

Software Metrics Need to Mature to Software Metrology: Recommendations

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Agenda

A - Software Metrics ?

B - Measurement Methods
Process Model

C - Quality Characteristics of
Measurement Methods

D - Recommendations

A- Software Metrics ??

- ⊙ A number?
- ⊙ A value?
- ⊙ A formula?
- ⊙ A predictor?
- ⊙ A guarantee?
- ⊙ Something automated?
- ⊙ A measurement method!

A- Software Metrics?

- ⊙ Hundreds of metrics:
 - ❖ Complexity
 - ❖ OO
 - ❖

- ⊙ How valid?

- ⊙ How to validate?

A- Software Metrics ?

Metrics Validation:

- ⊙ Many authors,
- ⊙ Many approaches

(Fenton, Zuse, Ince, Kitchenham, Pfleeger, Praher, Gustafson, Schneidemind, Weiuker, Shepperd

How to choose amongst authors, and for which reasons?

A- Validation of What ??

- ⊙ A number?
- ⊙ A value?
- ⊙ A formula?
- ⊙ A predictor?
- ⊙ A guarantee?
- ⊙ Something automated?
- ⊙ A measurement method!

Agenda

A - Software Metrics ?

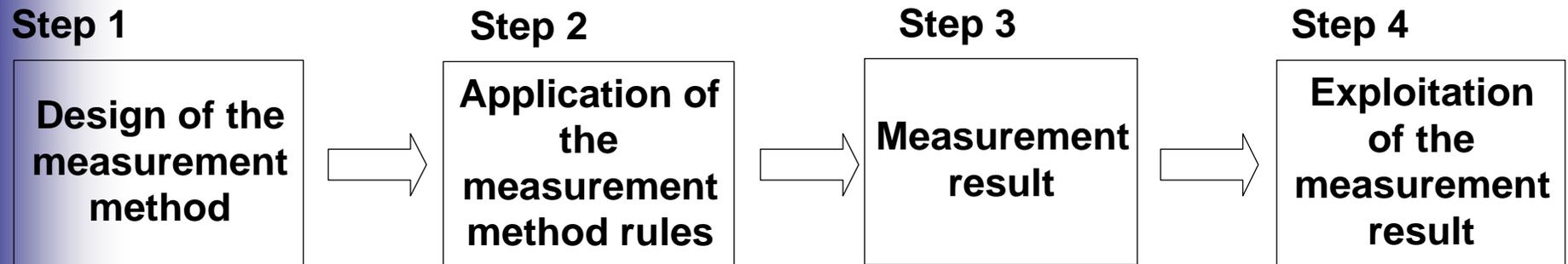
**B - Measurement Methods
Process Model**

C - Quality Characteristics of
Measurement Methods

D - Recommendations

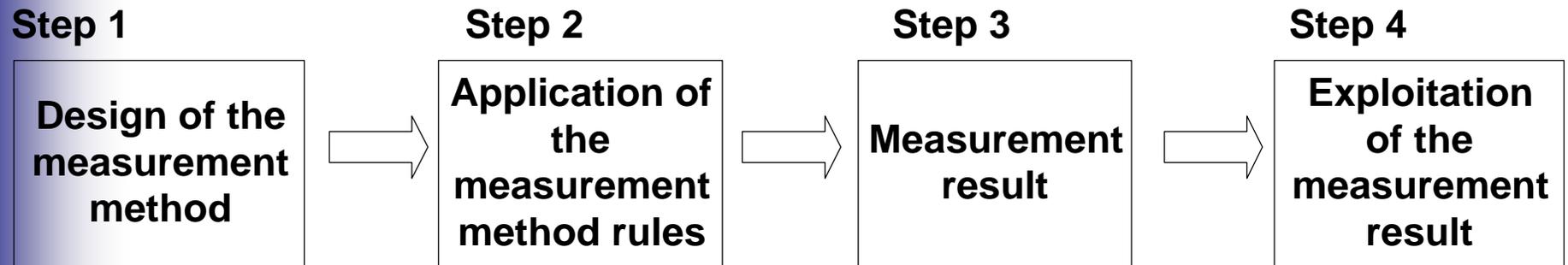
B - Measurement Method Model

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- 1) Before measuring, you need a measurement method
- 2) The rules of the measurement method are applied to software (or piece of software)
- 3) Output of Step 2 is a result (it should be auditable)
- 4) The result is exploited (quantitative or qualitative)

B - The right Sequence!



