Module SEFS Context

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Abstract

Understanding the context is essential to understand the problem and the solution space. We discuss the way companies work, the customer, business, and life cycle contexts, and how to scope the work.

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SEFS How companies work; workflow in organizations

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Abstract

Companies have a hierarchical organization structure. However, when developing and deploying systems, most work happens across organizational entities. This nugget explains the typical processes for developing and engineering programs and systems.
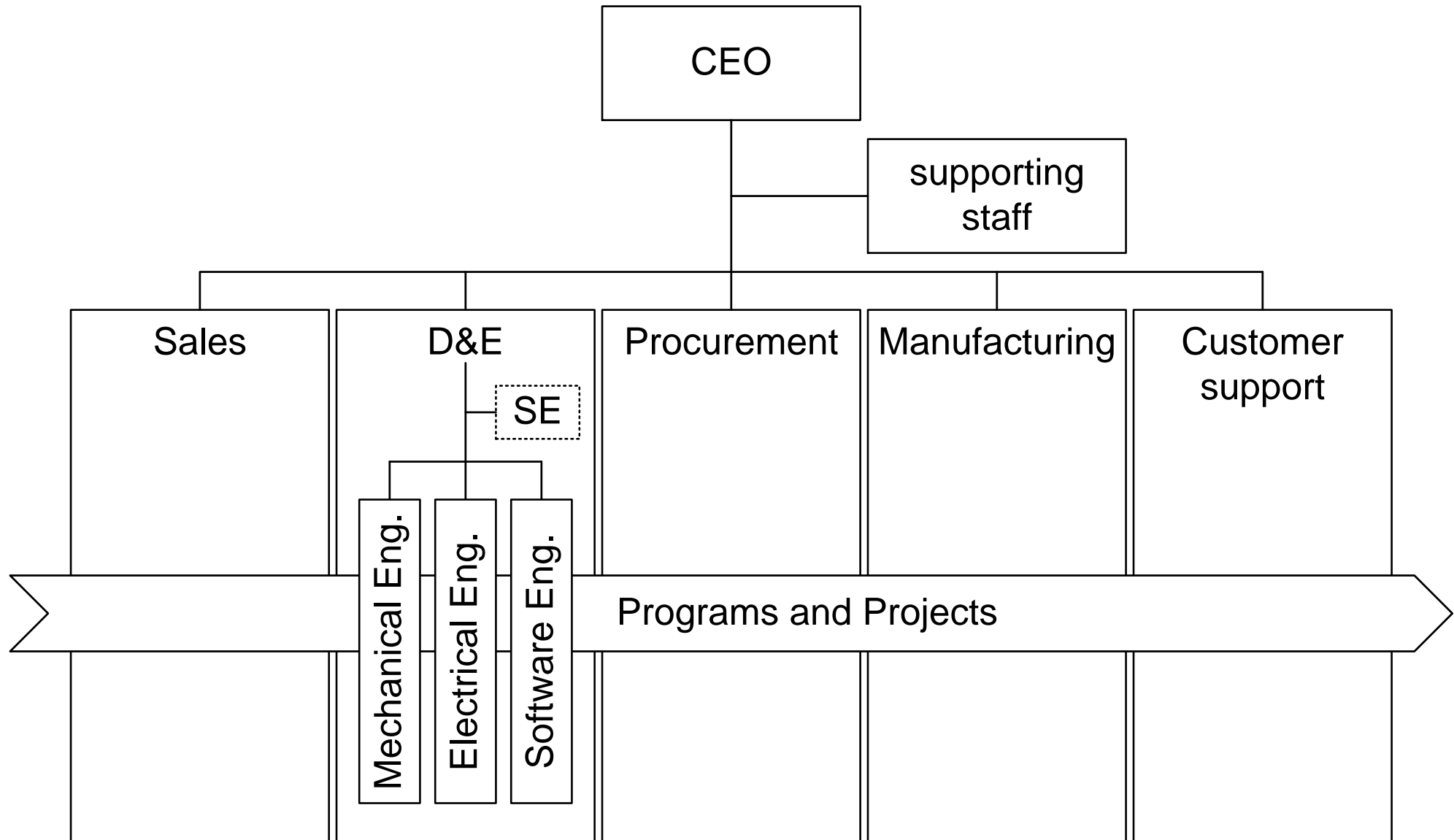
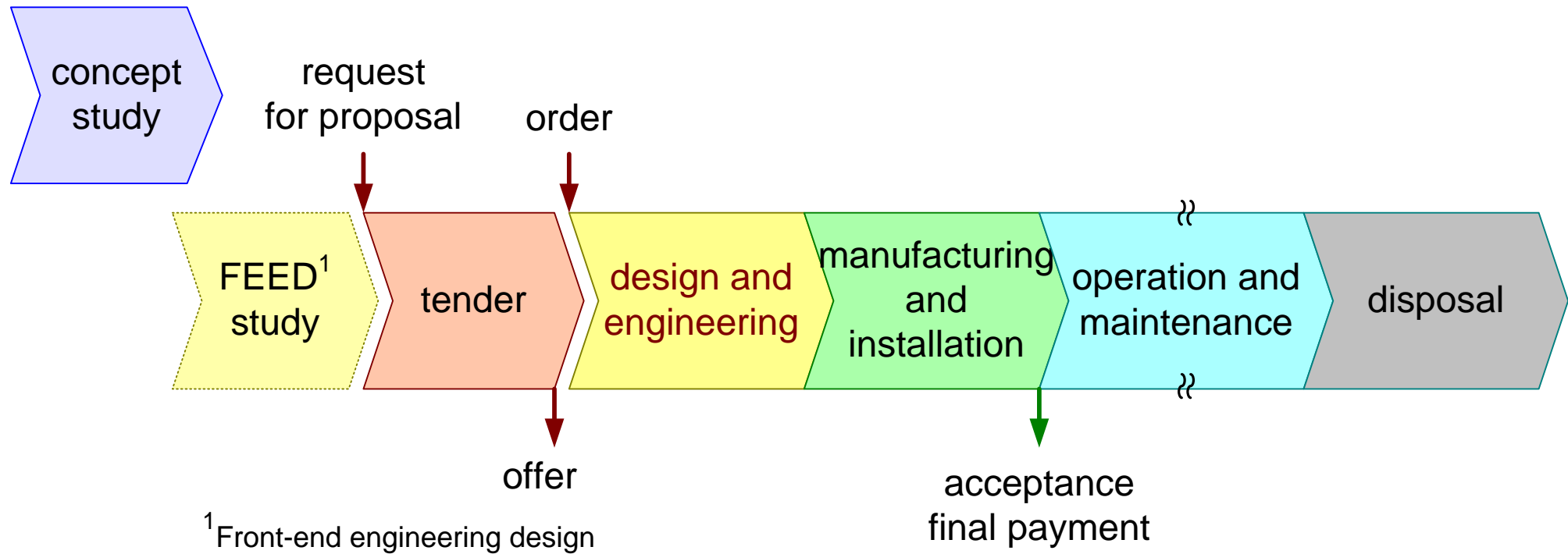March 25, 2021
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logo

