Lecture 01
Introduction to Course

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Outline

source: General references [Cha16, LZ11, SCJ10, **?**]

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courseID: 2184303 and 2142344
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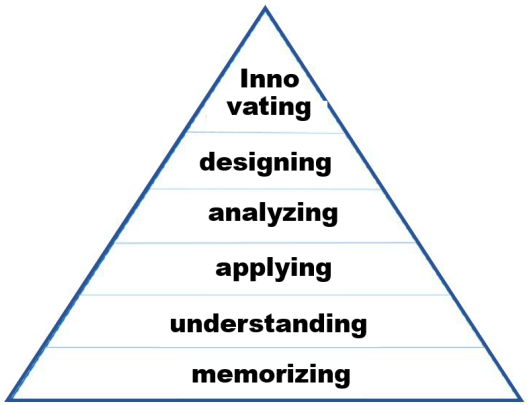
Syllabus: Before we start

Course Description

Modern management principles; operations strategy; methods of increasing productivity; quality system ; human relations; cost and budget; finance, marketing; risk management ; project management ; technology and innovation management

Learning Objectives



- Aware roles and importance of management in engineering works **[1]**
- Understanding important engineering management concepts **[4]**
- Applying and improving managerial skills **[7]**

Grading Policy

Work & Score Distribution

- Mid Term Exam (40%)
- Participation & Quizzes (20%)
- Final Exam (40%)

Grading Policy

85 & above: final grade is definitely 'A'

between 50 & 85: A, B^+, B, C^+, ... , D

50 & below: final grade may be 'F'

OKC Class rules & expectations

- No class attendance, but $\exists$ Quiz in CourseVille @ each lecture to check understanding
- Each lecture is divided into two halves with 10 minutes break
- Expect participation and volunteer during class
- No assignment due date (Quiz $<$ Exam $\ll$ HW)
- Don't interrupt others, but welcome for sharing
- Be responsible, especially meeting time & assignment
- All administrative stuff must be completed before fourth week

Code of honors

- Education with ethic standards & social responsibilities
- Trust as integral & essential part of learning process
- Self-discipline necessity
- Dishonesty hurts the entire community
- Evaluation reflects teaching and understanding

adapted from: Georgia Institute of Technology –The Honor Code

Any violation to code of honors will severely punished, especially cheating & plagiarism

Textbook & references

Textbook

[Cha16] Chang, C. (2016), *Engineering Management: Meeting the Global Challenges*, 2nd ed., CRC, NJ

References

[SCJ10] Slack, N.,Barndon-Jones, A. & Johnston, R. (2016). *Operations Management*. 8th ed., Pearson .

[LZ11] Zimmerman, J. (2016), *Managerial Accounting*, 9th ed., McGraw-Hill Education, NY.

Supplement Materials are available in LMS (CourseVille)

Engineering and Management

Engineer a person applying mathematical and science knowledge to solve practical problems, economically

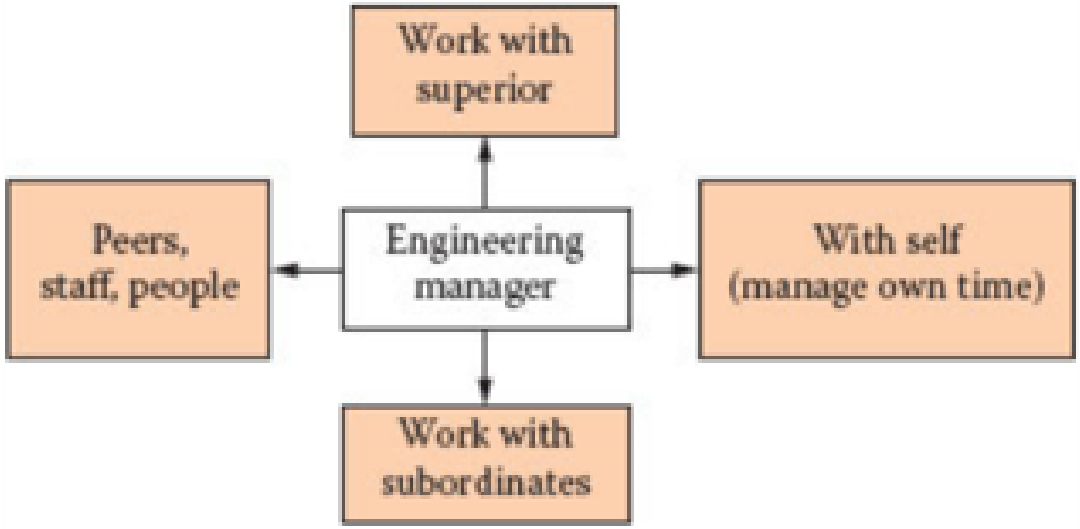
Manager an person who is in charge of a certain group of tasks or a certain subset of a company.

