

# Module Requirements

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## Abstract

This module addresses requirements: What are requirements? How to find, select, and consolidate requirements?

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March 27, 2021  
status: concept  
version: 1.4



# Fundamentals of Requirements Engineering

by *Gerrit Muller* USN-SE

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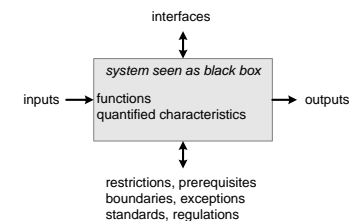
## Abstract

Requirements engineering is one of the systems engineering pillars. In this document we discuss the fundamentals of systems engineering, such as the transformation of needs into specification, the need to prescribe *what* rather than *how*, and the requirements when writing requirements.

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March 27, 2021  
status: concept  
version: 0.1



# Definition of “Requirement”

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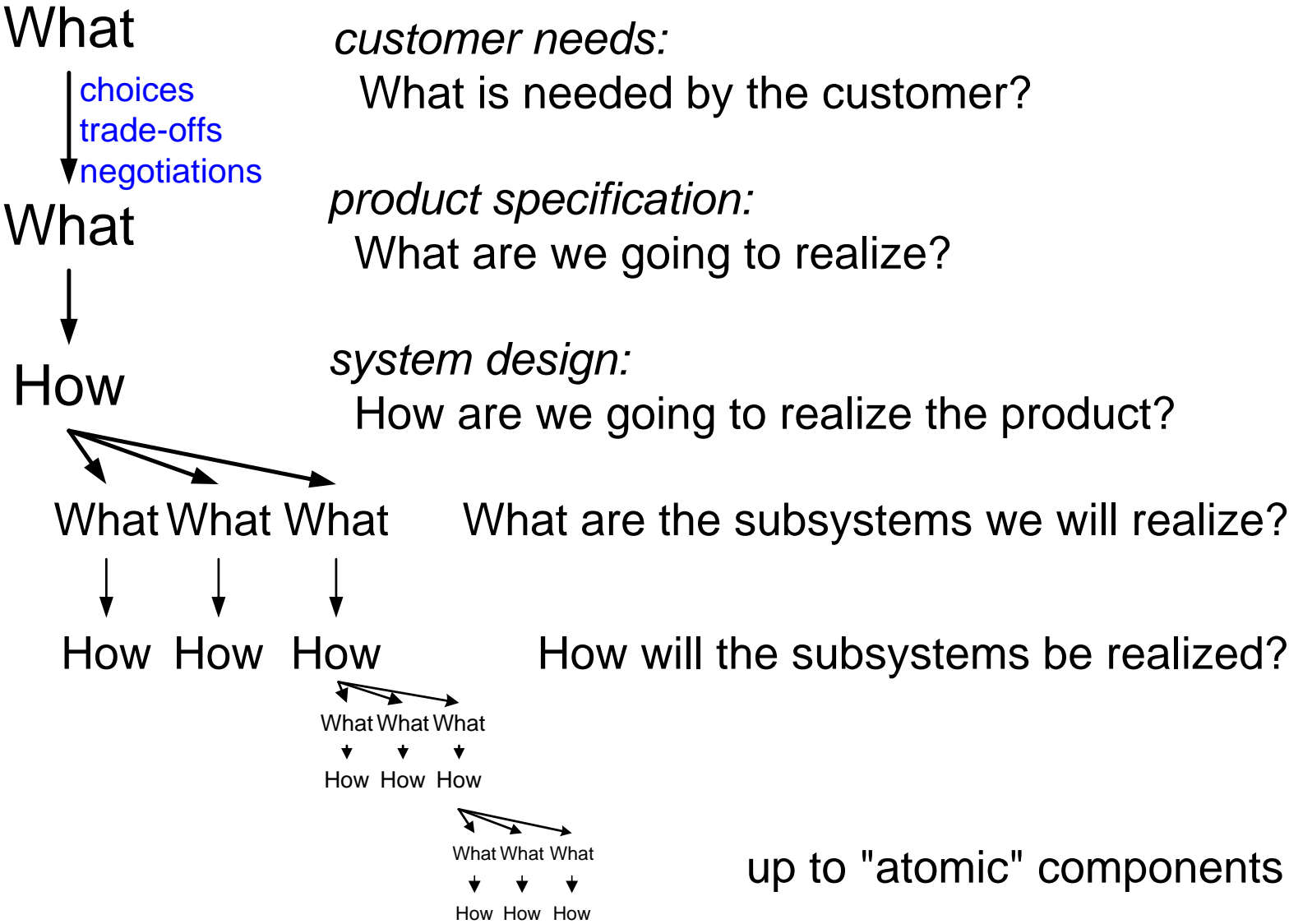
Requirements describing the needs of the customer:  
***Customer Needs***

Requirements describing the characteristics of the final resulting system (product): ***System (Product) Specification***

The ***requirements management process*** recursively applies this definition for every level of decomposition.

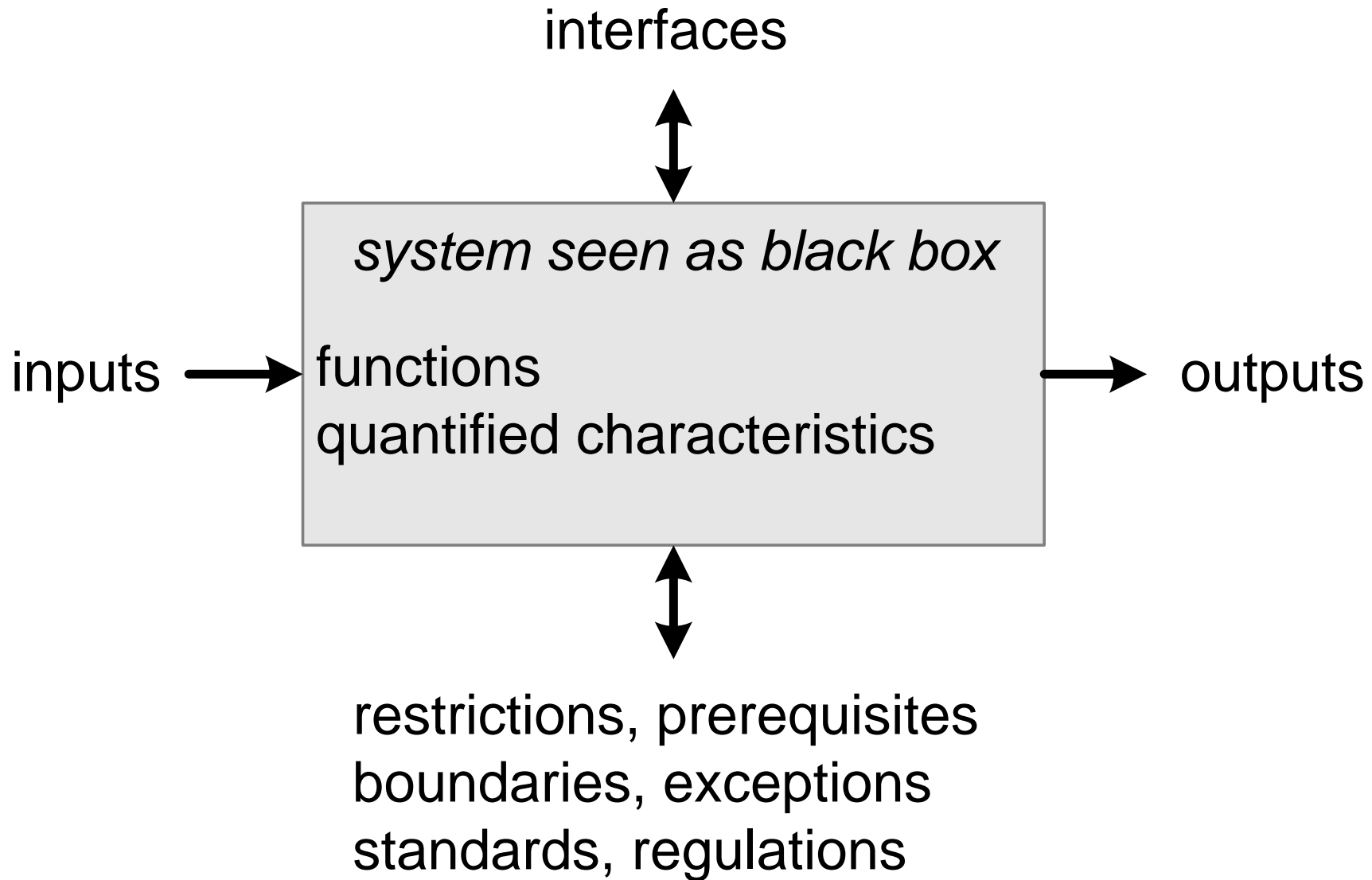
Requirements describing the needs of the company itself over the life cycle: ***Life Cycle Needs***