TBD

Typical Company Organization

Project Life Cycle

Phased Project Approach

DR = Design Review

| FEED study | tender | design and engineering | installation | operation and maintenance |

| 0. feasibility | 1. definition | 2. system design | 3. engineering | 4. integration & test | 5. field monitoring |

- needs
- specification
- design
- verification
- engineering

Legend:
- core information in draft
- 50%
- most information available in concept
- information is stable enough to use heavier change control
- full under development
- preparing or updating work

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Reuse and Products

Three parallel workflows each showing the sequence: **tender** → **design and engineering** → **installation** → **operation and maintenance** → **disposal**

Between the workflows, upward arrows labeled *reuse specs* (connecting tender stages) and *reuse products* (connecting design and engineering stages).

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Simplified Process View

customer

supplying business

strategy
process

customer oriented (sales, service, production) process

value

product creation
process

people, process and technology
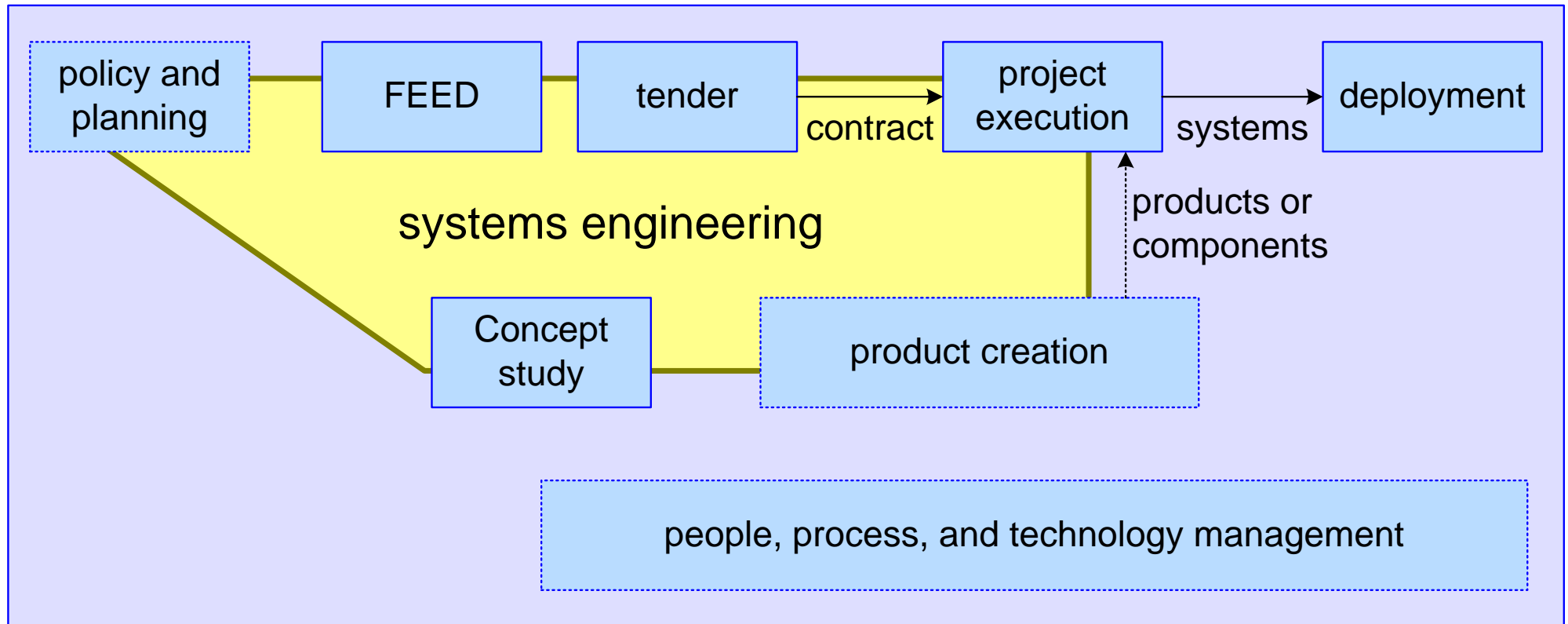management process

