Engineering Ethics

Lecture 5

Concept of Safety

- Absolute safety is never attainable nor affordable, in the senses of
  - (a) entirely risk-free activities and products, or
  - (b) a degree of safety that satisfies all individuals or groups under all conditions.
- According to William W. Lowrance: “*A thing is safe if its risks are judged to be acceptable*.”
- A modified version of Lowrance’s definition: *A thing is safe if, were its risks fully known, those risks would be judged acceptable by reasonable persons in light of their settled value principles*.

Risks

- A risk is the potential that something unwanted and harmful may occur.
- William D. Rowe refers to the risk as "*potential for the realization of unwanted consequences from impending events*."
- In regard to technology, it can equally well include dangers of bodily harm, of economic loss, or of environmental degradation.
- These in turn can be caused by delayed job completion, faulty products or systems, or economically or environmentally injurious solutions to technological problems.

Risks

- In addition to measurable and identifiable hazards arising from the use of consumer products and from production processes in factories, some of the less obvious effects of technology are now also making their way to public consciousness.
- Technology has greatly reduced the scope of some of these, such as floods and earthquakes.

Acceptable Risk

- William D. Rowe says that "a risk is acceptable when those affected are generally no longer (or not) apprehensive about it."
- Apprehensiveness depends to a large extent on how the risk is perceived.
- This is influenced by such factors as

  (1) whether the risk is accepted voluntarily;

  (2) **INFORMATION:** the effects of knowledge on how the probabilities of harm (or benefit) are known or perceived;

  (3) **Job-Related:** if the risks are job-related or other pressures exist that cause people to be aware of or to overlook risks;

  (4) **Magnitude:** whether the effects of a risky activity or situation are immediately noticeable or are close at hand;

  (5) **Proximity:** whether the potential victims are identifiable beforehand.

Assessing Risk

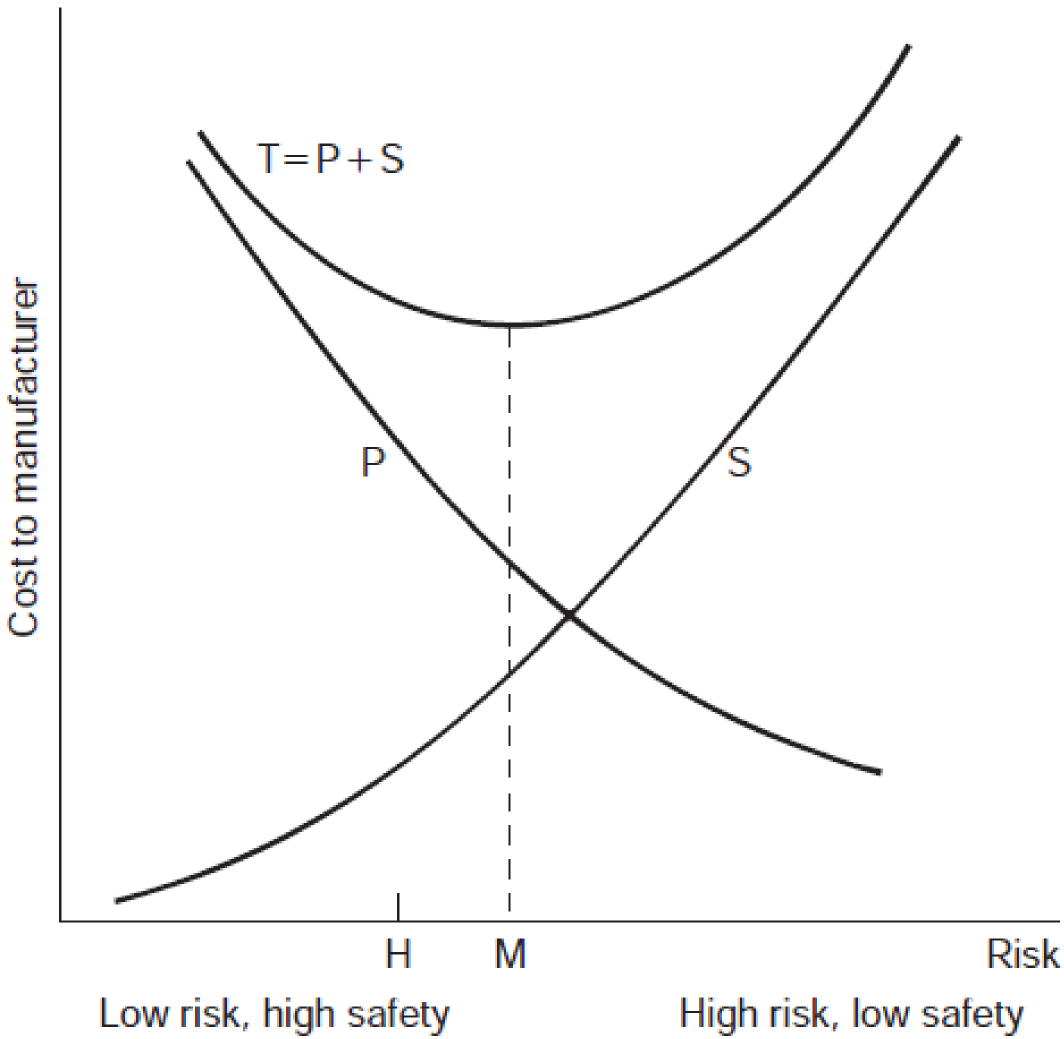

Figure 5–1
Why both low-risk and high-risk products are costly. **P = primary cost of product**, including cost of safety measures involved; **S = secondary costs**, including warranties, loss of customer goodwill, litigation costs, costs of downtime, and other secondary costs**. T = total cost. Minimum total cost occurs at M**, where incremental savings in primary cost (slope of P) are offset by an equal incremental increase in secondary cost (slope of S). Highest acceptable risk (H) may fall below risk at least cost (M), in which case H and its higher cost must be selected as the design or operating point.

Risk-Benefit Analyses

- Many large projects, especially public works, are justified on the basis of a risk-benefit analysis.
- The questions answered by such a study are the following:
  - Is the product worth the risks connected with its use?
  - What are the benefits?
  - Do they outweigh the risks?
- We are willing to take on certain levels of risk as long as the project (activity, product, or system) promises sufficient benefit or gain.
- Both risks and benefits lie in the future. As there is some uncertainty associated with them, we should address their expected values.
- It should be noted that **risk-benefit** analysis, like **cost-benefit** analysis, is concerned with the advisability of undertaking a project.
- **Personal Risk versus Public Risk**
- **Examples of Improved Safety**