# Flow of Requirements

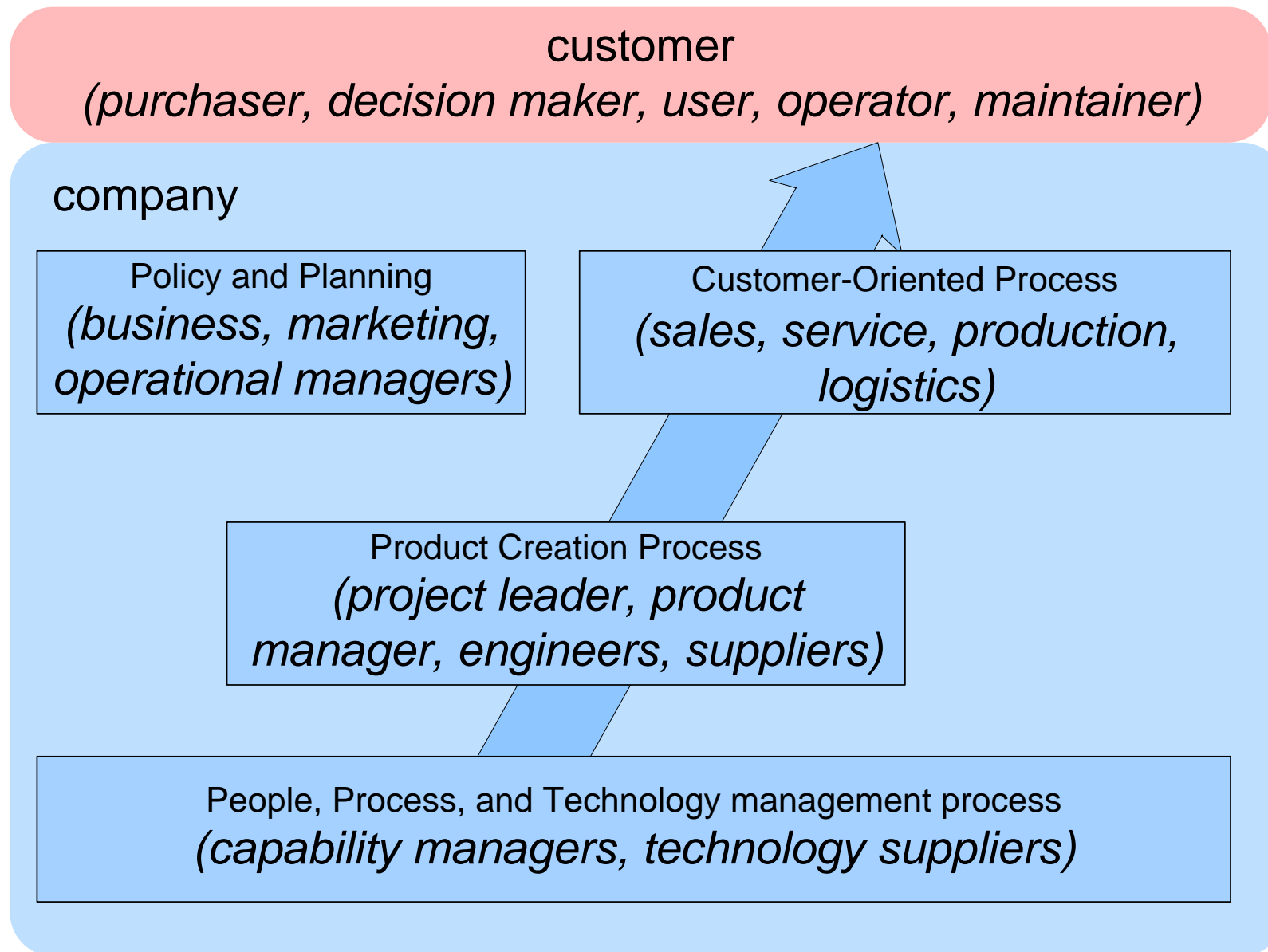


# System as a Black Box

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# Stakeholders w.r.t. Requirements



# The “Formal” Requirements for Requirements

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Specific

Unambiguous

Verifiable

Quantifiable

Measurable

Complete

Traceable

# The Requirements to Enable Human Use

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Accessible

Understandable

Low threshold



# Short introduction to basic “CAFCR” model

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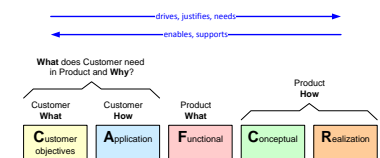
## Abstract

The basic “CAFCR” reference model is described, which is used to describe a system in relation to its context. The main stakeholder in the context is the customer. The question “Who is the customer?” is addressed.