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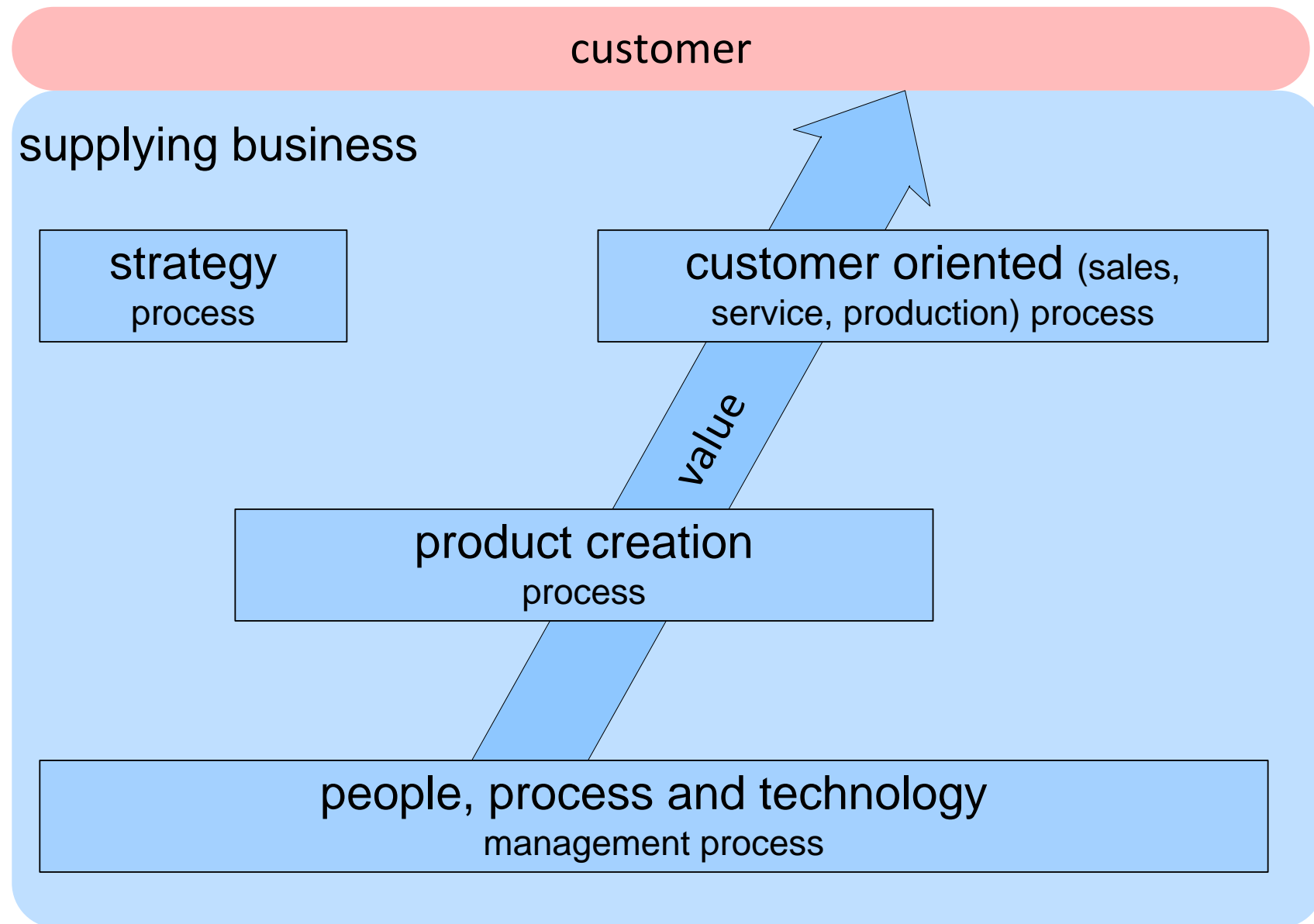
Systems Engineering in Projects

SEFS Customer Context

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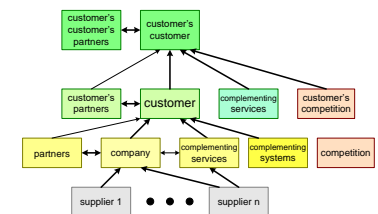
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Abstract

