



KHALIFA
UNIVERSITY

ENGR110
Introduction to Professional Engineering

Creativity



Different Kinds of Technical Creativity:

1. New scientific theories and knowledge
2. The frontier: new knowledge being separated, explored, expanded, and made usable to society.
3. Development of new devices, systems and structures

Creativity often results in inventions:

❑ **Invention** : Something that is new and useful and is a distinct device, process or system that is “reduced to practice”

❑ **Development**: implementing an idea into a real new product

Creative Person

- ☐ Everybody is creative to a certain degree
- ☐ Very likely closely related to intelligence
- ☐ Educational system may tend to inhibit the development of creativity in individuals
- ☐ “wild” and “silly” answers may be indications of creative potential
- ☐ Peers may negatively affect “different” individuals
- ☐ “all engineers are resident inventors”

Brainstorming

1. **Announce the problem to participants**
2. **Come up with as many ideas as possible to solve the problem as fast as they can**
3. **No judgment for the ideas at this stage. No good, bad or silly comments**
4. **Write down the ideas ASAP**
5. **Defer judgment till later time**
6. **Exchange ideas by writing if it is intimidating to talk**
7. **Use a computer network to exchange ideas for streamlining procedure**

Perspiration and Inspiration
Hard work (99%) → inspiration 1%

Blocks to Creativity

1. Getting stuck on an old familiar solution
2. Getting stuck on the familiar use of an object
3. Premature criticism
4. Fear of social disapproval
5. Fear of failure: a person is so afraid of failure → unwilling to depart from tradition → no creativity

A formula for creativity

1. Preparation
2. Concentration
3. Incubation
(subconscious mind continues to work)
4. Inspiration
5. Verification
(sometimes enormous determination)

Recommendations for creativity encouragement

1. Relaxed organizational systems
2. Supervisors to stimulate invention
3. Personal incentives
4. Frequent exchange of new information

Engineering Education and the Creative Experience

1. Desire and fulfillment (motivation)
2. Autonomy and support (environment)
3. Openness and knowledge (tools)
4. Engrossment (immersion) and connection to the process