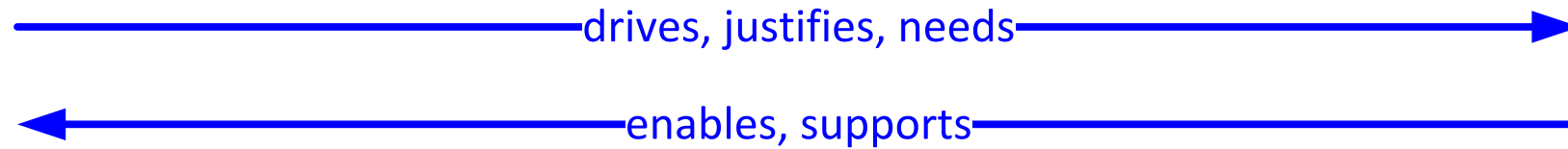
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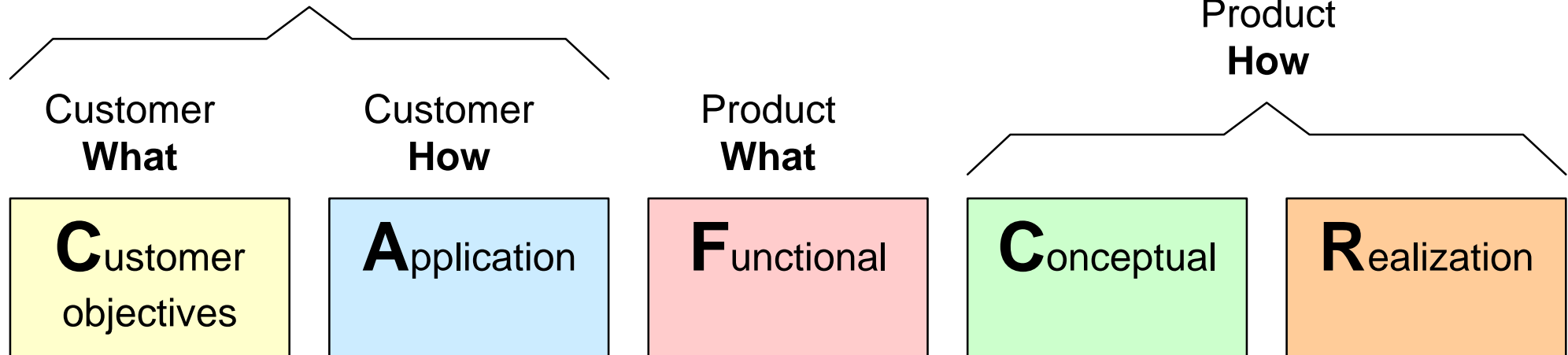
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# The “CAFCCR” model