Systems engineers need to understand many aspects about the customer context where the system-of-interest will be operating in. This nugget introduces the CAFCR model to understand the relation between customer and system. Then it introduces a number of questions and techniques for eliciting and capturing the customer context.
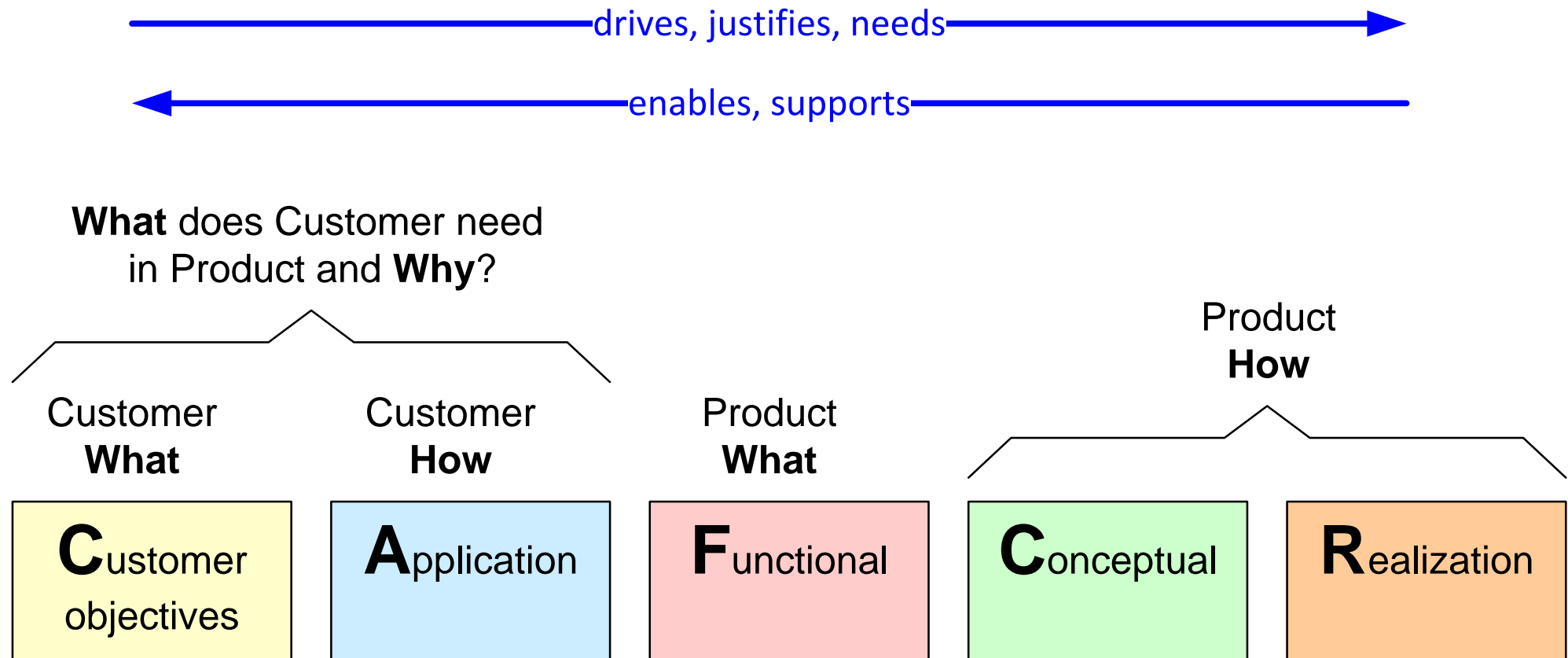
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The "CAFCR" model

drives, justifies, needs ⟶

⟵ enables, supports

What does Customer need
in Product and **Why**?

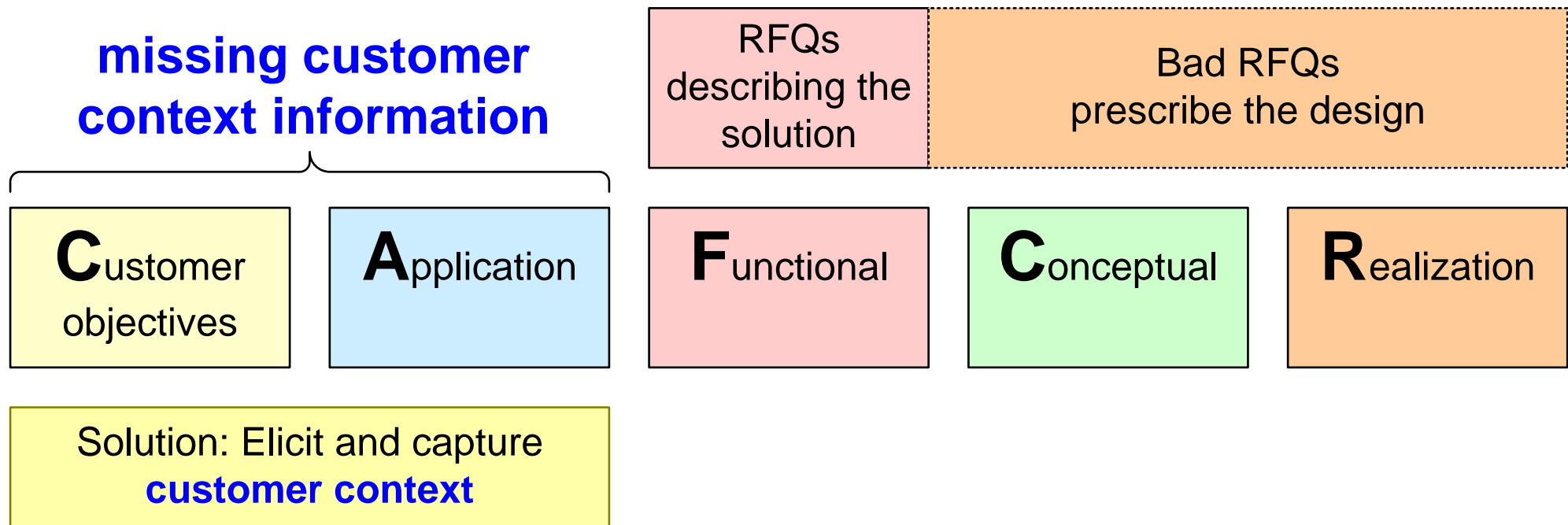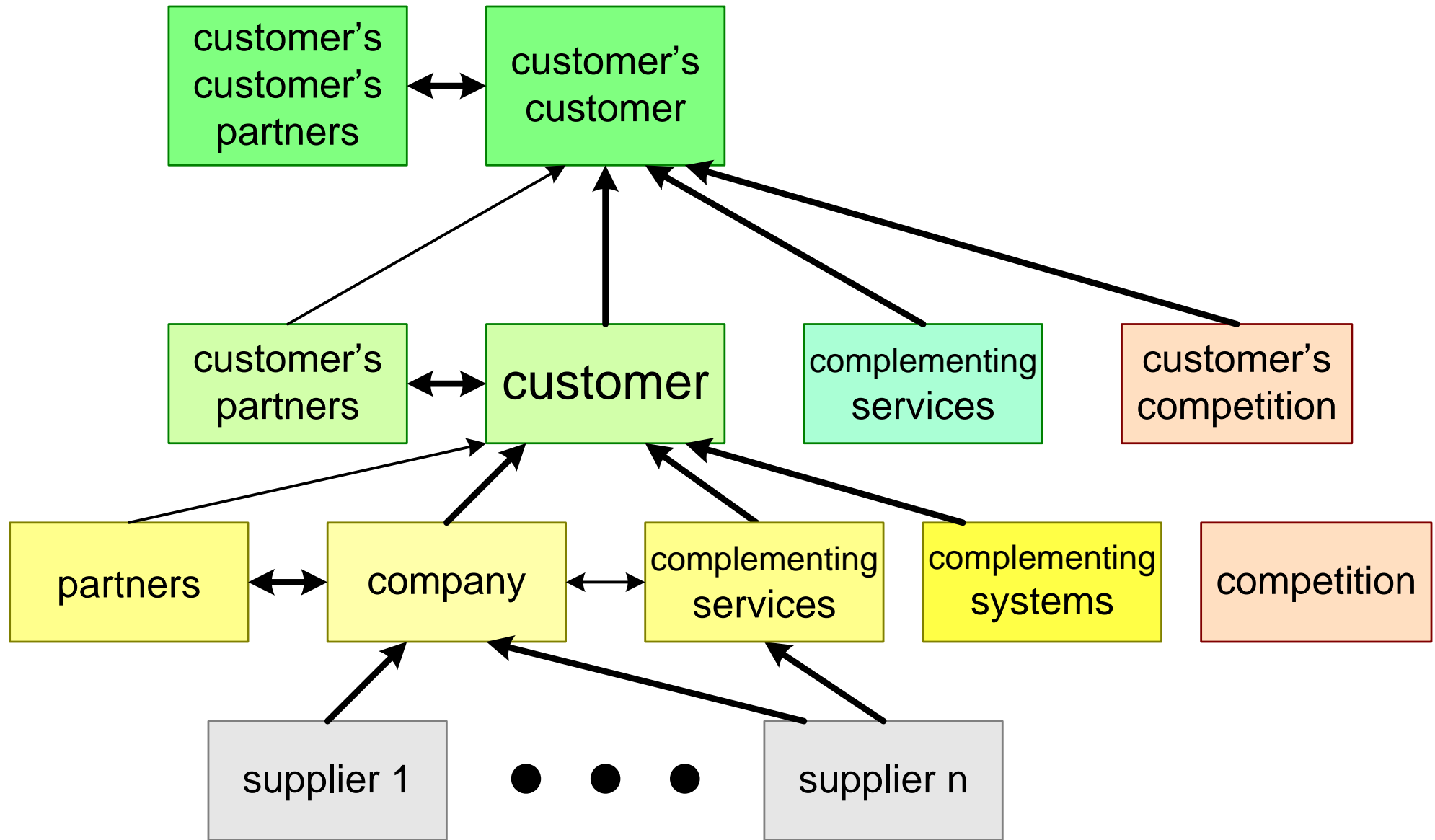| Customer **What**	Customer **How**	Product **What**	Product **How**	
Customer objectives	**A**pplication	**F**unctional	**C**onceptual	**R**ealization