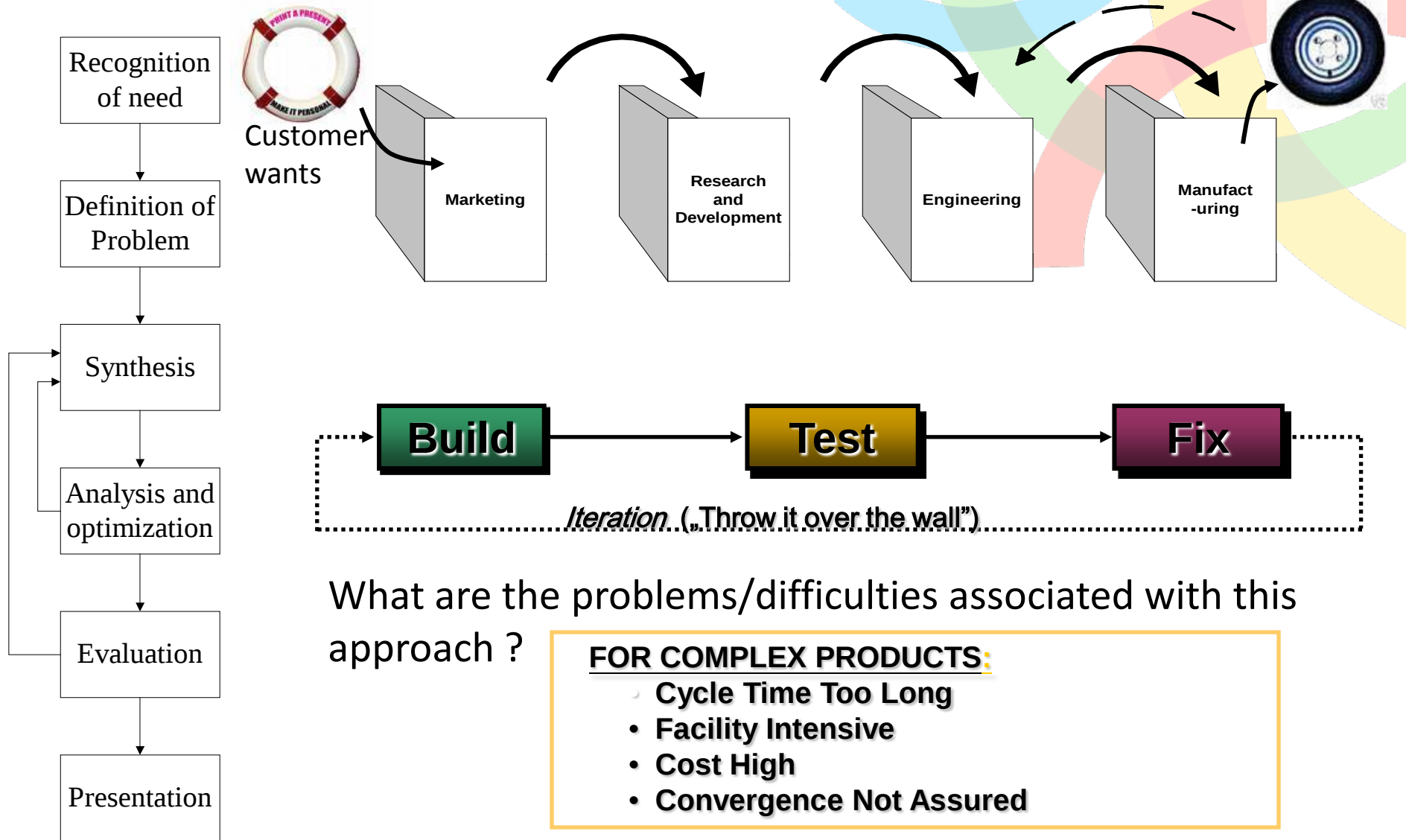
Teamwork and Team Building

- More productive than individual
- Has to be properly managed
- Given enough freedom
- Resembles what happens in real-world engineering practice

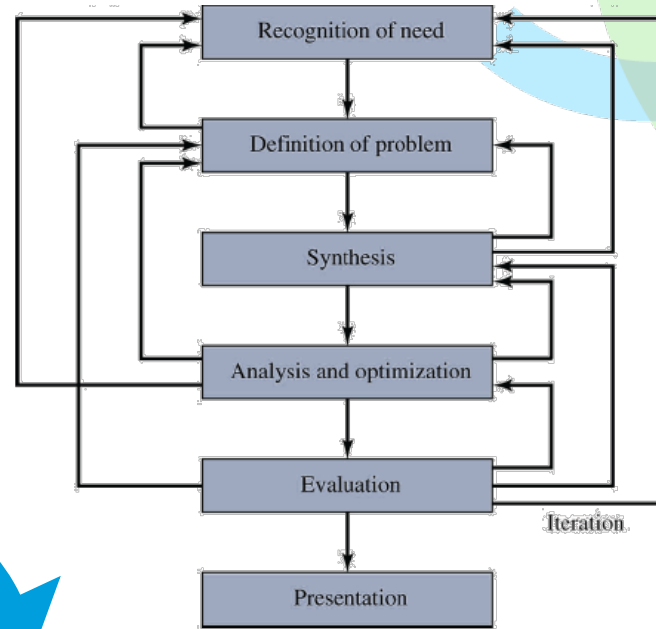
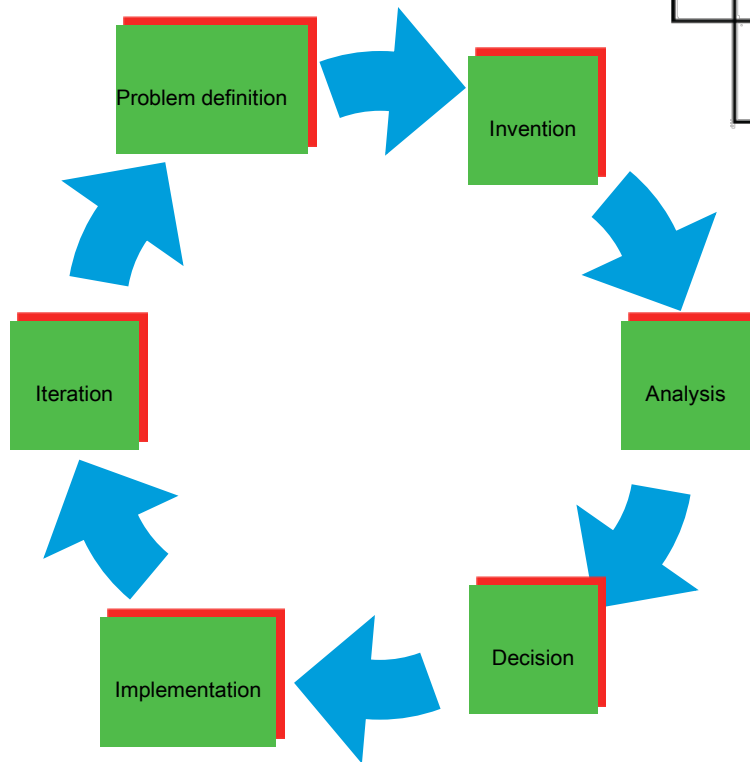
Engineering Design and Development