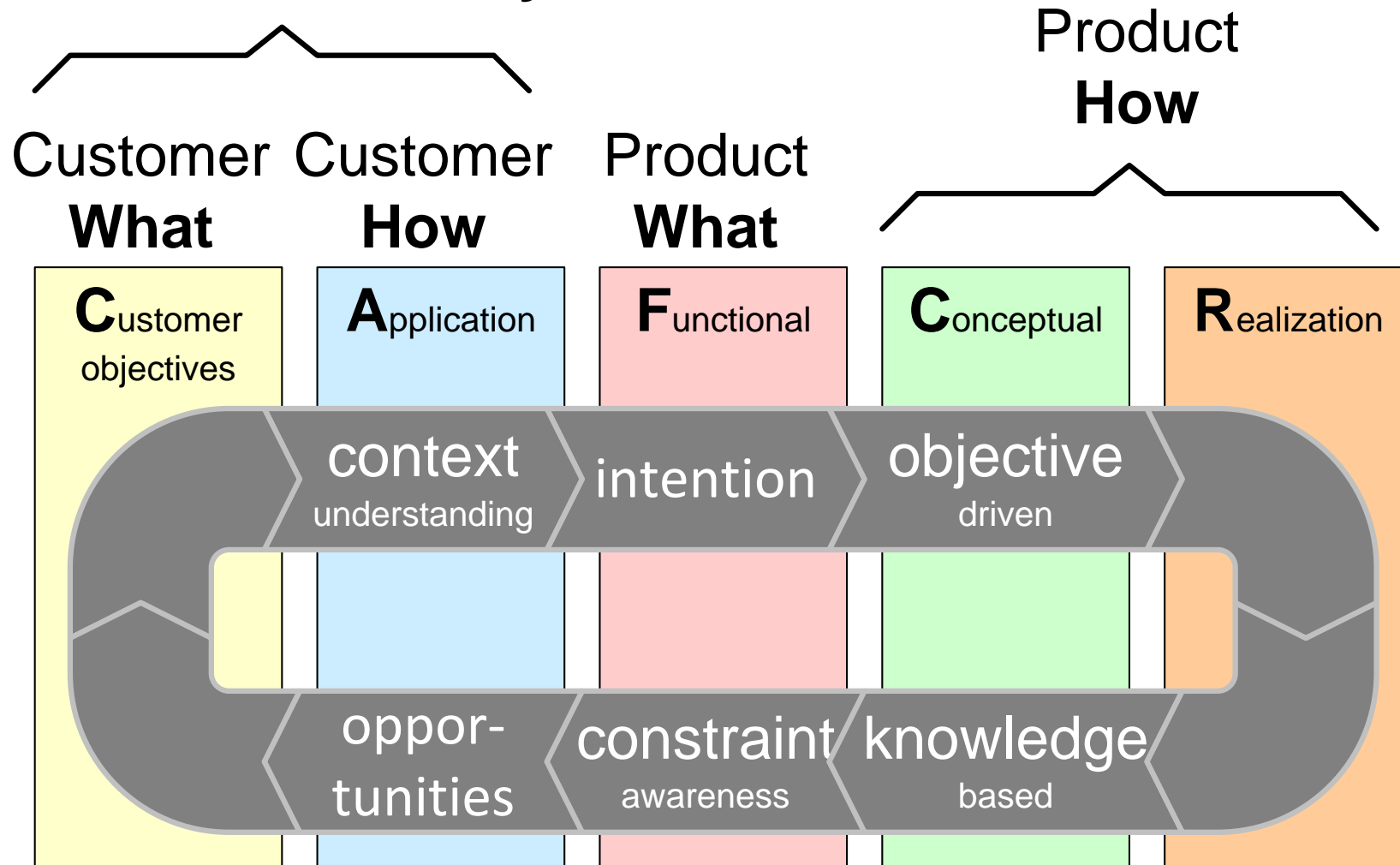


**What** does Customer need  
in Product and **Why?**

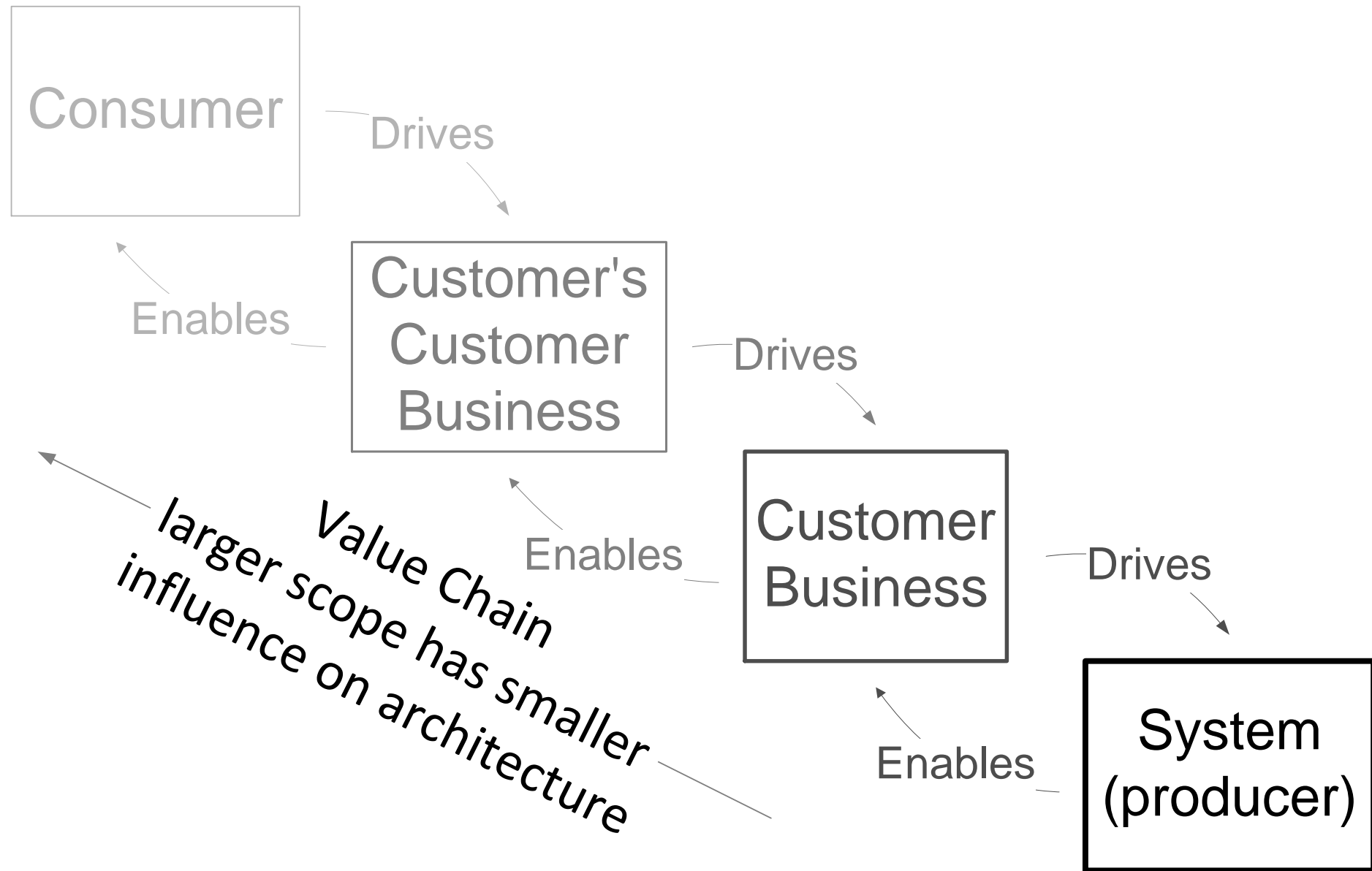


# Integrating CAFCR

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



# CAFCR can be applied recursively

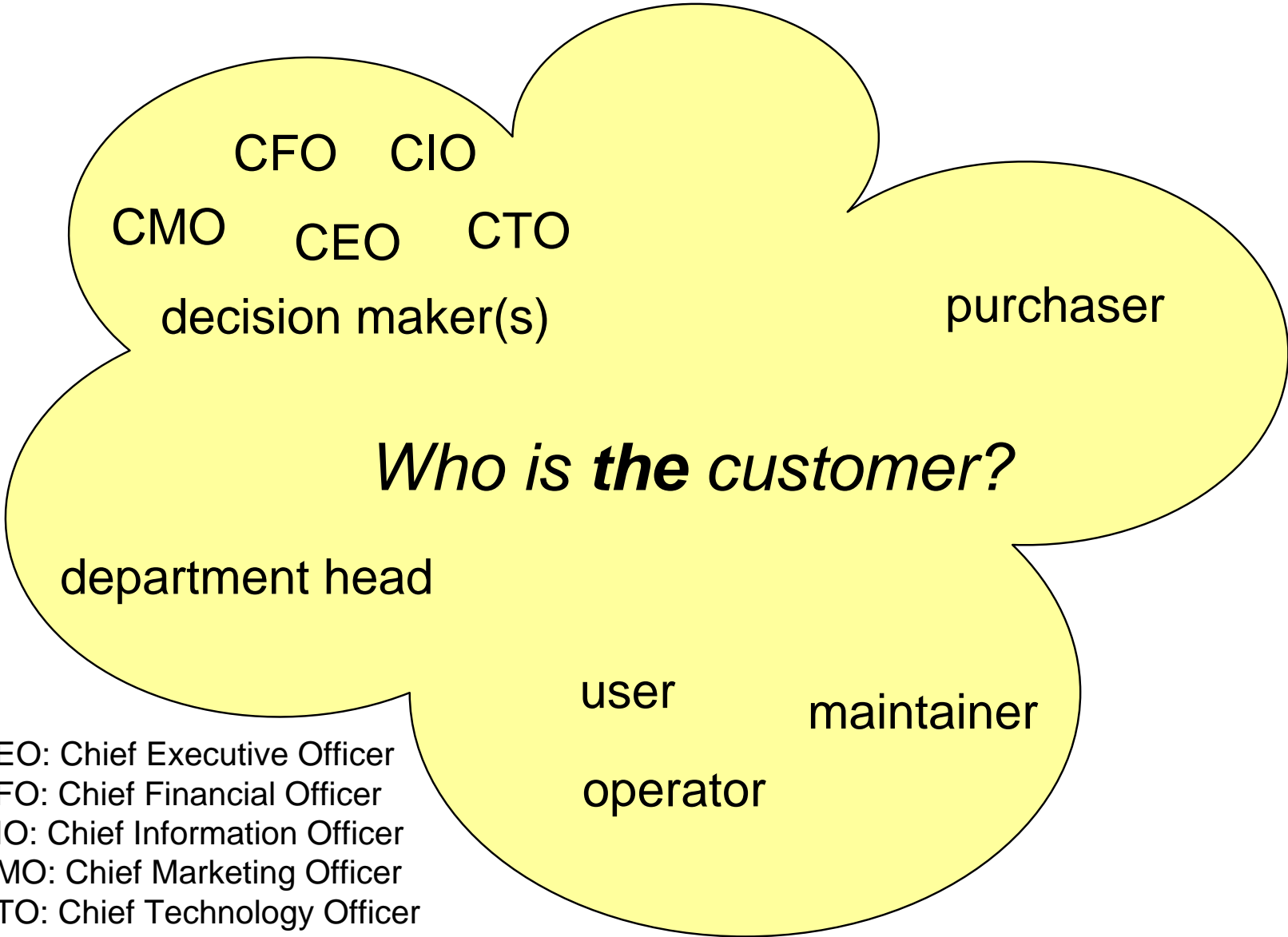


# Market segmentation

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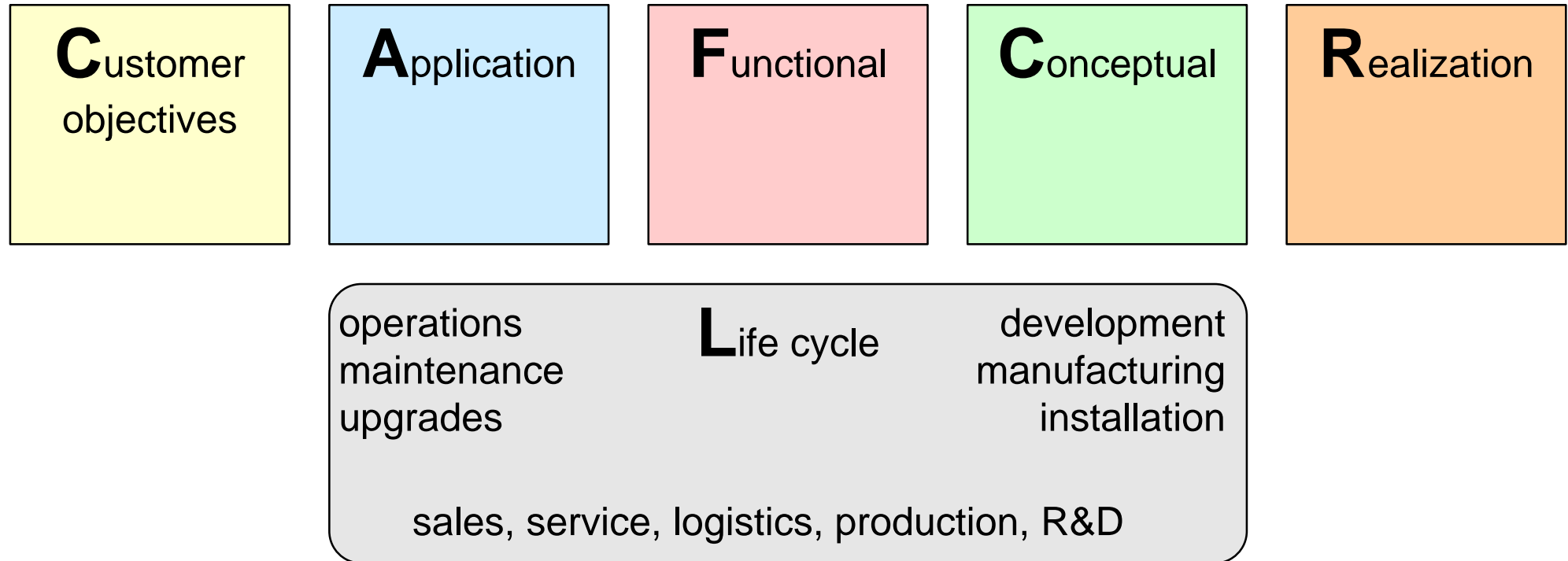
| segmentation axis | examples                                 |
|-------------------|--|
| geographical      | USA, UK, Germany, Japan, China           |
| business model    | profit, non profit                       |
| economics         | high end versus cost constrained         |
| consumers         | youth, elderly                           |
| outlet            | retailer, provider, OEM, consumer direct |