Problem Statement

Problem statement

A typical Request for Quotation (the starting point of the tender) asks for a **solution**, without describing the problem and needs.

Best case it specifies **system requirements** (F-view; what must the system do with what performance), worst case it prescribes many **realization aspects**

missing customer context information

RFQs describing the solution

Bad RFQs prescribe the design

| **C**ustomer objectives | **A**pplication | **F**unctional | **C**onceptual | **R**ealization |

Solution: Elicit and capture **customer context**

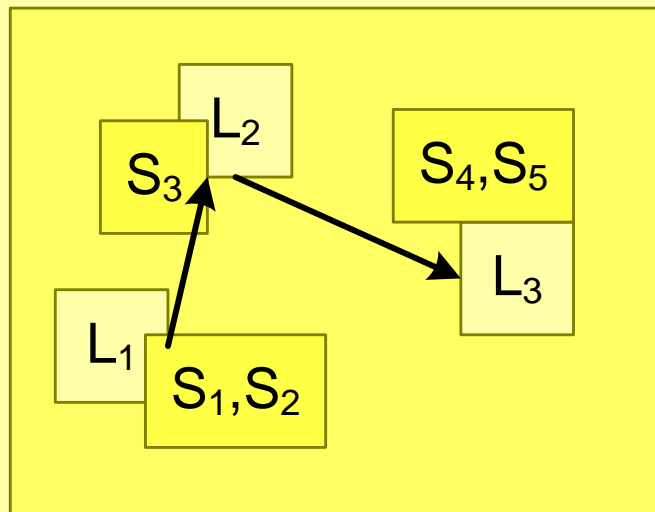USN ESI

Context of the Context
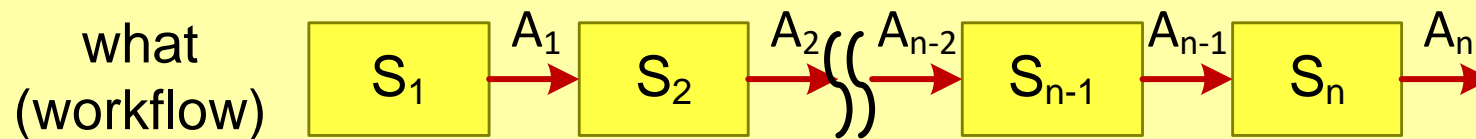
Know your Customer

- What is the role of the customer in the value network?

- How do they earn their money, what is their business model?

- SWOT analysis; what are their Strengths, Weaknesses, Opportunities and Threats?