Everybody is interested in Step 4
but:

Step 3 must have been accurate

and

Step 2 must have been carried out correctly

and

Step 1 there must be a GOOD measurement instrument
(*and in that sequence*)

B - Metrics ?? = ?? Measurement Methods

Too many ***metrics*** are discussed
from a Step 4 perspective only
without prior investigation of
the foundations:

Measurement Methods!!

Agenda

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**C - Quality Characteristics of
Measurement Methods**

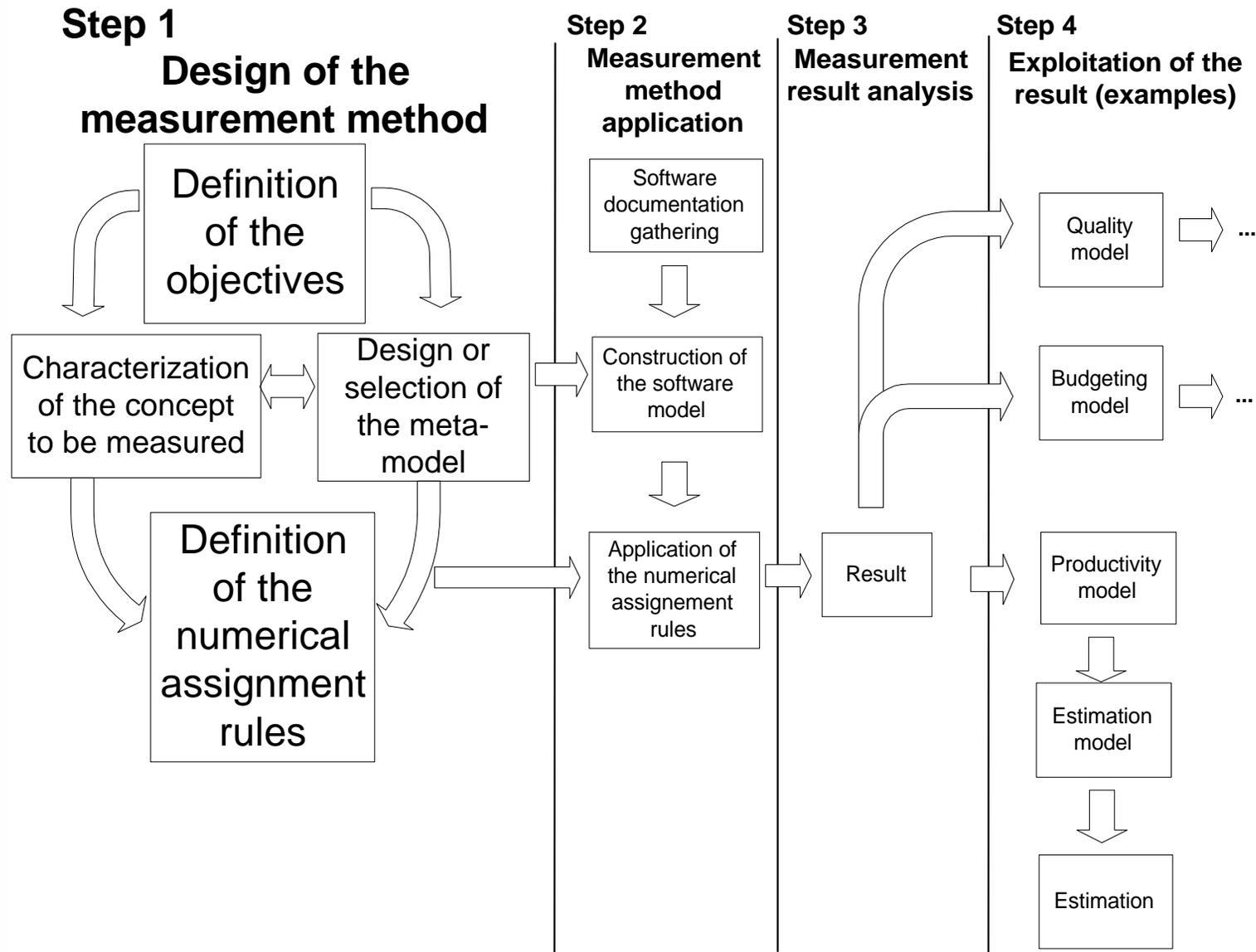
D - Recommendations

C- Quality Characteristics

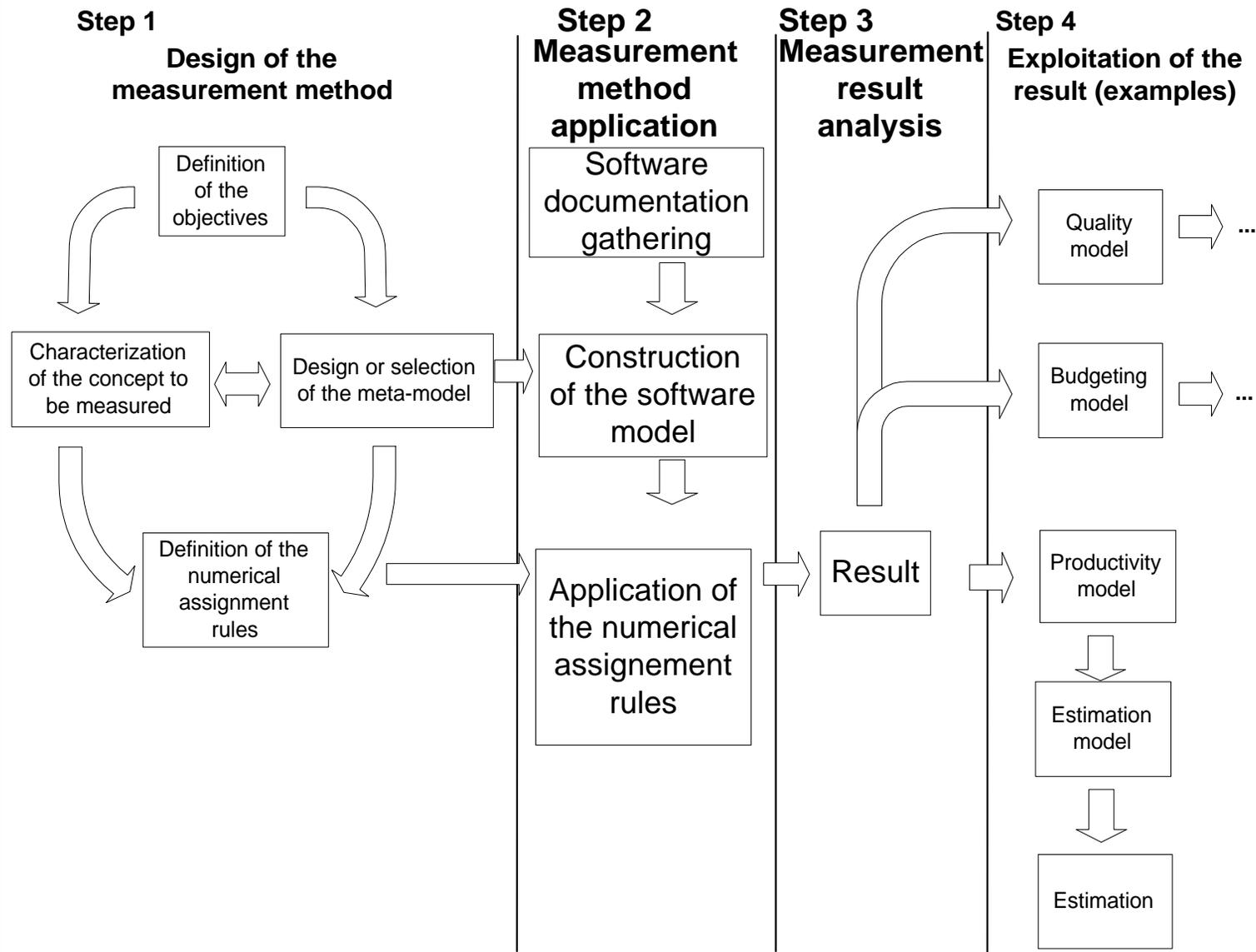
In engineering, QUALITY of measurement instruments is CRITICAL

- ⦿ How do you define quality of software metrics '?
- ⦿ Where is quality of software metrics discussed?
- ⦿ How to look at quality of software metrics?