# Example of a small buying organization



# CAFCR+ model; Life Cycle View

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# Key Drivers How To

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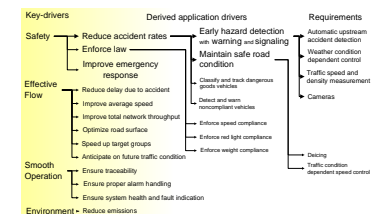
## Abstract

The notion of "business key drivers" is introduced and a method is described to link these key drivers to the product specification.

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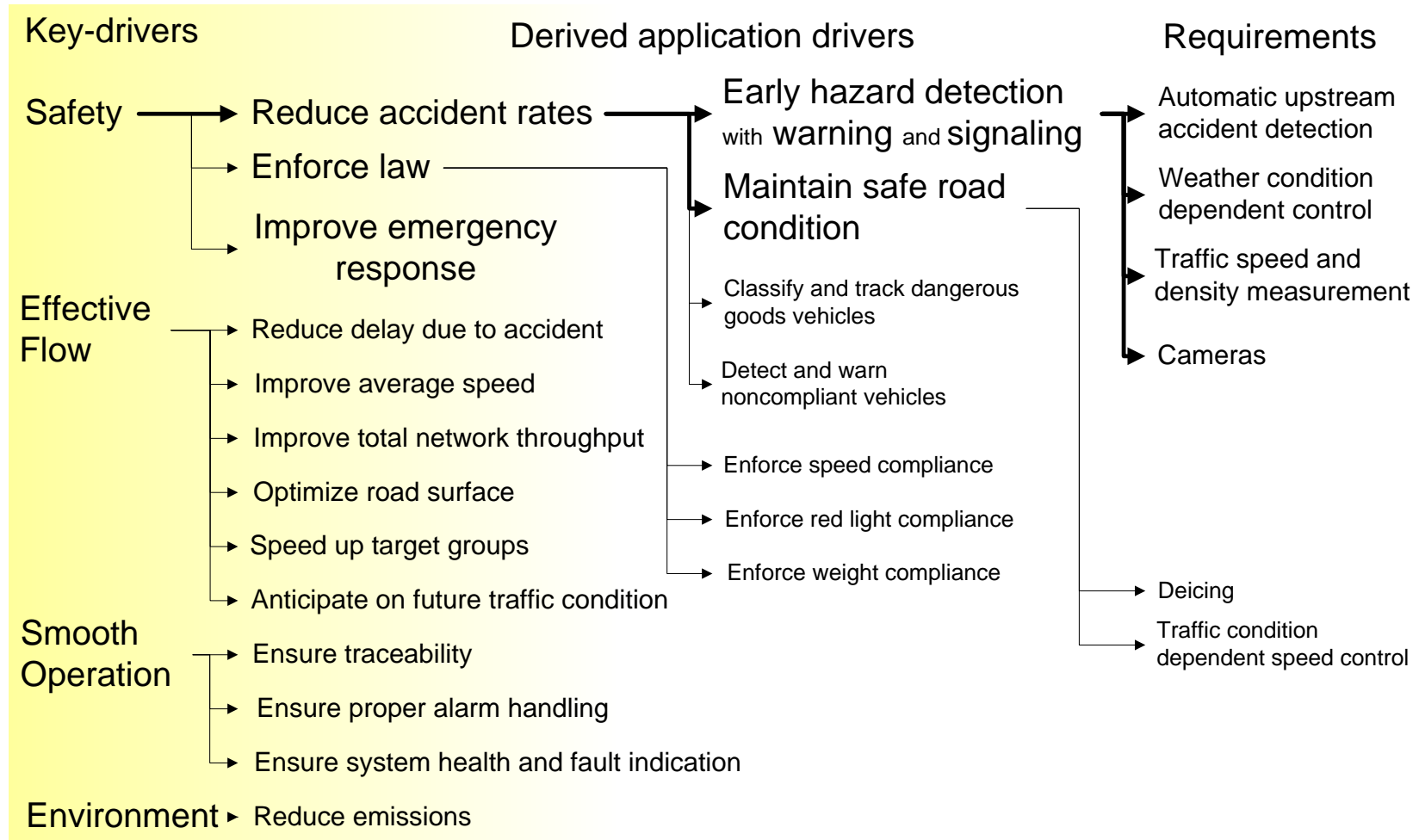
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status: draft  
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Note: the graph is only partially elaborated for application drivers and requirements



# Example Motorway Management Analysis



*Note: the graph is only partially elaborated for application drivers and requirements*