1. **Basic Research:** “fundamental research”
advancement of scientific knowledge
2. **Applied Research:** developmental research for
commercial objectives
3. **Development:** science and knowledge → products
and processes
4. **Design:** “applying various techniques and scientific
principles for the purpose of defining a device, a
process or a system in sufficient detail to permit
physical realization”

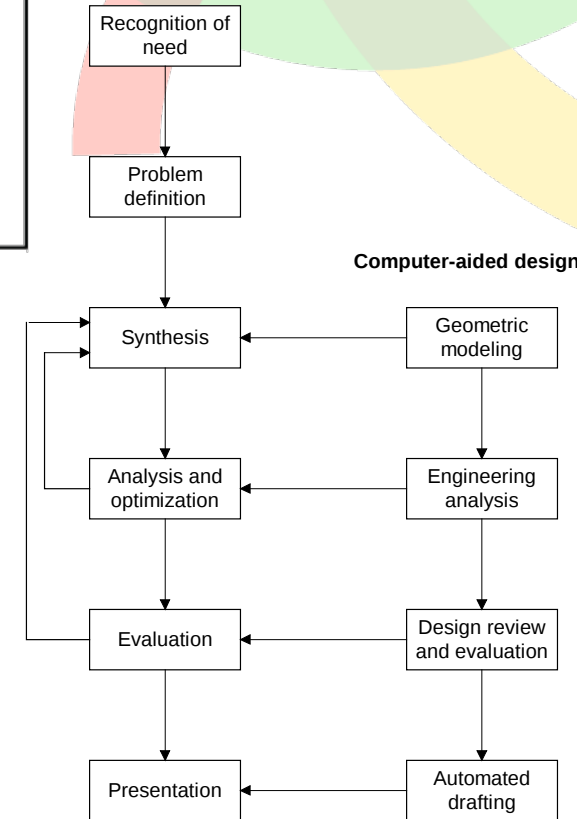
Traditional Design and Production Process



The Design Process (alternatives)



The design process



Computer-aided design

Design process using CAD

Bad Designs



Will Computers Replace Engineers?

CAD: Computer Aided Design

CAM: Computer Aided Manufacturing

CAE: Computer Aided Engineering

- What is the role of an Engineer?
- Do we trust Computers?
- Where did the testing and experiments go?