Eliciting and Validating Stakeholder Needs

by Gerrit Muller University of South-Eastern Norway-NISE
e-mail: gaudisite@gmail.com
www.gaudisite.nl

Abstract

A successful system offers value to the customer, and serves the needs of its stakeholders. To create a successful system we need to understand our stakeholders. However, success is also impacted by the way we realize the system. Poor realizations degrade the value of a product, while ingenious realizations can boost the value. We use the CAFCR+ model to illustrate this.
1. Case Oil & Gas Subsea Installation
2. Intro
3. Case Health Care Medical Workstation
4. Early Validation Fast Iterations
5. Case KM New Operator Stations
Early Phase Need Analysis - Can We Ease Systems Integration?
Eldar Tranøy, Aker Solutions

- Large cost overruns on EPC projects on the Norwegian continental shelf
- 10 large EPC projects totaled a 96 GNoK cost overrun
- Consistent trend with cost overruns from 1994 through 2008
- Main Cost Drivers: Scope changes and late design changes

Numbers from the investment committee's report are all calculated as value pr. 1998
Systems Engineering Benchmarking

- Systems Engineering Body of Knowledge (SEBoK)
- Fundamental SE process:

  ![Diagram of systems engineering process]

**Example Project – Vigdis NE WOS**

**Amount of SE:**
- **8.5% of total project cost**
- **Too low for optimum SEE**
- **High enough to expect good results**

**Finding:**
**Mismatch** between tendered design and **operational needs**

The design is **not suitable for the actual operational needs**

**Examples of typical missing data:**
- Meteorological and oceanographic data
- Field data
- Soil data
- Fluid data
- Installation vessel data
Analysis of Cost and Potential Impact

- Analysis of VO registry
  - Changes to design or scope normally results in a variation order (VO)
  - Cost of change is normally carried by customer
  - Review of 23 VO’s

- Findings
  - 74% of the VO’s were preventable by need analysis
  - 92% of the cost incurred by late design changes, were preventable

- Root cause analysis of the preventable VO’s
  - Changes to product design
  - Mismatches between project requirements and operational needs
Introduction CAFCR+

1. Case Oil & Gas
Subsea Installation

2. Intro

3. Case Health Care
Medical Workstation

4. Early Validation
Fast Iterations

5. Case KM
New Operator Stations
The “CAFCR” model

What does Customer need in Product and Why?

Customer
What

drives, justifies, needs

Product
How

enables, supports

Application
Functional
Conceptual
Realization

Customer objectives
Application
C
A
F
C
R

Eliciting and Validating Stakeholder Needs
version: 0
March 24, 2019
CAFCRannotated
Integrating CAFCR

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

**Customer**
- What: Customer objectives
- How: Application Functional Conceptual

**Product**
- What: Objective driven
- How: Knowledge based

**Context**
- Understanding

**Opportunities**
- Constraint awareness

**Realization**
CAFCR can be applied recursively

System (producer)

Customer's Customer Business

Drives

Enables

Consumer

Drives

Enables

Customer Business

Value Chain

larger scope has smaller influence on architecture

Customer Business

System (producer)
CAFCR+ model; Life Cycle View

**Customer objectives**

**Application**

**Functional**

**Conceptual**

**Realization**

**Life cycle operations**
- maintenance
- upgrades
- development
- manufacturing
- installation

**Life cycle**
- sales, service, logistics, production, R&D
Health Care Case

begin

1. Case Oil & Gas Subsea Installation

2. Intro

C A F C R +

3. Case Health Care Medical Workstation

4. Early Validation
Fast Iterations

5. Case KM New Operator Stations

dend
Easyvision serving three URF examination rooms

URF-systems     EasyVision: Medical Imaging Workstation

*typical clinical image (intestines)*
Chronology of Easyvision RF R1 development

1991
- basic application toolboxes
  - 100 kloc

1992
- performance problems

1993
- Easyvision RF integrated product
  - 360 kloc
- print server + communication + interactive viewing

marketing opinion:
"All the functionality is available, we only have to provide a clinical UI"
Thread of reasoning; introvert phase

Introvert view: cost and impact of new technologies
Thread of reasoning; phase 2

Philips operational view
(manufacturing, service, sales)

How to measure memory, how much is needed?
from introvert to extrovert
Radiologists diagnose from film, throughput is important. Extrovert view shows conceptual and realization gaps!
from extrovert diagnostic quality, via image quality, algorithms and load, to extrovert throughput

Philips operational view  
(manufacturing, service, sales)
cost revisited in context of clinical needs and realization constraints; note: original threads are significantly simplified
Many customers are conservative for valid reasons: "Do not disturb our volume production". Every delivery means change, change means risk of disturbance. Application models and prototypes are proxies for deliveries.

An active and close relation with demanding customers is required to obtain timely feedback.

\(^1\)Not only in health care, but also in manufacturing, defense, oil and gas, ...
Early Validation: Fast Iterations

begin

1. Case Oil & Gas Subsea Installation

2. Intro

3. Case Health Care Medical Workstation

4. Early Validation Fast Iterations

5. Case KM New Operator Stations

down

Eliciting and Validating Stakeholder Needs
Gerrit Muller

version: 0
March 24, 2019
EVSNlogoEarlyValidation
The Conventional Waterfall Approach

1. determine needs
2. write specification "requirements"
3. design
4. build
5. integrate
6. verify
7. deliver and validate
Iterative Approach Using CAFCR

**Customer objectives**

**Application**

**Functional**

**Conceptual**

**Realization**

**Life cycle and Business**

- ask needs
- reconstruct needs
- validate
- explore solutions
- draft spec
- design
- integrate
- verify build

why why why

get solution as answer

explore use cases

use proto

and iterate and evolve further....
Reflection on CAFCR and Iteration

- Customer objectives
- Application
- Functional
- Conceptual
- Realization

Life cycle and Business

Stakeholders tend to pose solutions, we have to reconstruct the needs. Multiple solutions satisfy the needs. The devil is in the detail.

Unforeseen shortcomings degrade value; unforeseen opportunities increase value. Constraints and opportunities.

We learn faster when we iterate faster, but learning requires critical evaluation and reflection.

Stakeholders tend to respond on actual deliverables. Prototypes are useful, but we have to switch to delivery in time to get feedback.
A KM case: new Operator Stations

1. Case Oil & Gas Subsea Installation

2. Intro

3. Case Health Care Medical Workstation

4. Early Validation Fast Iterations

5. Case KM New Operator Stations
Applying A3 reports for early validation and optimization of stakeholder communication in development projects
by Kristian Frøvold

Scope: Transit - Operation

Applying A3 reports for early validation and optimization of stakeholder communication in development projects
Kristian Frøvold, Gerrit Muller, and Michael Pennotti
INCOSE 2017 in Adelaide, Australia
We depicted a **proposed solution** for the system function at an **early** stage.

The **Vessel Mode functions** goal is to increase safety and efficiency on voyages/operations.

In this case we collected information from and created the **A3** reports with **stakeholders** mentioned earlier.

“To collect real information you have to go there”
Early Validation Results

Real/V2 has fewer operations steps

Version 1, Before (internal)

Version 2, After (external)
Chicken and Egg: Understanding is created by Successful Deliveries