

Chapter 1

Engineering and Management

DISCUSSION QUESTIONS

1-1. Q: The precursors of today's engineers listed in the quotation from Wickenden had no classes and few or no books from which to learn scientific principles. How can you explain their success?

1-2.

A: Certainly there was a great deal of trial and error, and lessons learned were passed on through long apprenticeship to the masters of such knowledge as existed in the field. Knowledge migrated slowly with the travels of artisans, and centers of unrecorded knowledge could disappear in the wake of conquerors or natural disaster. Nonetheless, the discoveries of some early thinkers (such as that of density measurement by Archimedes) were recorded for posterity, but progress was slow. In the Renaissance the leaders of scientific discovery in Europe maintained a correspondence with each other, and the written documentation of science and scientific progress began to accelerate.

1-2. Q: Compare how well *engineering* and *management* satisfy the several parts of the definition of a profession.

A: Engineering clearly meets all of the criteria of a profession. One might argue that engineering is not as consistent in establishing and self-policing ethical standards nor as unwavering in the pursuit of the public interest as it ought to be, but, neither are medicine and law. Management fails to meet the criteria of a profession in a number of ways: while there is a continually increasing body of literature in the art and science of management, many successful managers gain their knowledge of it through reading and experience rather than formal study, and the need for continuing education in management theory is hardly as pressing as it is in engineering. Further, no common professional society of managers' acts effectively to certify proficiency in the field, establish standards, and require conformance: policing the actions of management occurs instead through legislation and government regulatory authority. The inexperienced student may evidence an overly idealistic notion that management ought to act as a profession, and the instructor needs to point out that most management is instead still an art.

1-3. Q: Why is it so difficult to answer the simple question "How many engineers are there in the United States?" Is the question "How many physicians are there in the United States" easier?

A: The number of physicians is normally taken as those who are licensed by the several states to practice medicine, a matter of record. Registered professional engineers, on the other hand, represent a minority even of engineers who have graduated from accredited engineering programs, since few engineers in industry seek registration. Bureau of Labor Statistics data lists people currently employed in positions that normally require a graduate engineer, regardless of their original degree. National Science Foundation data include all those with an engineering degree, even though half may now be working in management or other positions.

1-4. Q: Comment on the sensitivity of U.S. engineering employment to a major change in the Department of Defense budget. What types of engineers would be especially affected?

A: DOD weapons R&D is an especially intensive employer of engineers, both internally and indirectly through defense contractors. Aerospace engineers are especially vulnerable to DOD budgets, followed by electronics engineers and then by mechanical engineers. Civil engineers would be more affected by expansions of military bases than by R&D.

- 1-5. Q:** What are the similarities in the definitions of *management* quoted from authors of management textbooks? Do the definitions provided by business executives differ in any way? Synthesize your own definition of management.

A: Management textbook definitions typically emphasize the achievement of organizational objectives through effective use of human and material resources. Definitions from business executives are not inconsistent with these, but tend also to cite more applied aspects such as making profits and satisfying customers with quality products. Two examples of student definitions are:

* “Conversion of tangible and intangible resources of an individual or organization into the goals and desired results set by well-defined standards.”

* “Utilization of human and material resources in an effort to produce quality products while minimizing costs and maximizing company profits.”

- 1-6. Q:** How does the job of supervisor or first-line manager differ from that of a higher manager?

A: The first-line supervisor is unique -manages only nonmanagers, has the shortest range viewpoint, may have risen recently from the ranks, and has the best understanding of the technology of his or her group. Increasing levels of management deal in longer range concerns and need more conceptual skills.

- 1-7. Q:** How does the job of a top manager differ from those of the several levels of middle management?

A: Top managers are responsible for the future of an enterprise, and normally have no full time manager above them (although they customarily report to a Board of Directors or some other elected structure). Their decisions have the longest time span and the greatest financial impact.

- 1-8. Q:** Identify the three types of skills needed by an effective manager as conceived by Robert L. Katz, and describe how the relative need for them might vary with the level of management.

A: This question is answered in Figure 1-2 and the discussion under “Managerial Skills.”

- 1-9. Q:** From the 10 managerial roles provided by Mintzberg, choose three or four that you consider most important for the first-line manager and explain your selection. Repeat for middle level and top managers.

A: The responses to this question are, of course, matters of opinion, and will differ with the level of experience of the respondents. Following is the response of a class of 17 seniors and graduate students, most without significant industrial experience above the worker level.

Type of Role	1st Line	Middle Manager	Top Manager
Interpersonal	16	19	26
Figurehead	0	0	15
Leader	13	8	8
Liaison	3	11	3
Informational	16	23	21
Monitor	3	10	4
Disseminator	11	12	1
Spokesman	2	1	16
Decisional	20	19	16
Entrepreneurial	0	3	8
Disturbance handler	13	1	1
Resource allocation	6	6	4
Negotiator	1	9	3

1-10. Q: How would you distinguish between engineering management and management in general?

A: One answer to this question is quoted in the chapter from an earlier article (Note 28). Others will have their own definitions.