

NAS 501 Research Methods and Scientific Ethics

Chapter 3: Ethical Problem-Solving Techniques

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The Purpose

- **Learn how to analyze and resolve ethical dilemmas when they occur**
- **examine methods for analyzing ethical problems and see how to apply them**

In solving engineering problems, it is always tempting to look for an appropriate formula, plug in the numbers, and calculate an answer. This type of problem-solving approach, while sometimes useful for engineering analysis problems, is less useful for ethical problem solving. There are theories that help us to frame our understanding of the problem, but there are no formulas and no easy “plug-and-chug” methods for reaching a solution.

Obviously, some problems are easily solved. If you are tempted to embezzle money from your employer, it is clear that this action is stealing and is not morally acceptable. However, as mentioned previously, many of the situations encountered by practicing engineers are ambiguous or unclear, involving conflicting moral principles. This is the type of problem for which we will most need analysis and problem-solving methods.

1. Analysis of Issues In Ethical Problems

A first step in solving any ethical problem is to completely understand all of the issues involved. Once these issues are determined, frequently a solution to the problem becomes apparent.

The issues involved in understanding ethical problems can be split into three categories:

1. Factual
2. Conceptual
3. Moral

→ Understanding these issues helps to put an ethical problem in the proper framework and often helps point the way to a solution.

Types of Issues in Ethical Problem Solving

Factual issues: involve what is actually known about a case – i.e., what the facts are. Although this concept seems straightforward, the facts of a particular case are not always clear and may be controversial. An example of facts that are not necessarily clear can be found in the controversy in contemporary society regarding abortion rights. There is great disagreement over the point at which life begins and at which point a fetus can be legally protected.

In engineering, there are controversies over facts as well. For example, global warming is of great concern to society as we continue to emit greenhouse gases into the atmosphere. This is thought to lead to a generalized warming of the atmosphere as emissions from automobiles and industrial plants increase the carbon dioxide concentration in the atmosphere. This issue is of great importance to engineers since they might be required to design new products or redesign old ones to comply with stricter environmental standards if this warming effect indeed proves to be a problem. However, the global warming process is only barely understood, and the need to curtail emission of these gases is a controversial topic.

If it were known exactly what the effects of emitting greenhouse gases into the atmosphere would be, the engineer's role in reducing this problem would be clearer.

Types of Issues in Ethical Problem Solving

Conceptual issues have to do with the meaning or applicability of an idea.

In engineering ethics, this might mean defining what constitutes a bribe as opposed to an acceptable gift, or determining whether the certain business information is proprietary. In the case of the bribe, the value of the gift is probably a well-known fact. What isn't known is whether accepting it will lead to the unfair influence on a business decision.

For example, conceptually it must be determined if the gift or tickets to a sporting event by a potential supplier of parts for your project is meant to influence your decision or is just a nice gesture between friends.

Of course, like factual issues, conceptual issues are not always clear-cut and will often result in controversy as well.

Types of Issues in Ethical Problem Solving

Moral issues: once the factual and conceptual issues have been resolved, at least to the extent possible, all that remains is to determine which moral principle is applicable to the situation.

Resolution of moral issues is often more obvious. Once the problem is defined, it is usually clear with moral concept applies, and the correct decision becomes obvious.

In our example of a “gift” offered by a sales representative, once it is determined whether it is simply a gift or is really a bribe, then the appropriate action is obvious. If we determine that it is indeed a bribe, then it cannot ethically be accepted.

Given that the issues surrounding an ethical problem can be controversial, how can these controversies be resolved?

Factual issues: can often be resolved through research to establish the truth. It is not always possible to achieve a final determination of the “truth” that everyone can agree on, but generally, further research helps clarify the situation, can increase the areas of agreement, and can sometimes achieve consensus on the facts.

Conceptual issues: are resolved by agreeing on the meaning of terms and concepts. Sometimes agreement isn’t possible, but as with factual issues, further analysis of the concepts at least clarifies some of the issues and helps to facilitate agreement.