Thinking exercise

Consider any managers that you personally knew,

- What are their skills/roles?
- What are their positions/levels/reponsibilites?
- Are they managed by someone else?

Type of Work



Technical work: professional, specialized, non-management work done by engineer (*e.g.*, designing, coding, certifying) → doing

Operating work: semi-technical that can been delegated, (*e.g.*, routine report, data entry) → monitoring & controlling

Management work: managerial (plan, organize, lead, and control) the efforts of self and team (*e.g.*, initialing new product/service/operation). → thinking

Why an engineer must know management?

We are engineers, but

- $\forall$ work requires management & leadership
- Engineering training $\rightarrow$ good managers (logical, problem solving, big picture)
- Engineers have skill in analyzing alternative and validating information
- Manager required engineering/technical background for
  - administrate modern & tech company
  - trade off technology VS cost VS risk
  - discuss technical and innovation issues
  - bring creditability with stakeholder
  - understand other engineers & can review others' work

Engineer can become a leader who understands both technology and management

Engineer VS Manager

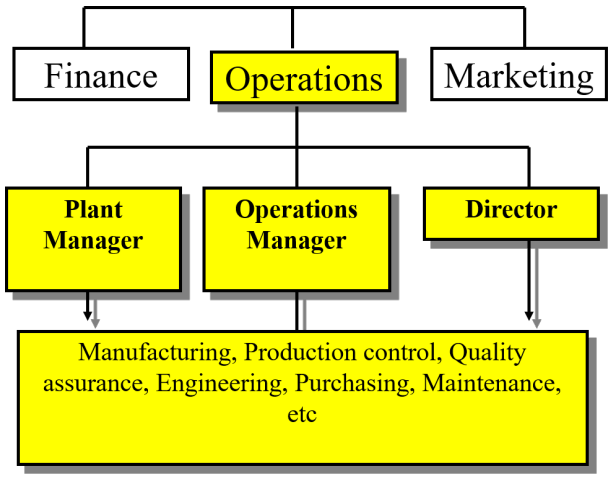
Similarities between engineer & manager

- Both are trained to make decisions in a complex environment
- Both must allocate resources for operating or developing systems
- Both must identify & evaluate the interactions in system

Differences between engineer & manager

What engineers do	What manager do
• minimize total risk	• take calculated risk
• reply on math model	• reply on intuition
• exercise scientific method	• exercise leadership, conflict mgt
• decide on consistency data	• decide on incomplete info
• solve problem by own self	• solve problem by others