# Method to create Key Driver Graph

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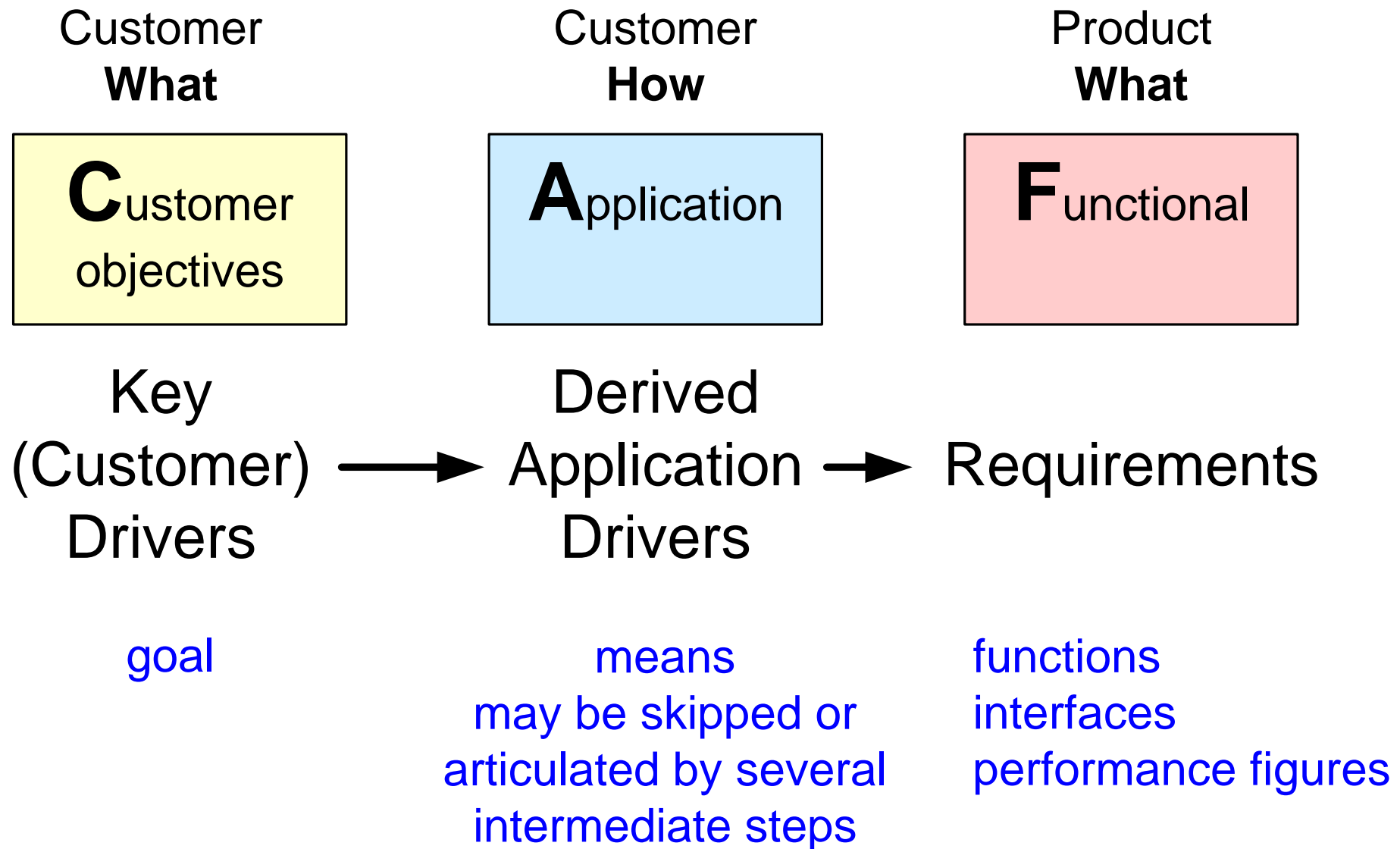
- |  |  |
|--|--|
| • Define the scope specific.   | in terms of stakeholder or market segments   |
| • Acquire and analyze facts  | extract facts from the product specification<br>and ask why questions about the specification of existing products.  |
| • Build a graph of relations between drivers and requirements<br>by means of brainstorming and discussions | where requirements<br>may have multiple drivers  |
| • Obtain feedback  | discuss with customers, observe their reactions  |
| • Iterate many times   | increased understanding often triggers the move of issues<br>from driver to requirement or vice versa and rephrasing |

# Recommendation for the Definition of Key Drivers

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- Limit the number of key-drivers minimal 3, maximal 6
- Don't leave out the obvious key-drivers for instance the well-known main function of the product
- Use short names, recognized by the customer.
- Use market-/customer- specific names, no generic names for instance replace “ease of use” by “minimal number of actions for experienced users”, or “efficiency” by “integral cost per patient”
- Do not worry about the exact boundary between Customer Objective and Application create clear goal means relations

# Transformation of Key Drivers into Requirements



# Requirements Elicitation and Selection

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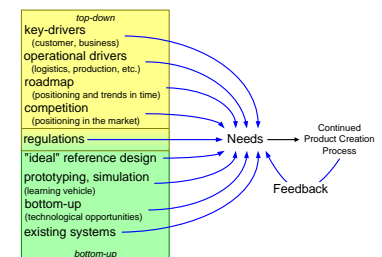
## Abstract

An elicitation method for needs is described using many different viewpoints. A selection process with a coarse and a fine selection is described to reduce the specification to an acceptable and feasible subset.