Moral issues: finally, moral issues are resolved by agreement as to which moral principles are pertinent and how they should be applied.

→ Often, all that is required to solve a particular ethical problem is a deeper analysis of the issues involved according to the appropriate principles. Once the issues are analyzed and agreement is reached on the applicable moral principles, it is clear what the resolution should be.

Challenges

- In many situations it is difficult or impossible to determine the relevant facts, especially when the factual issues have to do with the prediction of the likely consequences of events in the future.
- Arguments over the definitions of "bribe" or "proprietary" may be very difficult to resolve.
- People can disagree over moral issues, so let us examine these disagreements in more detail.

Conflict problems

Line drawing

Flow charting

Bribery/Acceptance of Gifts

Relevance vs. Conflict Problem

- In a **relevance problem**, we are not sure whether a principle applies in a particular situation. Whether James' applying the process he developed at Company A to the new situation in Company B is a use of proprietary information or is a relevance problem. Its resolution depends on the prior resolution of the conceptual issue as to how we define "proprietary."
- In a **conflict problem**, we are faced with two or more principles which seem to apply to a particular situation, and yet the two principles require different and incompatible actions.

Relevance Problems

Method for Relevance Problem

- First, set up a series of cases, ranging from a case where the concept clearly applies, through a series of ambiguous cases, to a case in which the concept clearly does not apply.
- Second, the morally relevant similarities and differences among the various cases must be enumerated. There is no magic formula for determining what is and is not morally relevant. Rather, you must rely on your own sense of what is morally relevant.
- Third, after enumerating the morally relevant similarities and differences in the various cases, you must determine the line of demarcation between transfers of information that should and should not be proprietary.

Conflict Problems

The most challenging problem in engineering.

An area of ethical problem solving that we will frequently encounter relates to problems that present us with a choice between two conflicting moral values, each of which seems to be correct. How do we make the correct choice in this situation?

Conflict problems can be solved in three ways.

Employing lower level consideration

Often, there are conflicting moral choices, but one is obviously more significant than the other.

Finding creative middle way

This solution is an attempt at some kind of a compromise that will work for everyone. The emphasis here should be on the word “**creative,**” because it takes a great deal of creativity to find a middle ground that **is acceptable to everyone and a great deal of diplomacy to sell it to everyone.** The sales job is especially difficult because of the nature of compromise, which is often jokingly defined as “the solution where nobody gets what they want.”

An example of a creative middle ground would be that rather than dumping a toxic waste into a local lake, one finds ways to redesign the production process to minimize the waste product, finds ways to pretreat the waste to minimize the toxicity, or offers to pay for and install the equipment at the municipal water system necessary to treat the water to remove this chemical before it is sent to homes. Obviously, no one will be completely satisfied with these alternatives, since redesigns and pretreatment cost time and take time. Some people will not be satisfied with even a minimized dumping of toxics.

Making hard choice

Finally, when, there is no easy choice and attempts to find a middle ground are not successful, all that is left to make the hard choice. Sometimes, you have to bite the bullet and make the best choice possible with the information available at the time. Frequently, you must rely on “gut feelings” for which path is the correct one.

LINE DRAWING

- Line drawing is performed by drawing a line along which various examples and hypothetical situations are placed.
- At one end “positive paradigm,” an example of something that is unambiguously morally acceptable.
- At the other end, the “negative paradigm,” an example of something that is unambiguously not morally acceptable, is placed.
- Those examples that more closely conform to the positive paradigm are placed near it, and examples closer to the negative paradigm are placed near paradigm.
- Placing the moral problem under consideration in the appropriate place along the line.

Problem:

It is proposed that our company dispose of a slightly hazardous waste by dumping into a lake. A nearby town takes its drinking water supply from this lake. The research shows that with the amount of waste in the lake will be 5 parts per million (ppm). The EPA limit for this material has been set at 10 ppm. At the 5 ppm level, we expect no health problems, and consumers would not be able to detect the compound in their drinking water.

