Validation of
- Context of consideration
- Execution of RE activities
- Created requirements artefacts
Verification and Validation

- **Validation:**
  - “Are we building the right system?”
  - Does our problem statement accurately capture the real problem?
  - Did we account for the needs of all the stakeholders?

- **Verification:**
  - “Are we building the system right?”
  - Does our design meet the spec?
  - Does our implementation meet the spec?
  - Does the delivered system do what we said it would do?
  - Are our requirements models consistent with one another?
Validation Goal

Check whether the **outputs** of activities fulfill defined quality criteria

Check whether the execution of **activities** adheres to process definitions and activity guidelines

Check whether the **inputs** of activities fulfill defined quality criteria
Validation Goal

Check whether the **outputs** of activities fulfill defined quality criteria

Content

Agreement

Documentation

Check whether the **execution of activities** adheres to process definitions and activity guidelines

Check whether the **inputs** of activities fulfill defined quality criteria
Requirements Lifecycle

Source: Adapted from Pohl, CAISE 1993
Validating
Created Requirements Artefacts

Validation with regard to

- **Content dimension**
  - Check whether all relevant requirements are known and understood to the required level of detail

- **Documentation dimension**
  - Check whether the requirements are documented according to the defined documentation and specification rules

- **Agreement dimension**
  - Check whether the stakeholders have reached agreement about the documented requirements
  - Check all known conflicts; if they have been resolved
  - Check whether there are conflicts that have not yet been identified
Validation of Content

Quality of the information contained in the requirements artefacts

- **Completeness of artefact/document**
  - Does the requirement artefact / document contain all relevant information and requirements?

- **Completeness of requirements**
  - Does each requirement contain all the information:
    - that is needed according to the relevant reference model (e.g., template)
    - that is needed to perform subsequent development activities?

- **Consistency**
  - Can the system meet all requirements together?
  - Are there requirements that contradict each other?
Validation of Content

Quality of the information contained in the requirements artefacts

• **Correctness of requirements**
  – Does the content of each requirement correspond to the actual stakeholder needs and wishes
  – Are all assumptions about the system context made when defining the requirements correct?

• **Correctness of requirements classification**
  – Has each requirement
    • assigned to the right requirement type
      – goal, scenario, functional, quality, constraint, etc.
    • documented at the proper place
Validation of Documentation

• **Correct documentation format**
  – Does the requirements artefact have the prescribed documentation format

• **Comprehensibility**
  – Are the documented requirements comprehensible in the given context
    • *e.g.*, **all terms** that are used in the requirements artefacts clearly defined
Validation of Documentation

- **Unambiguous documentation**
  - Does the documentation format of the requirements artefacts allows for an *unambiguous interpretation* of the requirements
  - **Could ambiguities be avoided**
    - by using a different, more appropriate documentation format

- **Compliance with documentation rules**
  - Does the requirements artefact adhere the documentation (or specification) *rules and guidelines*?
Validation of Agreement

• **Agreement**
  – Did the relevant *stakeholders agree* upon each requirement

• **Agreement after modification**
  – Has *approval* of the relevant stakeholders been obtained anew after
    • a requirements was modified
    • the content of the requirement changed
Validation of Agreement

• **Check for conflicts**
  – Have the requirements been *checked for potential conflicts* caused
    • e.g., by conflicting goals?

• **Conflicts resolved**
  – Have *all known conflicts* been resolved for each requirement
Validation Goal

- Check whether the **inputs** of activities fulfill defined quality criteria
- Check whether the **outputs** of activities fulfill defined quality criteria
- Check whether the **execution of activities** adheres to process definitions and activity guidelines

Subject facet  | Usage facet  | IT system facet  | Development facet
Context defects

- **Missing context information**
  - Important requirements have not been identified

- **Incorrect context information**
  - Requirements are defined on incorrect context information
    - E.g., wrong assumptions

- **Insufficiently considered context information**
  - Relevant context not adequately documented

- **Incomplete requirements sources**
  - Not all relevant requirements sources were considered
Subject Facet

• Have all relevant **objects** been identified and documented?

• Have all identified **objects** been captured completely and correctly?

• Have all **quality requirements** for the representation of **objects** been captured?
Subject Facet

- Have all relevant **legal requirements** (e.g., privacy regulations) for **representation of objects** in the system been considered?

- Have all relevant **requirements sources** been incorporated in the **identification** of the objects, their properties and relationships?
  - Stakeholders, documents and existing systems
Usage Facet

- Have the **desired interaction** with the environment been captured completely and correctly
  - **stimuli** the system must detect and
  - **responses** the system must produce

- Have the **quality requirements for interaction** with the environment been captured completely and correctly
  - desired performance
  - robustness against faulty operation and correct inputs
  - prevention of misuse
Usage Facet

• Have the **specifics of different user groups** been taken into account
  – *e.g.*, specific requirements for different cultures and countries

• Have the **usage goals** of the relevant stakeholders and the relevant systems been elicited completely and correctly

• Have all **relevant requirements sources** for the usage facet been involved
  – *e.g.*, expert for human-machine interfaces for the corresponding type of system
IT System Facet

• Have the relevant properties of the **hardware and software components** with which the system interacts or that belong to underlying hardware and software platform of the system been captured completely and correctly

• Have all required **system interfaces** and the **relevant protocols** at each interface been documented completely and correctly
IT System Facet

• Have all **relevant IT strategies** been considered appropriately
  – *e.g.*, with regard to the use of upcoming or future technology

• Have all **relevant IT policies** been considered and documented
  – installation, update and backup policies

• Have all **relevant requirement sources** of the IT system facet been involved in the requirements elicitation activities
Development Facet

• Have all requirements pertaining to the languages and development tools to be used been captured completely and correctly
  – Specification languages, programming languages, etc.

• Have the requirements for the development process and development standards been captured completely and correctly
  – including the development rules and guidelines with which the project must comply
Development Facet

- Have all **development artefacts** to be provided or exchanged been identified
  - *e.g.*, between the client and the contractor
- Have the **targeted project duration** and **cost** been checked for feasibility after all (essential) requirements been agreed on
- Have all relevant **requirements sources** of the development facet been considered
Validation Goal

Check whether the **outputs** of activities fulfill defined quality criteria

Check whether the **inputs** of activities fulfill defined quality criteria

Check whether the **execution of activities** adheres to process definitions and activity guidelines
Validation of Execution of Activities

• Has the **execution of the activities** been documented in the prescribed way?

• Have all **activities** that are required according to the process definition been performed

• Have all **inputs** defined in each activity description been considered for the respected activity
Validation of

Execution of Activities

• Does the **execution of each activity** correspond to the **rules and guidelines** defined in the activity description

• Have all **outputs** defined in each activity description been created

• Have all **stakeholders** who are relevant for performing the respective activity been involved in the execution of the activity
Validation Goal

Check whether the **outputs** of activities fulfill defined quality criteria

Check whether the **execution of activities** adheres to process definitions and activity guidelines

Check whether the **inputs** of activities fulfill defined quality criteria