Comparison of Requirements Hand-Off, Analysis, and Negotiation: Case Study

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Requirements communication is the process of conveying needs from a given customer to a given supplier that enables the supplier to implement a solution that is accepted by the customer.
Research Context (simplified)

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Requirements Communication (from Product Manager to Development Team)

- Responsible for goal-oriented early-phase requirements
- Responsible for solution-oriented late-phase requirements: „design“

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Requirements Communication
Challenges

• Product Manager (Project Customer):
  • How do I ensure that the project team delivers an acceptable solution, already with the first attempt?

• Project Team (Supplier):
  • How do I get the needed inputs for architecting and designing an accepted solution, even if requirements are of low-quality or not even existing?

• Steering Committee:
  • How long is it going to take?
  • How much do we need to invest?
Example of Dialogue between Product Manager and Development

Research Questions (1/2)

1. How much does the presentation of requirements influence design?
2. How much does the presentation of design influence requirements?

• If 1 clearly dominates:
  • Unidirectional requirements flow suffices: Customer should push and/or supplier should pull

• If 1 and 2 are comparable:
  • Bidirectional flow is important: Customer and supplier should engage in a dialogue
Three Kinds of Requirements Communication Approaches

• Requirements Push: Hand-Off

• Requirements Pull: Analysis

• Balanced: Negotiation
Research-Enabling Concepts: Formalized Implementation Proposals

**Product Manager:**
Goal-Oriented Requirements Catalogue
Technology: RAM (Gorschek, Wohlin, 2006)

**Architect:**
Solution-Oriented System Specification
Technology: ADORA (Glinz et al, 2002)

Dialogue between **Product Manager** and **Architect:**
Implementation Proposals (here formalized)
Process

• Experienced Product Manager (Fortune500 Company)
• Junior Architect (Student at University of Zurich)
• License Management Solution

• PO1: Positioning 1
  Product manager specifies requirements

• HO: Hand-Off
  Product manager hands requirements off to architect

• PO2: Positioning 2
  Architect performs requirements and system analysis

• NE: Negotiation
  Both review implementation proposals

• CO: Confirmation
  Both document negotiation results
Positioning 1: Product Manager Specifies Requirements

- **Product Manager's Perspective**
  - Effort Profile Product Manager
  - Fraction of Requirement Changes (Feature-Level)

- **Architect's Perspective**
  - Effort Profile Architect
  - Fraction of Design Changes

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Hand-Off: Product Manager Hands Requirements Off

"the meeting was too short to absorb the large amount of information"
Positioning 2: Architect Performs Analysis

"too many design decisions are based on assumptions"
Negotiation: Both Review Implementation Proposals

Example: „Yes, but you should add here a thin client to allow adapting the software to local customs.“

„I understand the requirements just good enough to implement an accepted solution.“

Effect of proposed design on requirements

Effect of improved requirements

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Confirmation: Both Parties Document Negotiation Results

„I am satisfied with the results.“

„The documentation confirmed that I correctly have understood the requirements.“
Interpretation

• Hand-Off:
  • Launch point for analysis, no solution available yet
  • Architect’s intuition: no requirements understanding

• Analysis:
  • Design was developed for a minority of requirements
  • A’s intuition: just not yet good-enough (but own capabilities overestimated)

• Negotiation:
  • Avalanche of changes on both sides
  • Design now covered a majority of requirements
  • A’s intuition: small but important change to good-enough

• Confirmation:
  • The supplier is working, the customer not
  • A’s intuition: requirements understanding again confirmed
Research Questions (2/2)

• How can be measured how much requirements are understood by the supplier?

• The measurements should be usable as a predictor for project success.
  • Completeness: risk of measuring a moving target
  • Architect’s gut feeling: often requested in practice
  • Requirements coverage: based on proposed concepts
**Measurements**

**Exec-Ability**
(Ability to Execute)

Am I able to implement an acceptable solution?

- 100%: perfectly able to deliver an accepted solution
- 60%: good-enough
- 0%: not able to deliver an accepted solution

**R-Cov**
(Requirements Coverage)

Coverage of requirements with implementation proposals (in %)

- Requirements
- Implementation Proposal
- Implementation Proposal
- Design

Subjective Self-Evaluation

Repeatable
Exec-Ability vs. R-Cov: PO1: Requirements Specification

Perfectly able to deliver an accepted solution

Good-enough

Not able to deliver an accepted solution

Coverage of feature-level requirements

Perceived Ability to Execute (Exec-Ability)

Coverage of Feature-level Requirements (R-Cov)

Effort Architect (hours)
Exec-Ability vs. R-Cov: HO: Hand-Off

[Graph showing the relationship between Effort Architect (hours) and Perceived Ability to Execute (Exec-Ability) and Coverage of Feature-level Requirements (R-Cov).]

Perceived Ability to Execute (Exec-Ability)
Coverage of Feature-level Requirements (R-Cov)
Exec-Ability vs. R-Cov: PO2: Analysis
Exec-Ability vs. R-Cov: NE: Negotiation

![Graph showing the relationship between Effort Architect (hours) and Perceived Ability to Execute (Exec-Ability) and Coverage of Feature-level Requirements (R-Cov).]
Exec-Ability vs. R-Cov: CO: Confirmation

Perceived Ability to Execute (Exec-Ability)
Coverage of Feature-level Requirements (R-Cov)
Interpretation

• Exec-Ability
  • Subjective, forgeable, not repeatable
  • Effortless measurement
  • Useful if compared against threshold „good-enough“

• R-Cov:
  • Objective, forgeable only if both parties cheat, repeatable
  • Measurement takes effort
  • Very sensitive to requirements-design alignment
  • It may be possible to identify a robust threshold (such as 60%)

• R-Cov and Exec-Ability correlate
  • R-Cov is more pessimistic than Exec-Ability before negotiation
  • R-Cov is more optimistic than Exec-Ability after negotiation

• No proof yet that they are good predictors for project success
**Contributions**

- The study results improve our understanding of the customer (marketing, product management) and supplier (architect) collaboration.

- Comparison of relative effect of requirements hand-off, analysis, and negotiation on requirements and design changes
  - Feedback led to requirement and design changes
  - Dialogue between customer and supplier was necessary

- Formalization of implementation proposals for measuring evolving requirements-design alignment between customer and supplier
  - Requirements and design changes could be easily observed
  - Coarse-grained traceability did not negatively affect effort

- Exploration of approaches for measuring requirements understanding
  - Self-evaluation appeared to be too optimistic before negotiation
  - Requirements coverage appeared to be more reliable
Threads to Validity

- Semi-industrial lab-like environment raises questions regarding transfer to full industrial environments
  - Control of the communication vs.
  - Rich and redundant communication channels

- Product manager and architect experience difference raises questions regarding generalization of results
  - Control of risk of persuasion architect $\rightarrow$ product manager vs.
  - Observation of richer interaction and more amplified changes

- Formalization of implementation proposals raises questions regarding transfer to industrial practice
  - Measurement of requirements and design changes vs.
  - Situational factors that require flexibility and pragmatism
Limitations and Future Research

- Not evaluated was:
  - Evolution of product manager’s understanding of requirements
  - Situational factors that encourage the selection of given requirements communication techniques

- A single case was presented and evaluated
  - Statistical generalization not possible

- Predictive qualities of measurements not evaluated
  - A longitudinal study may provide data
Thank You!

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