or as shown in the accompanying screenshots and images.

=FormulaName(A1:A10, 3)

Advice on computers and doing work electronically

There is nothing so tragic as bad things happening to good students. Unknown Instructor

If you want to avoid being one of those good students to whom bad things happen, take heed of the following advice. It should become a mantra, repeated to yourself over and over until it is a part of your psyche:

SAVE EARLY, SAVE OFTEN.

Anytime you make a substantial change to your work like pasting a graphic in, typing a whole sentence or paragraph, adding a table, or reformatting, you should save your file. Save as soon as possible after starting a file. There is also a keyboard shortcut for saving files: CTRL+S. Use this frequently to avoid losing a substantial part of your work.

Using the help system in Microsoft Office

The help system for Microsoft Office is fairly extensive. In Word or Excel (or Power Point), there is a button in the upper right corner of the screen that is labeled with a question mark. Clicking this button will activate the help system, shown in figure 1.1

The basic help dialog box has a search feature and some organized links about Excel. For starters, try searching for help on "help". Simply type the word "help" into the search box. If you are offline (not connected to the internet) you will have access to the basic help features; if you are online the help center can search a huge database of information to help you with your questions.