- VUCA analysis; what is Volatile (changing fast), what is Uncertain, what is Complex, and what is Ambiguous?
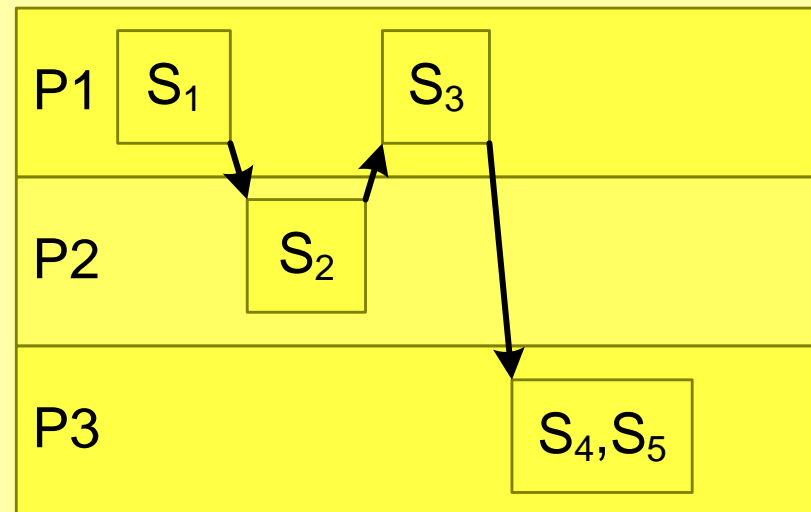
Capturing the Context

what   ConOps, story telling, scenario

who   stakeholders and concerns   *humans*
    organizations

how   system context diagram   *human-made artifacts*

    workflow

when

    timeline   from seconds to years

where   map   from nanometers to kilometers

why   customer key drivers, customer value proposition

financial   productivity model
    cost of ownership model
    money flow
    value network

ConOps

Concept of Operations (ConOps)

An envisioning of how the stakeholders will run their operation in relation to the system.

what (workflow)

S_1 → A_1 → S_2 → A_2 ~~ A_{n-2} → S_{n-1} → A_{n-1} → S_n → A_n →

L_2
S_3
S_4, S_5
L_3
L_1
S_1, S_2

where (map)

P1 S_1 S_3
P2 S_2
P3 S_4, S_5

who (swimming lanes)

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SEFS Scoping

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Abstract

Systems engineering is applicable from small systems to large and complex systems. The notion of a "system" is recursive: a system consists of subsystems that consist of subsubsystems. However, the subsystem developers may consider their subsystem as their system-of-interest, making the original system their supersystem. That makes systems engineering applicable at each aggregation level. An essential step is to define the scope of the system and the development and engineering effort.

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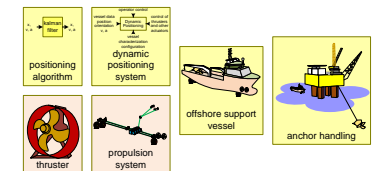status: preliminary draft
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Systems Engineering is Applicable at any System

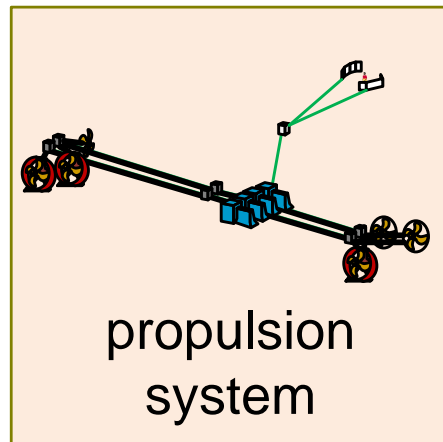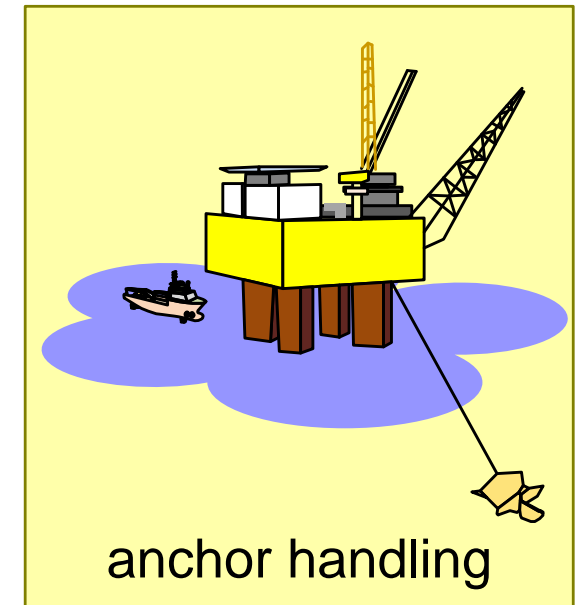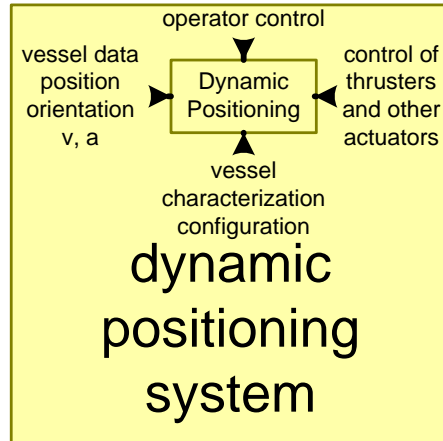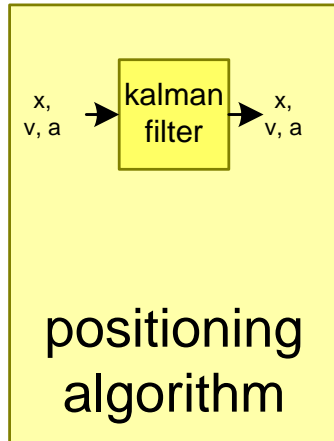**Systems Engineering** is applicable from **small systems** to **large and complex systems**.