Analysis problem :

Positive paradigm: The water supply for the town should be clean and safe.

Negative paradigm: Toxic levels of waste are put into the lake.

Let's start by drawing a line and placing the positive and negative paradigms on it:



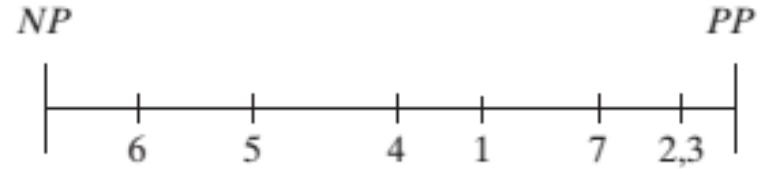
Now let's establish some other hypothetical examples for consideration:

Let's establish some other hypothetical examples for consideration:

1. The company dumps the chemical into the lake. At 5 ppm, the chemical will be harmless, but the town's water will have unusual taste.
2. The chemical can be effectively removed by the town's existing water treatment system.
3. The chemical can be removed by the town with equipment that will be purchased by the company
4. The chemical can be removed by the town with equipment for which the taxpayer will pay.
5. Occasionally, exposure to the chemical can make people feel ill, but this only lasts a week.
6. At 5 ppm, some people can get fairly sick, but the sickness only lasts a week, and there is no long-term harm.
7. Equipment can be installed at the plant to further reduce the waste level to 1 ppm.

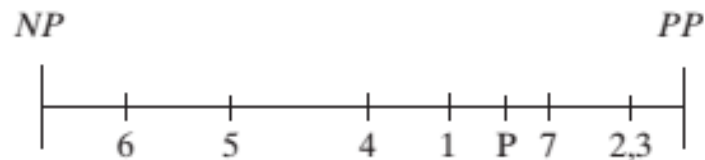
Ethical Problem-Solving Techniques

But the exercise should be continued with more examples until it is clear what the proper resolution is. So redraw our line with the examples inserted appropriately:



After setting up the examples, it may be clear that there is a gap in the knowledge. For example in our case, we might need more information on seasonal variation waste concentration and water usage of town. And use information on potential interactions of the chemical with other pollutants. NP

So we have to denoting our problem by a “P” and inserting it at the appropriate place along the line.



And now, if the problem far from the positive paradigm, then there are probably better choices that can be made.

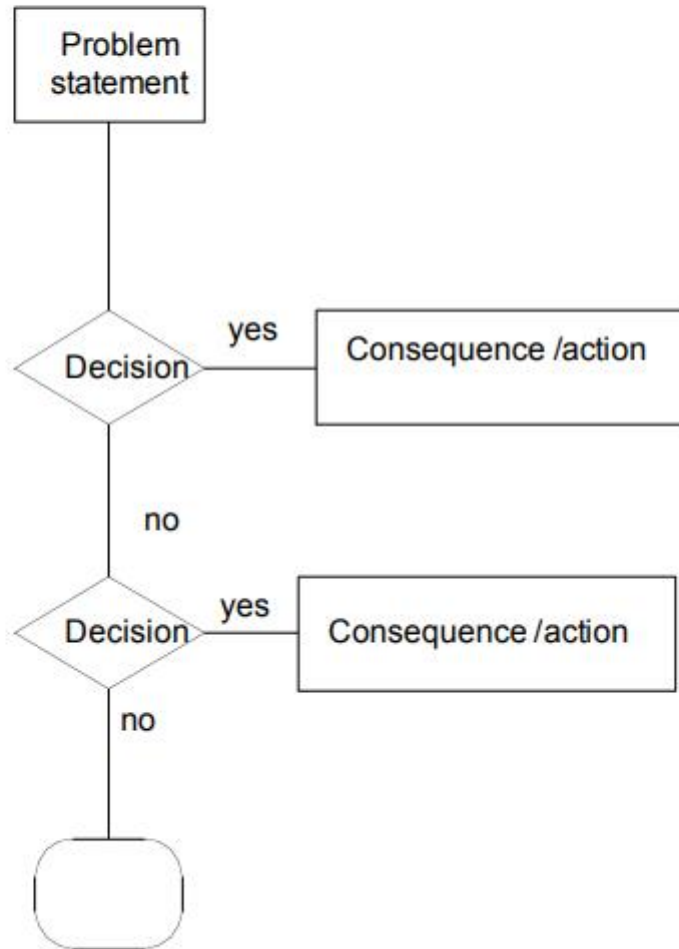
- It should be noted that although this action seems ethically acceptable. There are many other considerations that might be factored into the final decision.
- Although this problem-solving method seems to help with problem analysis and can lead to incorrect results, for example, line drawing can easily be used to prove that something is right when it is actually wrong. (line drawing is only effective if it is used objectively and honestly) the choice of where to put the examples and how to define the paradigms is up to you.
- You can reach false conclusion by using incorrect paradigms, by dishonest placement of the example along the line, and by dishonest placement of the problem within the examples.