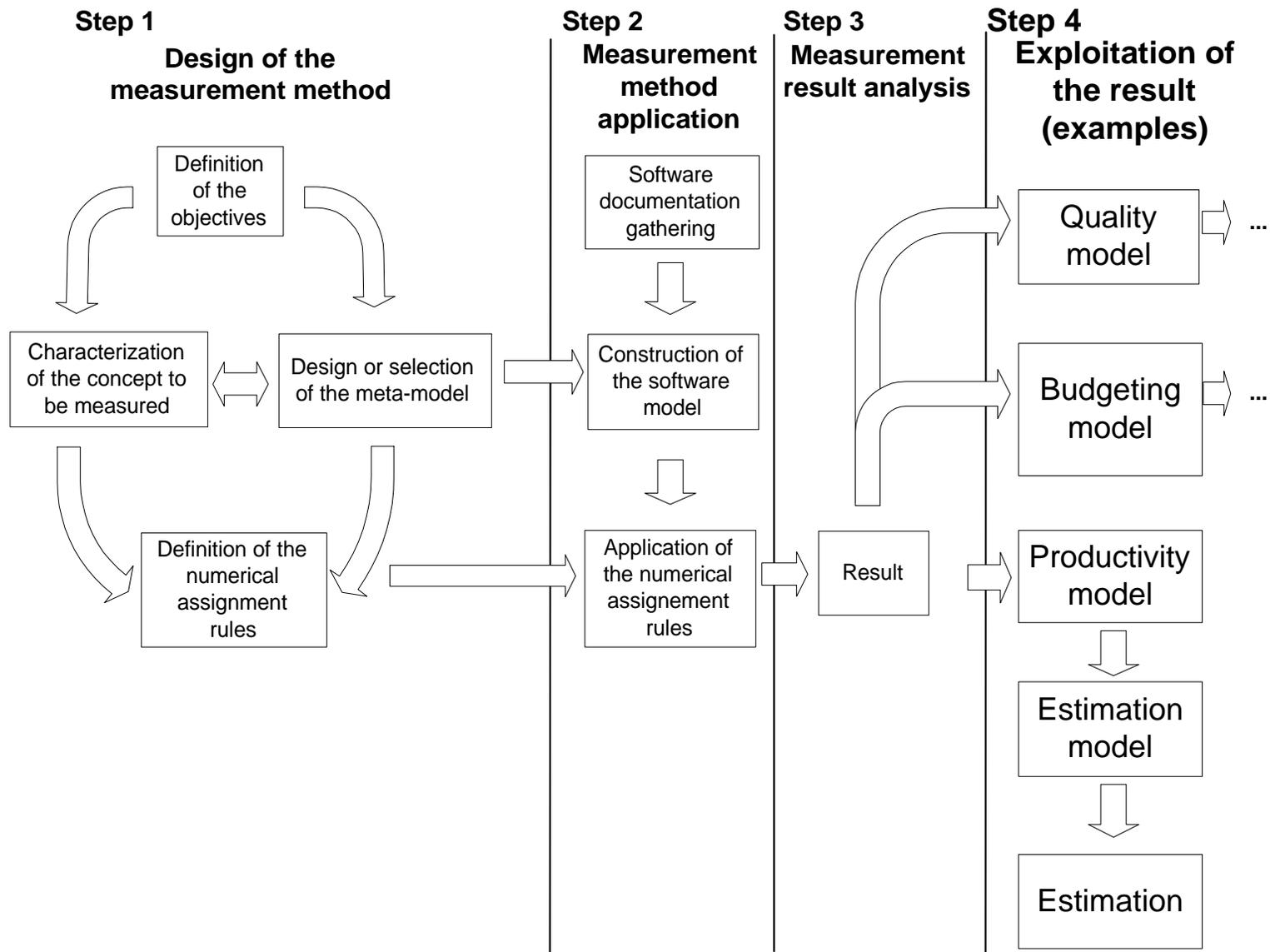
C - Measurement Model - Sub-steps



C - Measurement Model - Sub-steps



C - Measurement Model - Sub-steps



C - Quality Requirements

- ⊙ Measurement Design:
 - ❖ Consistency with concept: Functional Size
 - ❖ Not ambiguous & relationships clearly defined
- ⊙ Measurement Practice:
 - ❖ Documentation required
 - ❖ Identification of valid components, etc.
- ⊙ Measurement Results:
 - ❖ Reliability
 - ❖ Repetitiveness, etc.
- ⊙ Convertibility to an 'étalon'!