Systems engineers must **tailor** the **systems engineering methods** to the **System of Interest**.

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Hierarchy of System Levels
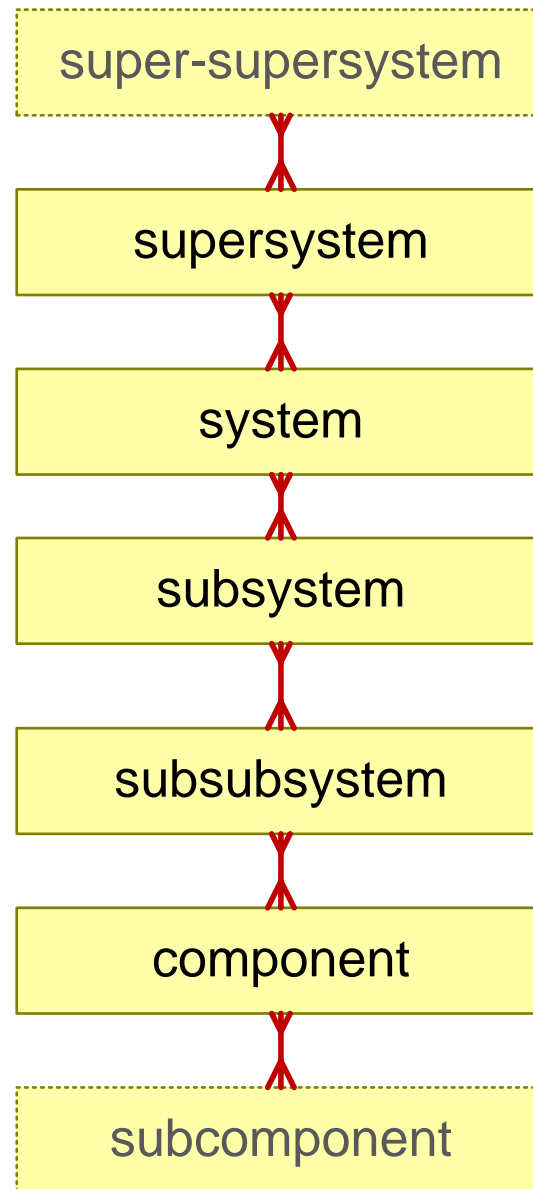
Example of System Levels

positioning algorithm

kalman filter

x, v, a → x, v, a

dynamic positioning system

operator control

vessel data position orientation v, a

Dynamic Positioning

control of thrusters and other actuators

vessel characterization configuration

thruster

propulsion system

offshore support vessel

anchor handling

Enabling Systems

enabling systems

| System of Interest (SOI) | Manufacturing System | Transportation System | Installation System | • • • | Training System |

Development and Engineering must develop the System of Interest and all Enabling Systems

