

4.11. RISK-BENEFIT ANALYSIS

4.11.1. What Is Risk-Benefit Analysis?

- ✓ Risk-benefit analysis is a technique, similar to cost-benefit analysis*, used to analyze the risk in a project and to determine whether the project should be carried out or not.
- ✓ Risk-benefit analysis answers the following questions:
 - What are the benefits of the project/product?;
 - Is the project/product worth the risks connected with its use?; and
 - Do benefits outweigh the risks?
- ✓ It is understood that everyone is ready to certain levels of risk as long as the project/product/activity promises sufficient benefit or gain.
- ✓ In risk-benefit analysis, the risks and benefits of a project/product are assigned money values, and the most favorable ratio between risks and benefits is determined.

4.11.2. Conceptual Difficulties In Risk-Benefit Analysis

Risk-benefit analysis is a very difficult process, because of the following reasons:

- ✓ In risk-benefit analysis, both risk and benefits are very difficult to quantify. Because both lie in the future. That is, both risk and benefits are associated with uncertainties.
- ✓ It should be noticed that who takes the risks and who enjoys the benefits? Therefore it is important to ensure that those who have taken the risks are the beneficiaries of it.
- ✓ It is mostly difficult to express both risk and benefits in a common set of units. For example, when the risks can be expressed and measured in one set of units (say, accidents/deaths on the airways) and benefits in another (say, speed of travel), then very difficult to do risk-benefit analysis. In this case, risk-benefit analysis is used to judge the relative merits of different designs.

4.11.3. Ethical Implications On Risk-Benefit Analysis

While performing the risk-benefit analysis, one should keep in mind the following ethical questions:

- (a) Under what conditions, someone in society is entitled to impose a risk on someone else on behalf of a supposed benefit to others?
- (b) How can we consider the worst-case scenarios of persons exposed to maximum risks while they are also obtaining only minimum benefits? Are their rights violated? Are they provided safer alternatives?

* In cost-benefit analysis, the costs and benefits of a project are assessed. Only those projects with the highest ratio of benefits to costs will be implemented.

"It is more than probable that the average man could, with no injury to his health, increase his efficiency fifty per cent." - Walter Dill Scott

4.12. PERSONAL RISK
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4.13. PUBLIC RISK

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4.12. PERSONAL RISK

- ✓ If sufficient information is given to a person, then he can be able to decide whether to participate in a risky activity or not.
- ✓ Many experiments have concluded that individuals are more willing to face voluntary risks than involuntary risks, even when the voluntary risks are more harmful than the involuntary ones.
- ✓ Personal risks are difficult to assess especially if they are involuntary personal risks.
- ✓ **Examples for personal risks:**
 - A person living near a chemical plant voluntarily or involuntarily; and
 - A person working in a nuclear power plant or oil refinery plant.
- ✓ The quantification in assessing personal safety and risk is very difficult to estimate.
- ✓ While assessing the personal risk, one should consider the following ethical questions:
 - How to access the money value of an individual's life?
 - On what basis, the compensation for a risk can be decided?
 - Is the compensation for a risk by an amount based on the exposure tolerance of the average person justifiable?
 - What will be the compensation if the tolerance level of the person is below or above the average tolerance level?
- ✓ In order to minimize the above difficulties in assessing personal risks, the analysts employ all the available quantitative measures such as
 - making judgments on the basis of the amount of life insurance taken out by an individual; and
 - assessing a hazardous job by looking at the increased wages a worker demands to carry out the task.

4.13. PUBLIC RISK AND PUBLIC ACCEPTANCE

- ✓ Risks and benefits to the public at large can be more easily determined than the personal risks and benefits. Because individual differences tend to even out as large numbers of people are considered.
- ✓ Assessment studies relating to technological safety can be conducted in a better manner for public risk than for personal risk, as statistical parameters take on greater significance.
- ✓ In this regard, America's National Highway Traffic Safety Administration (NHTSA) has emphasized the following two points:
 1. A value for human life can be estimated based on loss of future income and other costs associated with an accident.

"The public has more interest in the punishment of an injury than the one who receives it." - Colton

2. An estimate of quantifiable losses in social welfare (resulting from a fatality) is not based on the maximum expenditure allocated to save a life.

4.14. ACCOUNTING PUBLICLY FOR BENEFITS AND RISKS

Public accountability for risk has been affected by the following problems:

- ✓ An expert or even group of experts cannot be expected to know everything. Hence the public processes (which are designed to establish safeguards and regulations) suffer from incomplete engineering knowledge.
- ✓ The uncertainty produced by scientists and regulators (who assure the public that there are no risks, but they know that the answers are not at hand) also infects the risk regulation. In other words, a refusal to face the hard questions created by lack of knowledge affects the risk regulation.
- ✓ Since the conceptions of risk vary depending on how the facts are presented, therefore special caution should be given when stating probabilities of rare events.

4.15. BECOMING A RESPONSIBLE ENGINEER REGARDING RISK

(Role Of Engineers To Safeguard The Public From Risk)

- ✓ The engineers can provide background material to prove the faulty positions.
- ✓ Engineers should actively participate in the debates related to safety and risk.
- ✓ Engineers should always insist on meaningful numbers and figures when assessing safety and risk.
- ✓ Engineers should also recognize the previously mentioned difficulties with measuring risks and benefits in absolute terms.
- ✓ Engineers should not be influenced by any influential lobby or trade organization.
- ✓ Engineers need to be sensitive to various qualitative value judgments related with human and ethical values.
- ✓ Engineers should be aware at the legal liabilities regarding risk.

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