

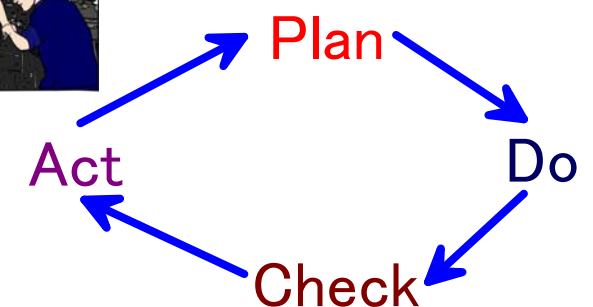
What is "Engineering" ?

- academic learning or study on "***Monozukuri***" where we **manufacture / make / product *artificially*** several things, goods or tools useful for human and society

□ **PDCA** (**P**lan - **D**o - **C**heck - **A**ct) cycle on ***Monozukuri***



- before a "practical making" stage, the "plan / design" stage is *indispensable*
- after a "practical making" stage, the "evaluation" stage is *necessary*
- the "feedback / improvement" stage from an "evaluation" to a (re)"plan / design" is *important*



PDCA cycle (in general)

What is "Engineering Design" ? (1)

□ the fusion of "**Engineering**" and "**Design**" (in the broad sense)

□ to "**design**" (in the broad sense)* several "**Engineerings**"

□ to make the good and practical uses of such methods as "**Design**" (in the broad sense) for studies on "**Engineering**"

* "**design**" (in the broad sense)

(— Encarta(R) World English Dictionary)

(*verb*)

1. **create** detailed **plan** of something: to **work out** or **create** the form or structure of something
2. **plan** and **make** something: to **plan** and **make** something in a skillful or artistic way
3. **intend** for a use: to **intend** something for a particular purpose
4. **invent**: to **contrive**, **devise**, or **plan** something

What is "*Engineering Design*" ? (2)

- not only accumulating knowledge of "**Engineering**" but also **applying practically** the knowledge to "***Monozukuri***" (stages) where we start on a "**plan / design**" stage
- academic fields where we acquire the comprehensive and synthetic skills in "**planning / designing**", "**making practically**" and "**evaluating**" things, goods or tools

What is "the skill of *Engineering Design*" ?

- the skills necessary for synthesizing several knowledge and techniques, and then finding out feasible plans and answers, **for any problem which has no necessarily unique answer**
 - "**Engineering Design**" skills are indispensable for highly professional engineers (= experts with engineering skill of a high order) in general

the skills of "*Engineering Design*"

— as instances of standards for accrediting the engineers —

the **capability**

- to elaborate / formulate a plan
- to set up a problem
- to apply / put totally several knowledge and techniques
- to create
- to recognize the problems from the points of view of public health, safety, security, culture, economy, environment, morals and ethics et al., and then to solve the problems under the constraints derived from them
- to represent the elaborating plan by figures, diagrams, charts, sentences, compositions, expressions, formulas and programs et al.
- to plan / design sustainably and to enforce / execute
- to communicate together
- to keep teamworks

acquiring the skills in "*Engineering Design*"

- indispensable for the highly professional engineer (= expert with engineering skill of a high order) who can get a total view of a *Monozukuri* process composed of "plan / design", "practical making" and "evaluation" stages, and can perform any stage
 - acquiring the skill not only that makes practically things or goods as instructed on a plan or a design, but also that expresses clearly "when, where and how (in what way) are the products useful"

"What to" as to Technology (1) — as against "How to" —

- **What** do we **realize** or **want to do** by the technology?
- **What** do we **intend** doing by the technology?
- **What** do we **aim at** with the technology?
- "**What to**" is the "**Engineering**"

cf.) "**How to**"

- What is the good way **how** to realize the technique?
 - **How** do we realize the technique?
 - "**How to**" is the skill or the technique itself
-

"What to" as to Technology (2) — as against "How to" —

□(examples) [concrete skills]

- What is the problem?
- What causes the problem?
- What is the mechanism?
- Which methods are there?
- Which is the better and which is the worse?
- How can we implement it? (no how we can solve it, no how to do it)
- How does we improve it? (no how we can solve it, no how to do it)
- How can we product a good thing? (no how we can solve it, no how to do it)

= the **skill** capable of telling over not only "**how-to**" but also "**what-to**"

learning program for "*Engineering Design*"

□ learning objects of "*Engineering Design*"

- a wide range of from people's commodity and tools to such highly-developed systems as electric ones, information ones and mechanical ones et al.



- for the respective learning object, to acquire the **practical design skills** in **enumerating**, **comparing** and **evaluating** several alternative **mechanisms** or **methods** by plenty of **laboratories**
- to complement the skills by the knowledge accumulated by **lectures**



- to acquire the all-around and special skills in "**planning / designing**", "**making practically**" and "**evaluating**" the things on the respective ***Monozukuri*** process

practical learning in "*Engineering Design*"

- the skill in specifying what the **things**, **goods** and **tools** are **useful for** qualitatively and quantitatively, and to **model** them or to **produce the models by way of trial** is main
- on the "**Design**" stage, the design skills in **enumerating**, **comparing** and **evaluating** several alternative **mechanisms** or **methods** are indispensable
 - the student completing an "**Engineering Design**" course = the highly professional **developing engineer**
 - the expert **with engineering skill** of a high order

● no one can tell of any *Monozukuri* process without "**Engineering Design**"!



● a study on "**Engineering Design**" is almost the same as a study on *Monozukuri* process