Life of an engineer as a manager

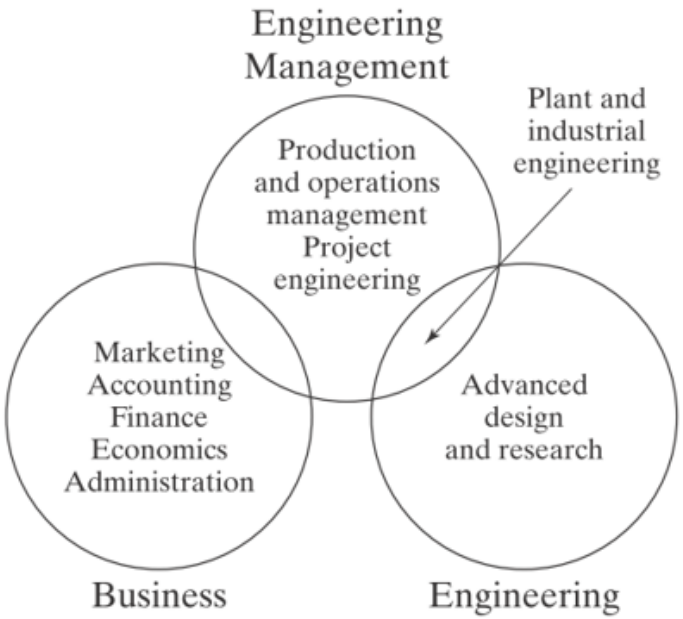


Trade-Off in managerial carrier

PRO	CON
• Financial rewards	• Long hours
• Authority	• High stress
• Perk (power, influence, status)	• Family issue
• Career advancement	• Health hazards (food)

Engineering Management and me

Engineering Management is a profession that brings technological problem-solving ability of engineering and the organizational, administrative, and planning abilities of management to oversee the operational performance of complex engineering enterprises



source: Morse, L.C. & Babcork, D.L. (2013), *Managing Engineering and Technology*, 6th ed. [**?**]

Brief History of Engineering Management

- **Ancient:** training (Mesopotamia), division of labor (Alexander), std part & T-accounting & wage_{unit} (trading city of Venice)
- **Industry Revolution:** individual innovation
  - growth in small town, trade hub,
  - no ownership and work separation, e.g., father-son, apprenticeship
  - no b/g supervisors
- **Colonial Era:** larger projects, global souring, resources, formal engineering/ school
- **Modern Management**
  - *Scientific Mgt:* time study, no rule of thumb, std planning
  - *Administrative Mgt:* communication, division of labor, big picture mgt, roles in writing, organization theory
  - *Behavior Mgt:* Maslow's Hierarchical theory, Hawthorne Effect
  - *Innovation & technology Mgt:* entrepreneurship, knowledge mgt, IT, project

Areas related to Engineering Management

- **Industrial Engineering:** how to make routine work more efficient?
- **Systems Engineering:** how to design and manage [control] complex system?
- **Management Science:** how to make better decide?
- **Management of Technology:** how to integrate technology?
- **Product development and engineering:** how to bring a successful product to market at reasonable cost?

Contemporary Issues

	Global	N. America	EMEA	APAC	L. America
Customer Relationship Management	1	4	1(t)	2(t)	4
Benchmarking	2(t)	2(t)	1(t)	14	2
Employee Engagement Surveys	2(t)	1	5	8	9(t)
Strategic Planning	2(t)	2(t)	9	5(t)	1
Outsourcing	5	6	3(t)	5(t)	9(t)
Balanced Scorecard	6(t)	7(t)	3(t)	15(t)	3
Mission and Vision Statements	6(t)	5	8	18	5
Supply Chain Management	8	7(t)	10	2(t)	13(t)
Change Management Programs	9	9	6(t)	21	9(t)
Customer Segmentation	10	14(t)	6(t)	12(t)	7
Core Competencies	11(t)	10	–	7	–
Big Data Analytics	11(t)	–	–	1	–
Total Quality Management	11(t)	–	–	4	–
Satisfaction and Loyalty Management	16	–	–	9	–
Digital Transformation	19(t)	–	–	10	–
Business Process Reengineering	15	–	–	–	6
Strategic Alliances	17	–	–	–	8

Note: (t)=tied

- **Quality Management:** product life cycle, TQM, Six Sigma
- **Information Technology:** SCM, eBusiness, IoT
- **Project Management:** complex and dynamic systems, deep tech
- **Risk Management:** globalization, corrective action

Characteristics of Management

Good management is the art of making problems so interesting and their solutions
so constructive that everyone wants to work and deal with them.