SEFS Business and Life Cycle Context

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Abstract

The business context of the system of interest needs a viable business proposition. Many business functions, often active throughout the entire system life cycle, need to operate well. All of them generate life cycle needs. There also needs to be a business model, who pays for what, ensuring an economic sound business.
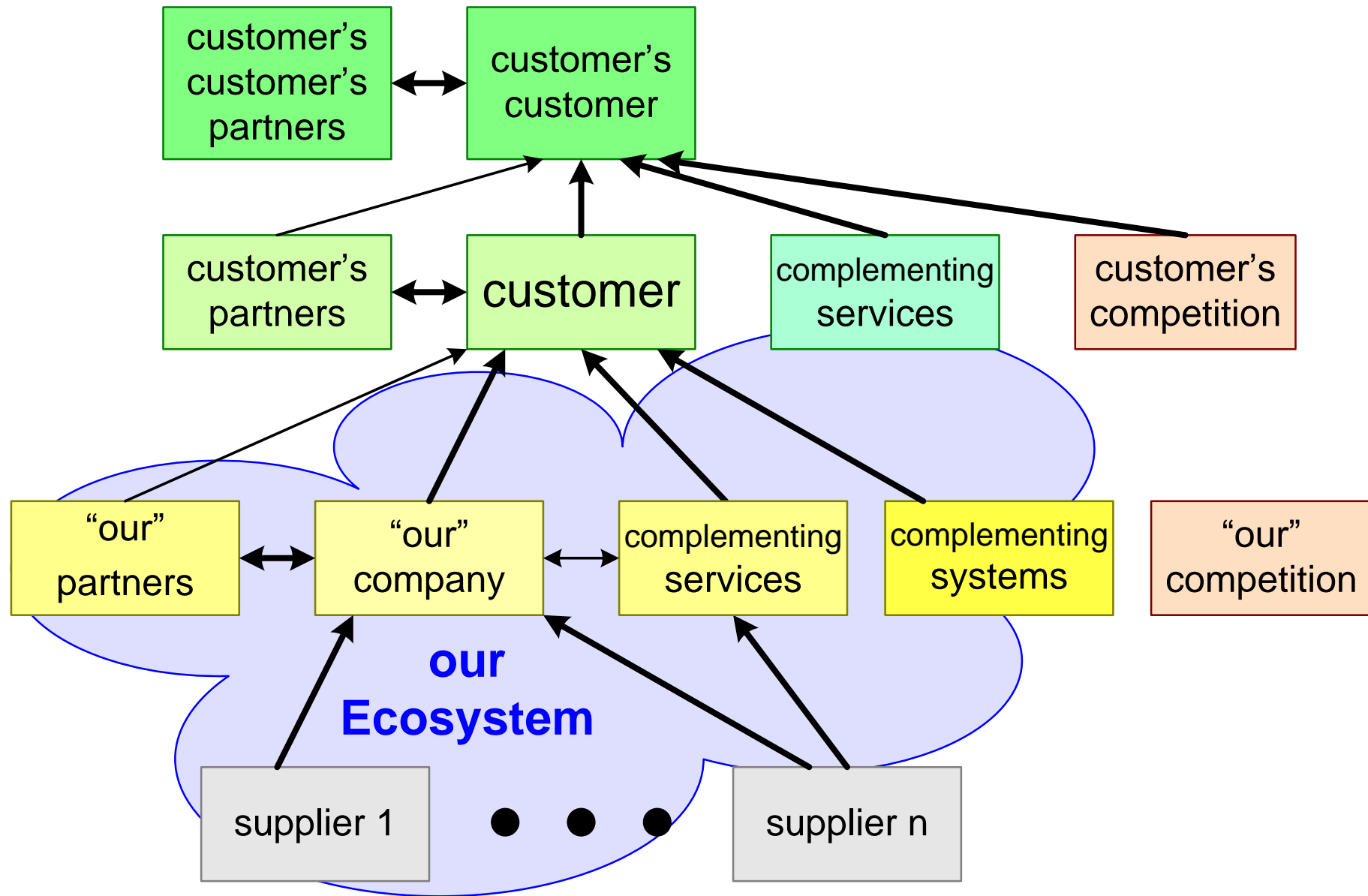
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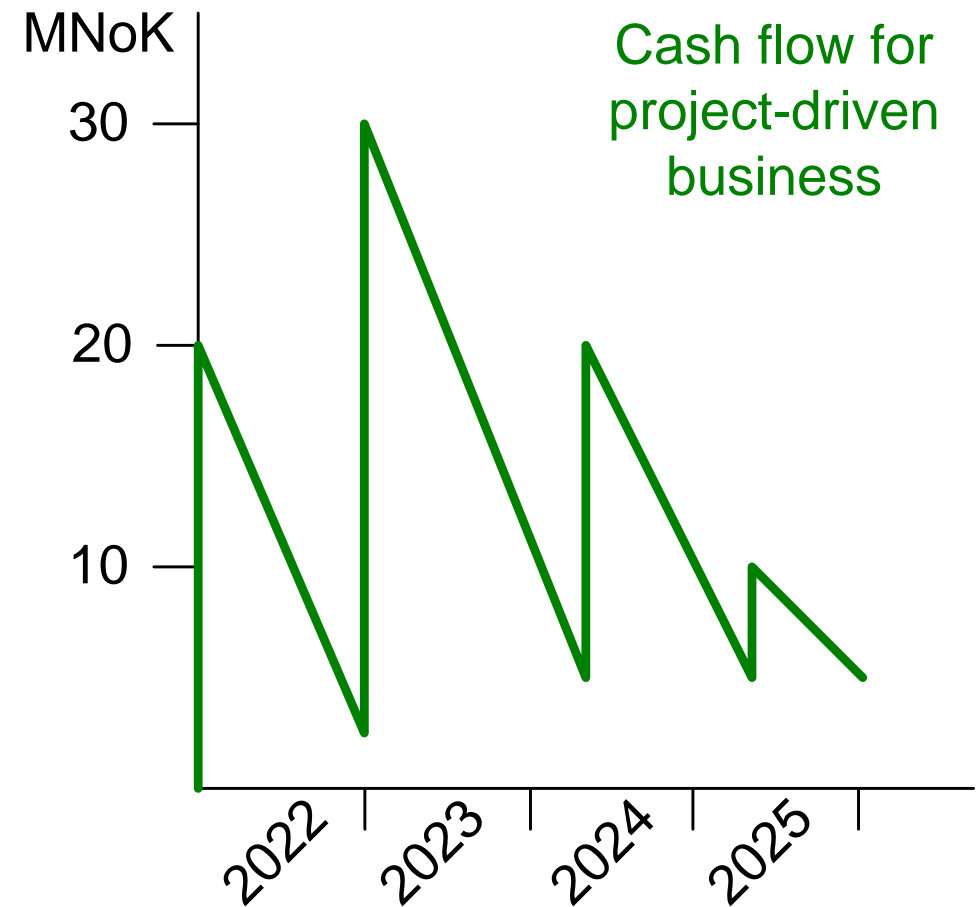status: preliminary draft
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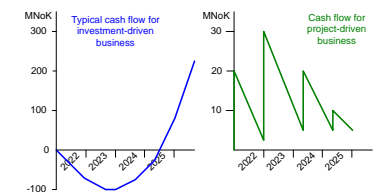
What is Our Company's Role?

What is our Business?

- What is "our" role in the value network and in "our" ecosystem?

- How do we earn money, what is our business model? When and how much?

- How and when do we have expenses? What is our cash flow?

- VUCA analysis; what is Volatile (changing fast), what is Uncertain, what is Complex, and what is Ambiguous?

Cash Flow Models

MNoK

Typical cash flow for investment-driven business

300

200

100

0

-100

2022 2023 2024 2025

MNoK

Cash flow for project-driven business

30

20

10

2022 2023 2024 2025

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Life Cycle Needs

technology base
certification
standards
tooling
competence

procurement
logistics
supply chain
transportation
storage
manufacturing
installation
configuration
commissioning
qualification
training

health monitoring
cleaning
maintenance
diagnostics
accessibility
spare part man.
obsolescence
consumables
waste
upgrading
evolution
training

decommissioning
removal/plugs
recycling

concept
study

FEED
study

tender

design and
engineering

manufacturing &
installation

operation and
maintenance

disposal

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