3rd conference of the EURO Working Group
on the Practice of Operations Research
Challenges in the deployment of OR projects

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Requirements Definition in OR Projects

Definition, impact on other project phases, best practices
Discussion group 3

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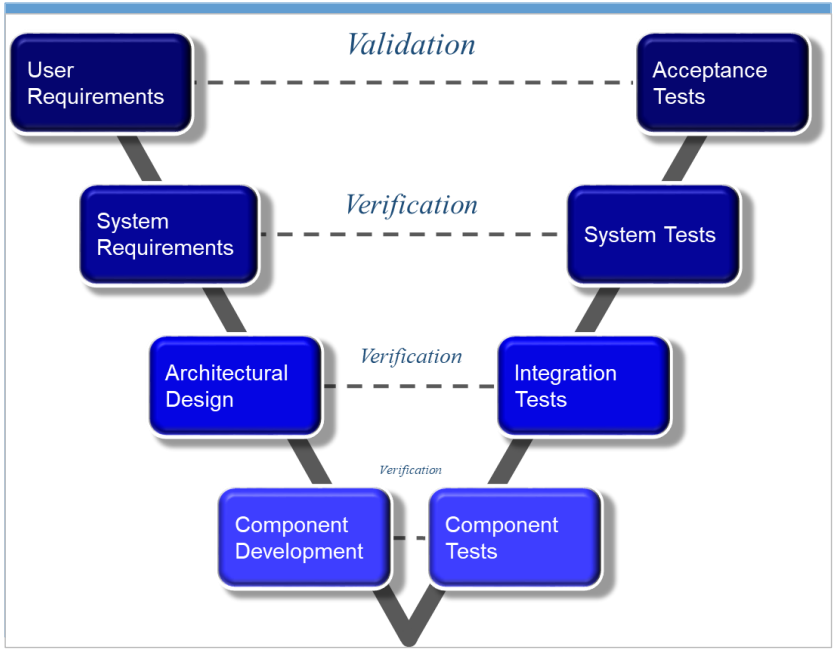
Agenda

- What are “requirements”?
- Purpose and method of discussion
- Interactive discussion
- Summary of discussion results and closing

What are “requirements” and how do they relate to OR projects?

A requirement is “a statement that identifies a system, product or process’ characteristic or constraint, which is unambiguous, clear, unique, consistent, stand-alone (not grouped), and verifiable, and is deemed necessary for stakeholder acceptability.”

INCOSE. 2011. Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities. Version 3.2.2. San Diego, CA, USA: International Council on Systems Engineering (INCOSE), INCOSE-TP-2003-002-03.2.2: 374.



Successful Integration of systems Engineering and Program Management Processes, Witte, INCOSE 14th Annual International Symposium Proceedings 2004

- OR projects may
  - involve a design of a new system, product, or process,
  - improve existing systems, products or processes

  or,
  - involve a design of another system’s component, i.e., a decision support algorithm to give feedback to system’s user,
  - provide decision support to another system’s development process, i.e., a modeling and simulation system to optimize system architectural design.

How do requirements impact an OR project?

User Requirements → **System Requirements** → **Design Requirements** → **Test Definitions** → **Test Results**

Requirements Definition & Validation

- What is the system expected to do, under which circumstances, i.e., the environment?
- Communication of requirements with the user / stakeholders → Domain related terminology
- Can the requirements be implemented with the current level of technology / state-of-the-art of methodology?

Interface & Performance Requirements

- Functional requirements
- Interface requirements → with users, environment, legacy systems, etc.
- Performance requirements
- Quality factors: Reliability, availability, maintainability, safety, security, reusability, testability, etc. → usually conflicting with cost and schedule requirements

Verification

- Integration tests → testing interfaces with users and/or other system components including legacy systems

Validation

- Test whether the system is valid, i.e., the system can achieve its intended use in its intended operational environment → the system is assessed whether it complies with the user requirements → sign-off decision

Purpose & method of our discussion

We would like to get an understanding of requirements definition process in successful deployment of OR projects by learning your experience of requirements definition in OR projects in terms of your problems and best practices with the help of an online interactive discussion methodology.

Method:

- The moderators are going to ask each question to the whole group and let the participants to write their answers with an order from most important to the least (3min).
- The participants are asked to write their most important three points in the spreadsheet.
- We will start discussing from these points.

Questions:

1. What are the problems encountered at requirements definition process in OR projects?
2. How/when these problems have impact on the later stages (to sign-off decision, to legacy systems integration, etc.) of the project?
3. How can we have an effective requirements definition phase?

Question 1

What are the problems encountered at requirements definition process in OR projects?

- Priority 1
  - Quantifying the impact of additional requirements on algorithm performance
  - Stakeholders unaware of OR and its capabilities
  - Need for a common language when two experts from different domains talking
  - Hard to have a complete list of requirements and not miss points that are so obvious to end user they don't consider them

- Priority 2
  - Quantifying the impact of additional requirements on development cost
  - Requirements being vague or too open
  - A tool to collect, store and manage requirements throughout project
- Priority 3
  - Link requirements to field practice
  - Requirements uncovered at later stages of the projects
  - End users not always involved

Question 2

How/when these problems have impact on the later stages of the project?

- Priority 1
  - A waterfall approach leads to unclear requirements due to a lack of user feedback
  - Gaps in requirements are only identified when a user validates the results
  - Missed requirements, identified during project delivery, result in replanning

- Priority 2
  - Unclear requirements will cause issues when integrating with other systems
- Priority 3

Question 3

How can we have an effective requirements definition phase?

- Priority 1
  - Requirement elicitation should occur throughout the project
  - There should be an orientation/discovery phase before requirements capture
  - Follow iterative/Agile principles that allow rapid prototyping
  - Bring experience from previous projects, and ask ‘Have you thought about?’

- Priority 2
  - Requirements should always match a clear end user need
  - Personal relationships and a common goal are important
  - Be agile and open to change
  - Have users regularly test the solution and provide feedback
- Priority 3
  - All stakeholders should be able to contribute to requirements, written in a common language
  - Co-create with end users as part of the team

Key themes from the discussion

- Communication barriers: the need to have a common language between OR experts, domain experts and the end user.
- The need to include end users and get regular feedback throughout the project.
- Be aware and accept that the complete set of requirements will not be known at the start of the project, requirements will be discovered during the project which will require replanning.
- Applying Agile principles will overcome many of the challenges.
- Have a discovery phase at the start of the project as part of requirement elicitation.

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Thank You