Agenda

- A - Metrics ?
- B - Measurement Methods
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- C - Quality Characteristics of
Measurement Methods
- D - Recommendations**

Observation 1

NIST 97 White paper on ITL- Metrology:

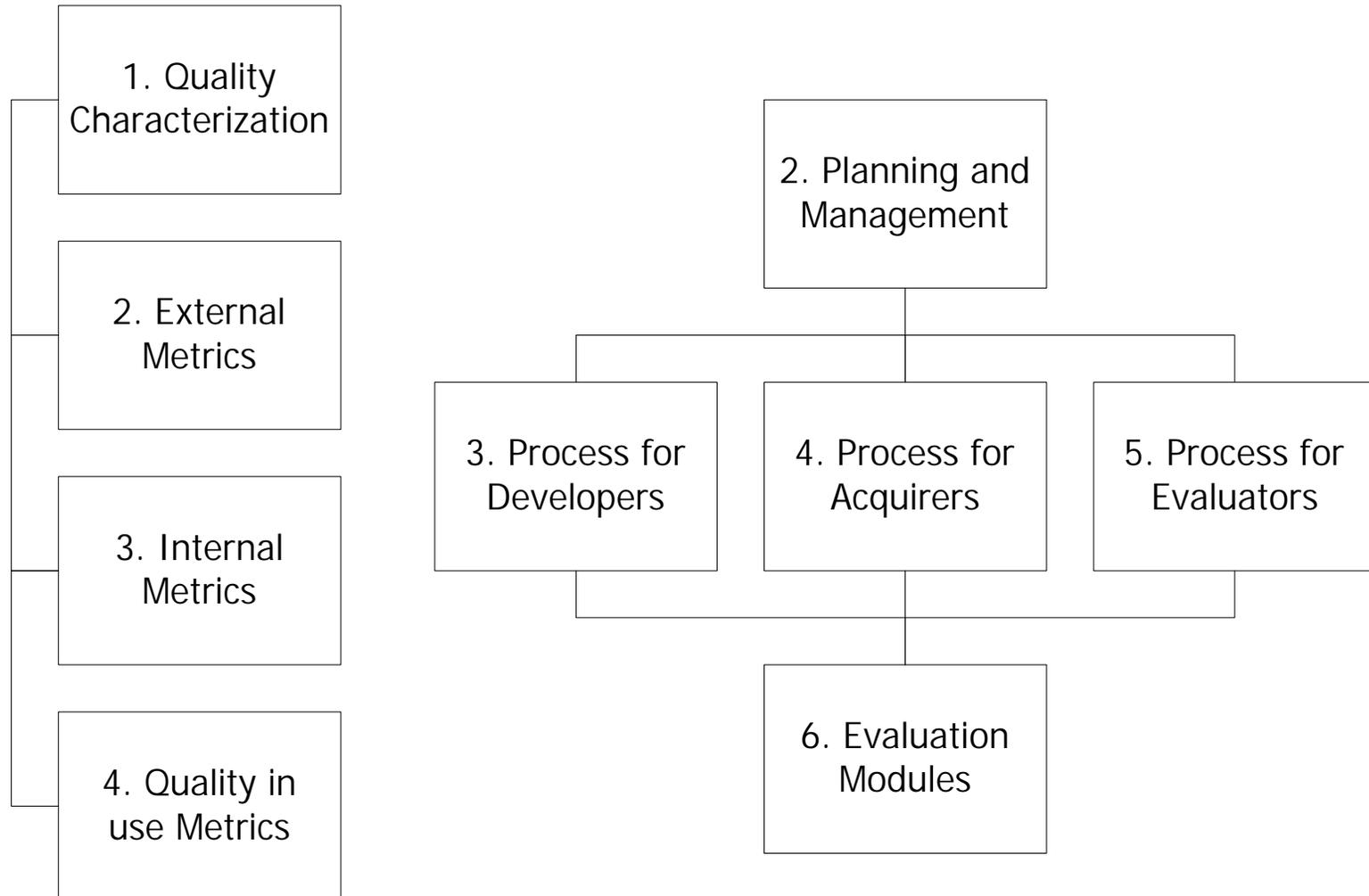
- ⊙ Metrology concepts and vocabulary to prepare a White Paper
- ⊙ Software ' Metrics ' vocabulary to look at the state of measurement knowledge in Software Engineering
- ⊙ Where is the intersection?