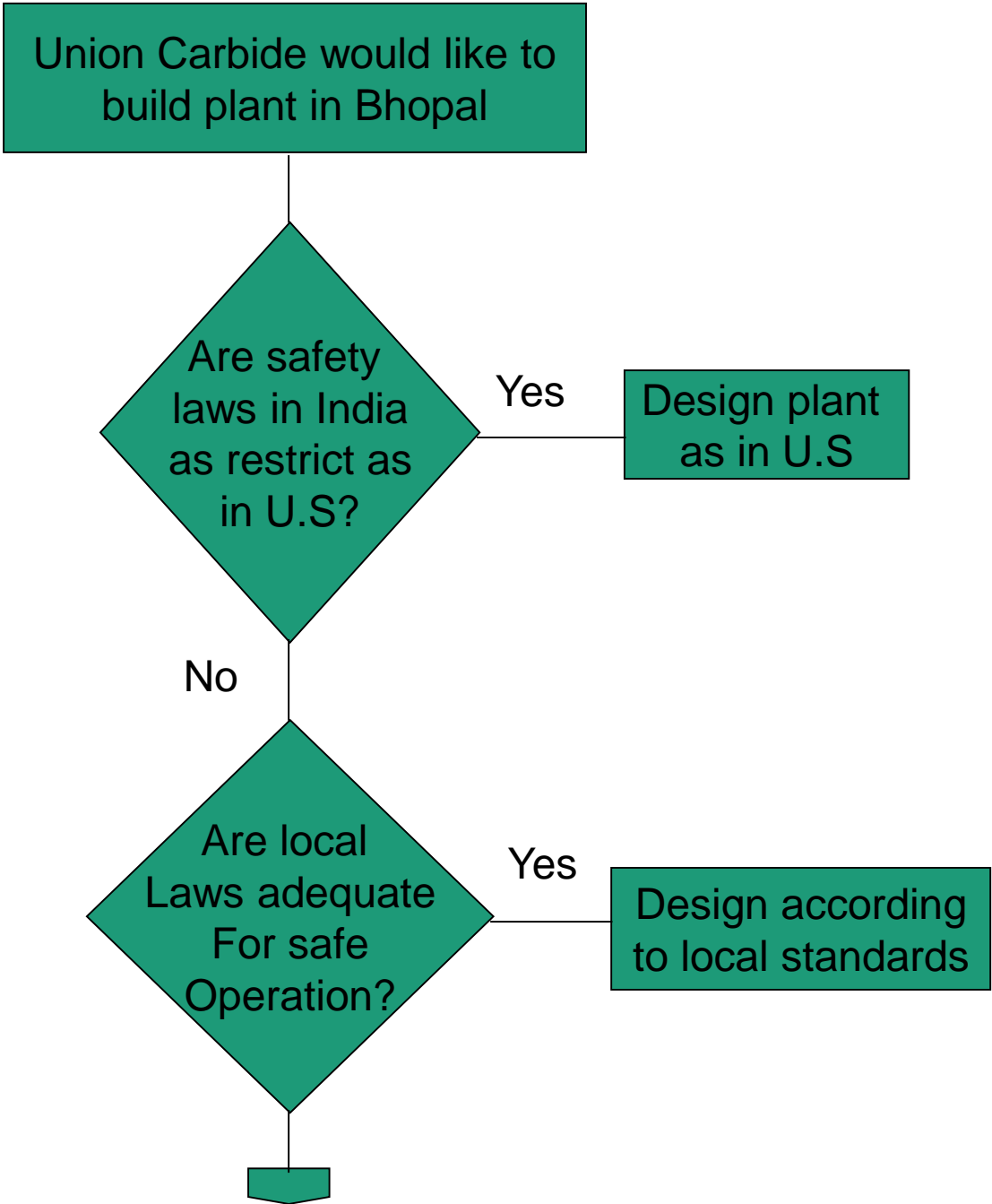
FLOW CHARTING

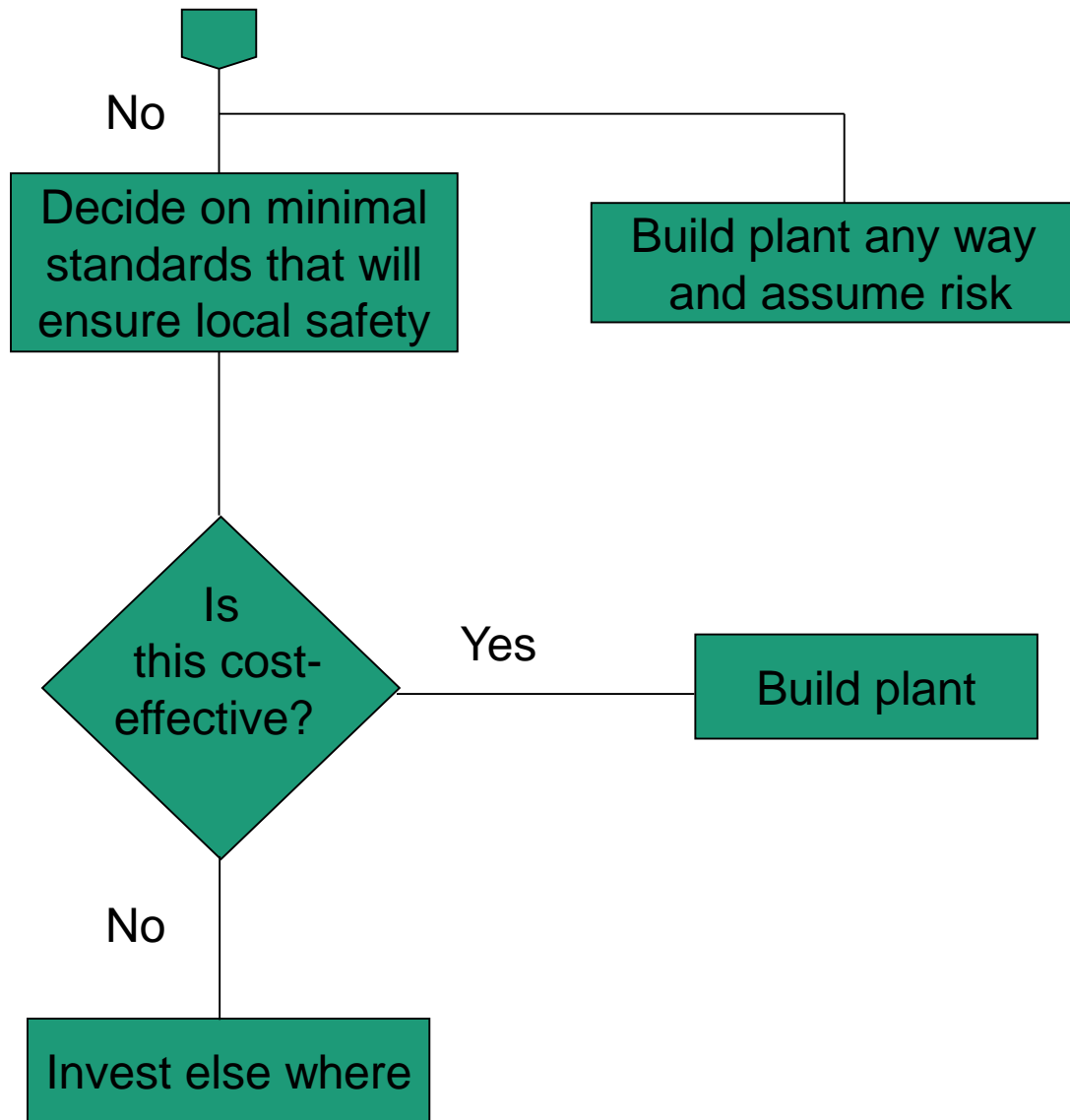
- Flow charts are most often used by engineering student, especially in developing computer programs.
- In engineering ethics, flow charting will be very helpful for analyzing a variety of cases, especially those in which there is a sequence of events to be considered or a series of consequences that flows from each other.
- There is no unique flow chart that is applicable to a given problem. So, different flow charts can be used to analyze the same problem.
- Advantages of using flow charts:
 - Gives a visual picture of a situation.
 - Allows you to readily see the consequences that flow from each decision.
- It is essential to be objective and honest as possible in flow charting to solve a problem.