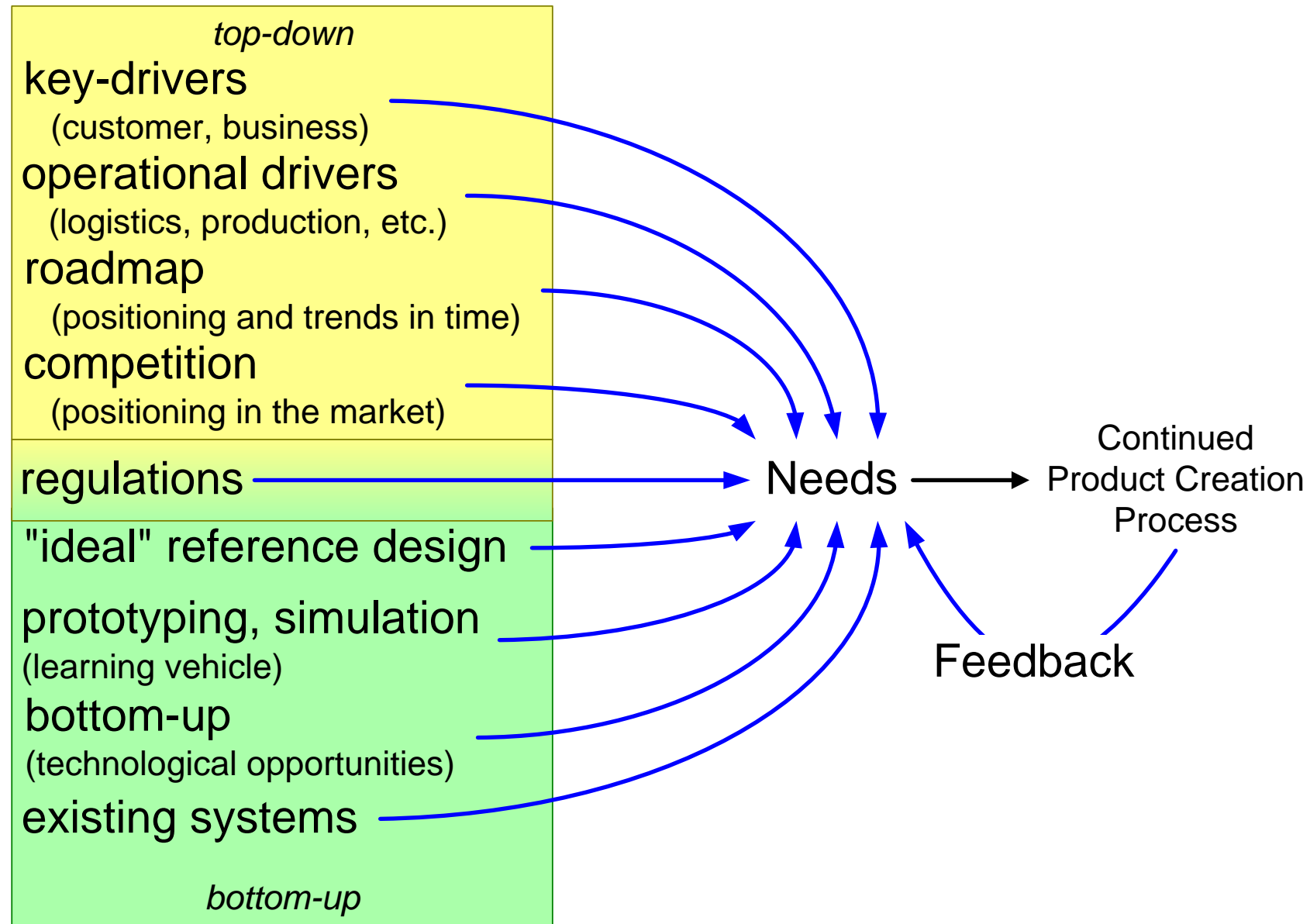
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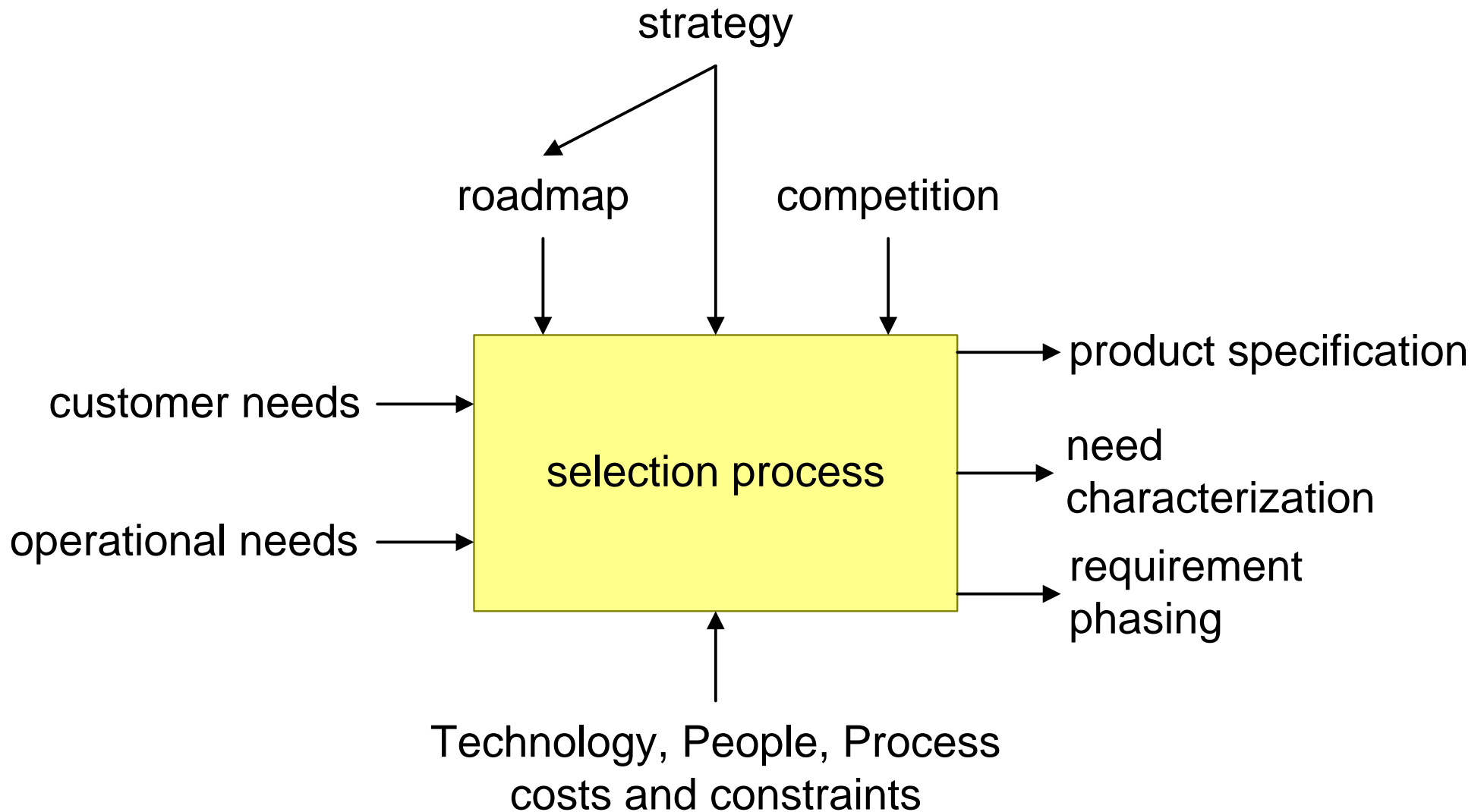
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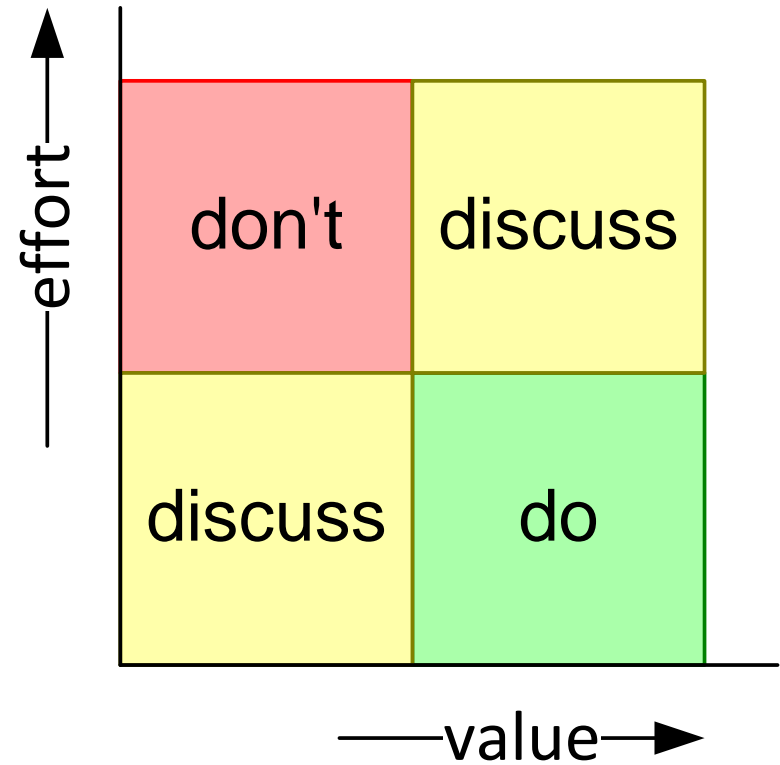
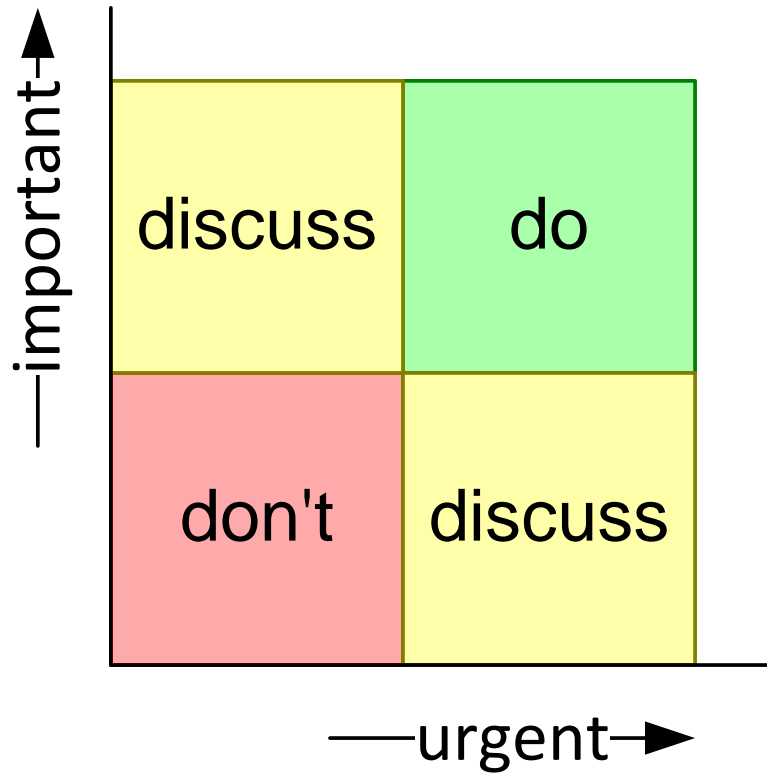
# Complementary Viewpoints to Capture Requirements