Recommendation 1:

Using the body of knowledge of metrology:

- ⦿ review the current state of knowledge on *metrics validation*
- ⦿ and identify potential contributions for a full validation framework.

Observation 2



ISO 9126 & 14598 Structure

Observation 2

- ⊙ ISO WG16 is a child of the ' software metrics ' field
- ⊙ Very limited input from outside domains (traditional measurement field: metrology)
- ⊙ Will include hundreds of ' metrics '

Recommendation 2:

- The current program of work of ISO SC7 WG6 on software products quality should be urgently investigated prior to its final approval to ensure that it meets the sound requirements of *metrology*

(including the definition for the term *metrics*)

Observation 3

Innovations of ISO WG12 on
Functional Size Measurement
Methods:

- ⊙ Definition of concepts 14143-1
- ⊙ Verification guide 14143-3
- ⊙ Reference Model 14143-4
- ⊙ Functional Domains 14143-5

Recommendation 3:

- Current program of work of ISO SC7 WG12 on functional size measurement methods should be investigated prior to its final approval to ensure its consistency with the requirements of the *metrology* discipline.

Observation 4

- ◉ ISO WG6 - Quality Metrics: a significant list of characteristics, sub-characteristics and candidate metrics for any one!

- ◉ ISO WG12 - Functional Size Measurement Methods:
 - ❖ a single concept, and maybe multiple candidate methods
 - ❖ how to find if a candidate method is a good one, and to which degree?

Recommendation 4:

- ① The current program of work of ISO SC7 WG12 should be investigated to learn how the metrology-related concepts are being tackled, and to identify and document lessons learned.

Observation 5

ISO WG13 is initiating work for the development of a new standard:

- Software measurement process program

Recommendation 5:

- The program of work ISO SC7 WG13 on the software measurement process program framework should be investigated up-front to ensure that it will take into consideration the sound requirements of *metrology*, including the definition selected for the term *metrics* and the requirements of traceability.

Observation 6

- ⊙ Hundreds of 'metrics ' of complexity
- ⊙ Hundreds of ' metrics ', of OO
- ⊙ Are they all good measurement instruments?
- ⊙ How do you study them as measurement instruments?

Recommendation 6:

- Study from a metrology perspective a measure from the classic software *metrics* track
- Take an example for the testing track.

Observation 7

- ⊙ Functions Points have been studied (at least partially) as measurement instrument.
 - ❖ **Repeatability**
 - ❖ **Accuracy**
 - ❖ **Measurement method (successive versions of the measurement guide)**
- ⊙ Derivatives measurement methods are addressing some key weaknesses, and are being designed as measurement instruments:
 - ❖ **Full Function Points for real-time software**

Observation 7

Example of measurement instrumentation

- ⊙ FFP 1997:
 - ❖ Documented and in the public domain
 - ❖ Concepts & Definitions
 - ❖ Measurement Structure
 - ❖ Measurement Rules
 - ❖ Examples, Case Study, Training, etc.

Recommendation 7

- Study from a metrology perspective a measure from the non classical track, such a Function Point Analysis (or one of its derivative designs for other domains of applicability).

Observation 8

- ⊙ In recommendation 4, we suggested to look at Functional Size Measurement to look at how metrology concepts were embedded.
- ⊙ But what would be missing?

Recommendation 8:

- ◉ Investigate Functional Size Measurement Methods to verify to what degree (in terms of criteria) it meets the *metrology* concepts, with its strengths and weaknesses, and collate lessons learned for the field of software measurement.

Observation 9

- ⊙ Functional Size measurement methods are addressing the measurement of the 'problem' rather than the technical 'solution'
- ⊙ It is addressing a concept of Functionality
- ⊙ How close is it to measuring 'information'?

Recommendation 9

Investigate Functional Size Measurement Methods to verify whether or not it can contribute to further analysis aimed at the development of measurement of information.

For more information

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Questions Period



B - Measurement Methods Process Model

REFERENCES:

- ◉ Key Concepts of Measurement Methods

Ref: «***From Software Metrics to Software Measurement Methods: A Process Model***»

Jacquet & Abran, Third International Symposium and Forum on Software Engineering Standards, ISESS'97, Walnut Creek (CA). June 2-6, 1997

- ◉ ISO Quality requirements

Ref: *Information technology - Software Measurement - Verification of a Functional Size Measurement Method*

ISO/IEC JTC1/SC7 WG12 Sub-project 7.31.3, Spring 1998