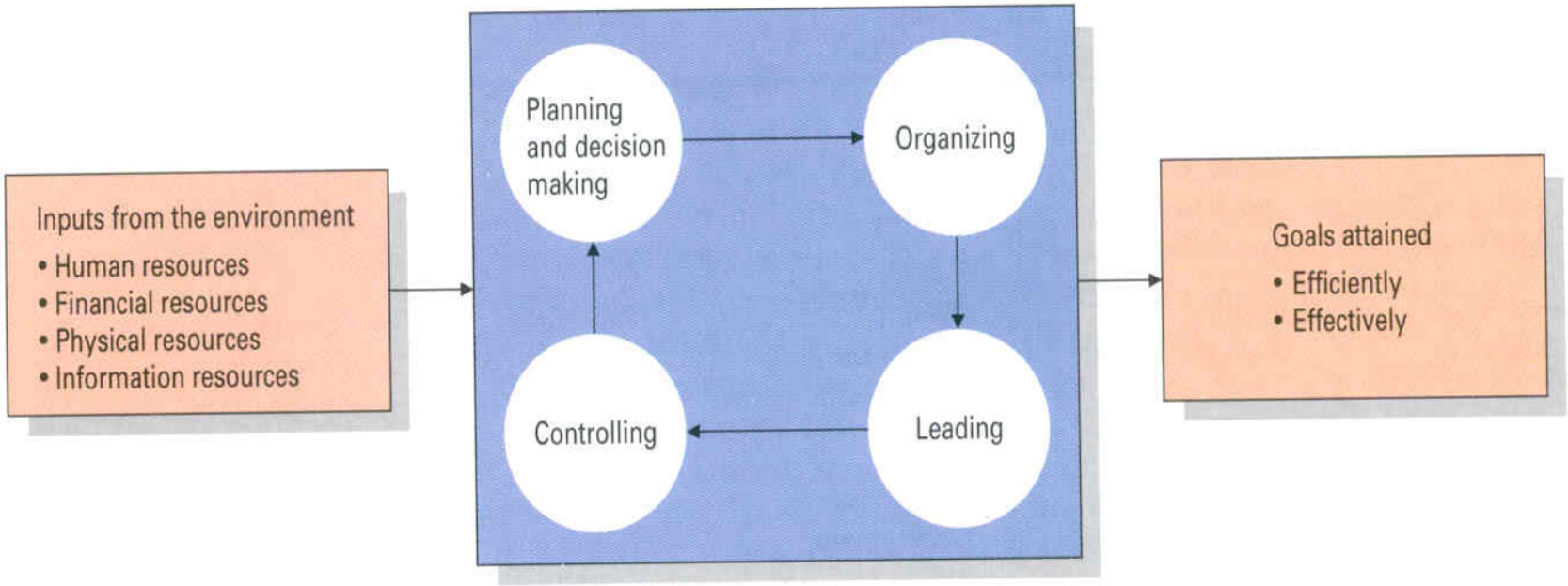
source: Paul Hawken

- **Goal-Oriented Process:** sharing same goal
- **Multi-Dimension, yet common:** scope work/decipline/ people
- **Continuous Process:** dynamic, hand-on, operation (output/input/process/feedback)
- **Group Activity:** managing and embracing differences of team
- **Intangible Force:** unnotice until, begin to fail!

Basic concept of management

Management is getting things done though others

- **Planning:** set goal & decide how best to achieve
  - **Decision Making:** select an action from alternatives
- **Organizing:** group activities and resources
- **Leading:** get members to work for organization interests
- **Controlling:** monitor progress toward goal and correct when needed



Failure of engineer in MGT position

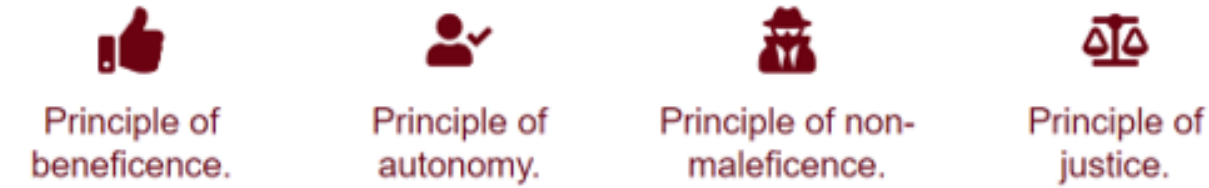
- **No EQ:** ignore people, no respect/trust, hash comment
- **Wrong fit:** culture (lone wolf)/ 'chemistry' ('hero', 'elite')
- **Risk aversion:** fear of uncertainty/change, comfort life, avoid hard conversation
- **Self-Destructive:** work in secret, too aggressive $\leftrightarrow$ no commitment,
- **Lack of focus:** Jack of all trade, stop learning
- **Measure performance by your output:** keep coding/inventing, 'my work'