# Requirement Selection Process



# Simple Qualification Method





# Examples of Quantifiable Aspects

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- Value for the customer
- (dis)satisfaction level for the customer
- Selling value (How much is the customer willing to pay?)
- Level of differentiation w.r.t. the competition
- Impact on the market share
- Impact on the profit margin

Use relative scale, e.g. 1..5 1=low value, 5 -high value

Ask several knowledgeable people to score

Discussion provides insight (don't fall in spreadsheet trap)

# Exercise Requirements Capturing

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- Determine the key drivers for one particular product family.
- Translate these drivers into application drivers and derive from them the requirements.

# Needs and Requirements

## Needs, Specification, Requirements

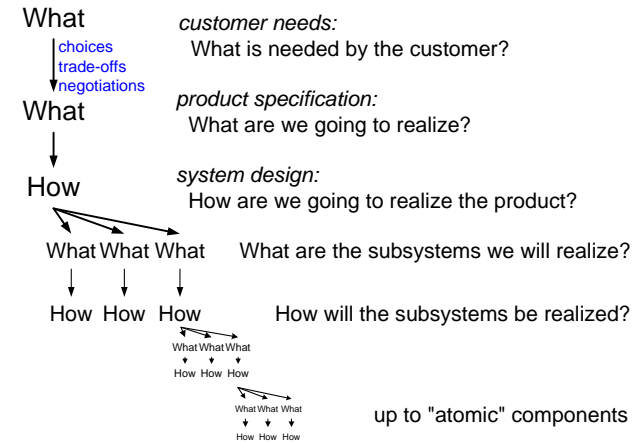
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Requirements describing the needs of the company itself over the life cycle: **Life Cycle Needs**

## Flow of Requirements



## Requirements for Requirements

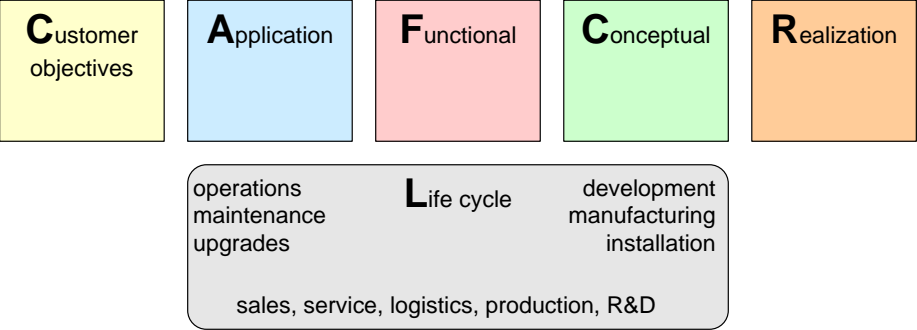
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- Unambiguous
- Verifiable
- Quantifiable
- Measurable
- Complete
- Traceable

## Enable Human Use

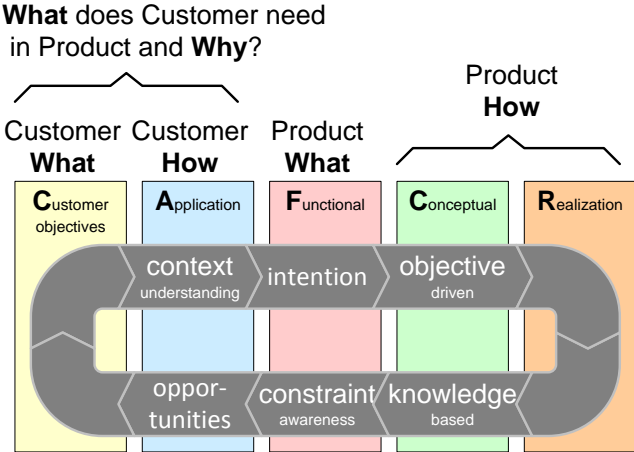
- Accessible
- Understandable
- Low threshold

# CAFCR, Customer Key Driver Graph

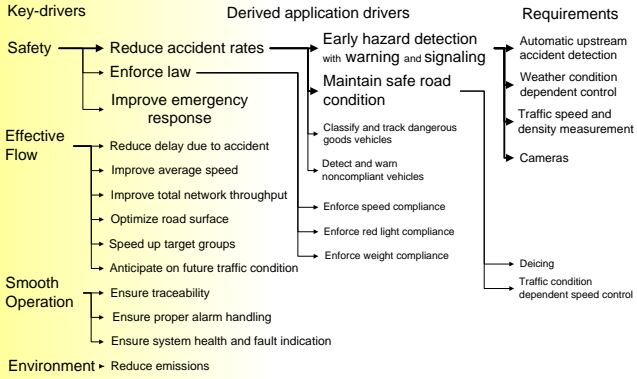
## CAFCR+ Model



## Iterate over Views



## Example Key Driver Graph



*Note: the graph is only partially elaborated for application drivers and requirements*

## Complementary Viewpoints