- This chart emphasizes safety issues for the surrounding community.
- As indicated on the chart, there were several paths that might have been taken and multiple decisions that had to be made.
- So, flow chart helps you to decide which choice is ethical and which is not.
- **The key to effective use of flow charts** is to be creative in determining possible outcomes and scenarios and also not to be shy about getting a negative answer and deciding to stop the project.

Flow chart







- Application of a simple flow chart to the Bhopal case.

An Application of Problem-Solving Methods: Bribery/Acceptance of Gifts

Bribe: is something, such as money or a favor, offered or given to someone in a position of trust in order to induce him to act dishonestly.

One of the many gray areas of engineering ethics is the acceptance of gifts from vendors or the offering gifts to customers to secure business. The difficulty here comes because of the potential for gifts to become bribes or to be perceived of as bribes. Frequently, engineers find themselves in the position of either dealing with vendors who wish to sell them products for incorporation into the engineer's work or acting as vendors themselves and working on sales to other engineers to companies.

In many cases, there is a fine line between bribery and a simple gift. Sometimes, the distinction has to do with the value of the gift. Always, it has to do with the intent of the gift. It is important to ensure that no matter how innocent the gift may be, the appearance of impropriety is avoided.

During a sales visit, a sales representative offers you a coffee mug with his company's name and logo on it. The value of the mug is five dollars. Can you accept this item?

Does the answer to this question change if this item is a \$350 crystal bowl with the name of the company engraved on it? How about if there is no engraving on it?

Your meeting with a sales representative is running into the lunch hour. She invites you to go out for lunch. You go to a fast-food restaurant and pay for your own lunch. Is this practice acceptable?

Does the answer to this question change if you go to an expensive French restaurant? If she pays for lunch?

A sales representative from whom you often purchase asks if you would like to play tennis with him this weekend at one of the local municipal courts. Should you go?

Is the answer to this question different if the match is at an exclusive local club to which he belongs? What if he pays the club's guest fee for you?

A company sales representative would like you to attend a one-day sales seminar in Cleveland. Your company will pay for your trip. Should you go? How about if the meeting is in Maui? What if the sales representative's company is going to pay for you to go? What if your family is invited as well?

FLEDDERMANN, CHARLES B. "Engineering Ethics."