source: Brad Armstrong. *How to fail as a new engineering manager.*

Why do we need ethic?

Ethics

moral norm and responsibility that persons 'must' conduct in the environment.



Engineering Ethic

- hold paramount the safety, health, and welfare of public.
- perform services only in areas of competence
- issue public statements only in an objective and truthful manner.
- act for each employer or client as faithful agents
- avoid deceptive acts.
- conduct honorably, responsibly, and lawfully so as to enhance the profession.

source: National Society of Professional Engineers

Management Ethic

Challenger Trivial

In the *Challenger* explosion, the night before the launch, Morton Thiokol engineers had identified the potential danger of launching the shuttle in temperatures less than 53F. NASA management challenged the recommendation. During an off-line discussion among Morton Thiokol participants in Utah, a vice president of engineering was the only one among four to hold out for a launch delay. A senior vice president told him bluntly,

> *"It's time to take off your engineering hat and put on your management hat".*

The vice president capitulated, and the launch went forward, resulting in the disaster on record. (Rossow 2012)

What a manager should consider? How it different from the engineer ethic?

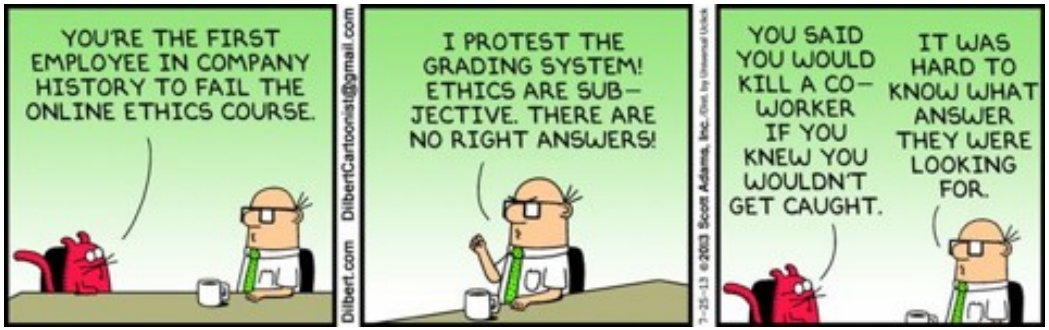
Management VS Engineering Ethic

	Engineer	Manager
Scope	client, public, users	+shareholder, +supplier, +investors, +public
Focus	technical, safety	+cost, +schedule, +employee morale, +supply chains, +image
Nature	more explicit	vague
Govern	prof.organization	public sentiment

Example of Dilemma

- Cost VS Safety VS Quality
- Cover-Up Error VS Presenting Unwanted Results

Moral Campus and Mirror Test



Mirror Test

- Is it legal?
- If someone else did it to you, would you think it was fair?
- Are you ok if appeared on social media?
- Would you like your mother to see you do it?

Summary: importance of managerial skills

- management are important to business and teamwork/project
- a managerial carrier is a possible next phases of engineer carrier
- complex & advanced activities or system requires engineer as managers
- Four management processes are:
  - **planning & deciding:** pick and plan goal
  - **organizing:** prepare resources
  - **leading:** $\rightarrow$ delegate & motivate
  - **controlling** measure performance, address gap, & feedback
- management skill needs life time to practice, not just know

Reference

[Cha16] Ching Ming Chang.
Engineering management: Meeting the global challenges.
CRC Press, 2016.

[LZ11] Jerold L Zimmerman.
Accounting for decision making and control.
McGraw-Hill/Irwin, 2011.

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