

A proposed evolution of Validation Definition

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Outline

- 1. Study Context**
- 2. VV&A processes and definitions**
- 3. A System Engineering approach**
- 4. A socio-technical perspective**
- 5. Conclusions**

1. Study Context

- . Study under the auspices of AFDRG*
- . VV&A study for:
 - FR, Operational Analysis studies
 - UK, SBA
- . VV&A research, studies and standards (DMSO, IEEE, ...)

* Many thanks to our colleagues of:

ALEKTO: Pierre Bouc

DSTL/CDA: Robin Miller, Mark Dumble

Cranfield University: Phil John, Marcus Coombs, Sean Price

Study Objectives

- . To deepen the understanding of VV&A concepts focussing on Validation**
- . To focus on a short/medium term applicability**
- . To propose a comprehensive view of M&S development and a VV&A methodology**
- . To evaluate the methodology**

2. VV&A processes and definitions

- . DoD, DMSO, IEEE, ... proposals**

VV&A as a process related to M&S development

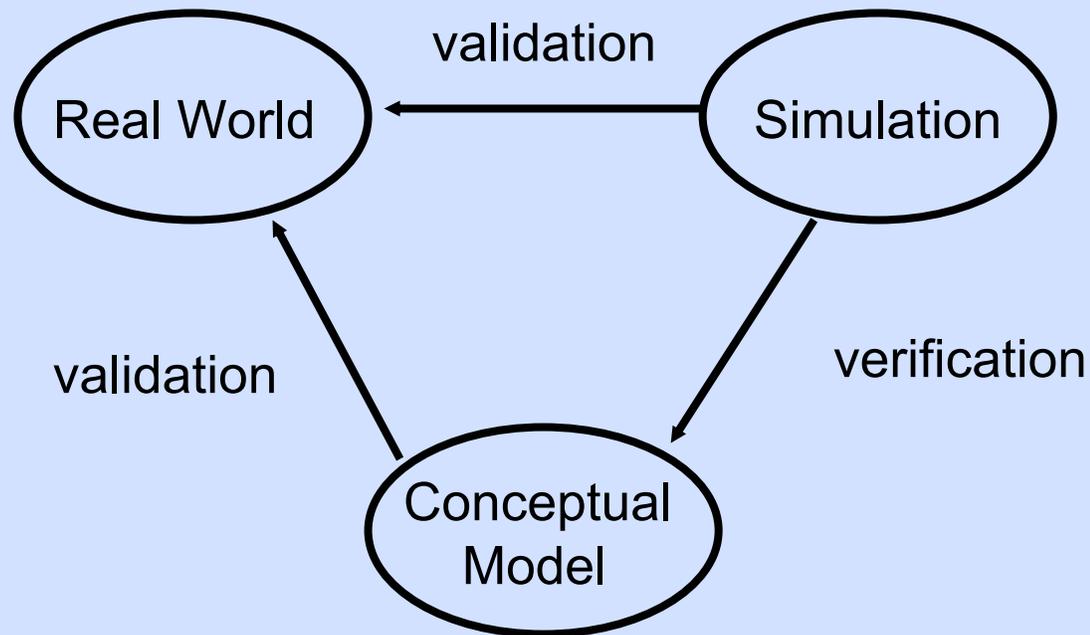
“a FEDEP overlay”

- . In this context Validation defined as**

“the process of determining that a model or simulation is an accurate representation of the real world from the perspective of the intended use of the model and simulation”.

Foundations of these VV&A processes

Basic View



Foundations (Cont'd)

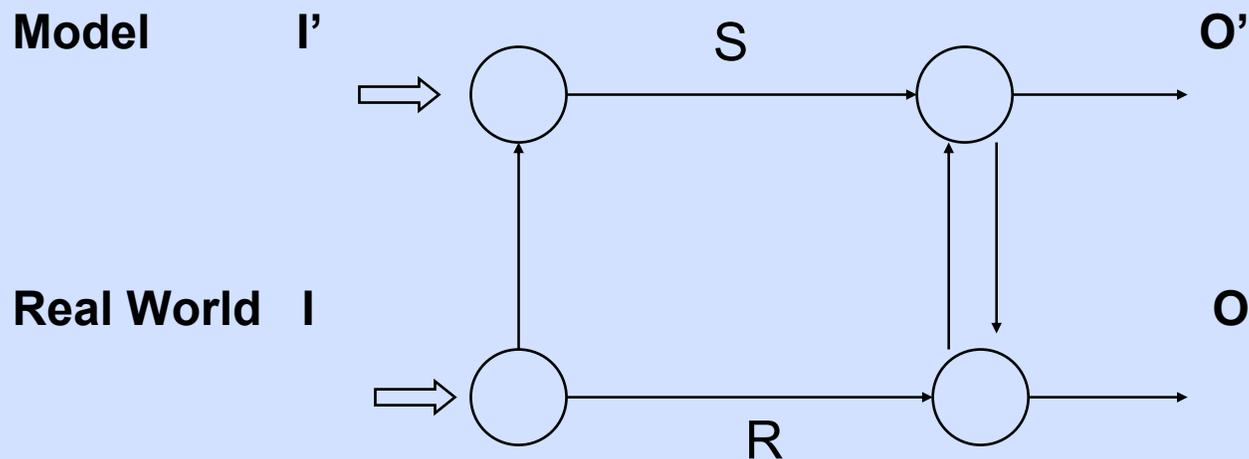
More elaborated contributions

- . **Zeigler's distinction between the real world, the base model and the lumped model**
- . **Sargent's model**
- . **Hone and Moulding, Knowledge Engineering approaches.**

Foundations (Cont'd)

Assumptions

- . The Real World is accessible
- . Modelling is a matter of fidelity adjustment wrt the simulation purposes



(I', O') are isomorphic to (I, O)

Foundations (Cont'd)

Criticisms

- . **Data poor environments**
- . **Applications domain limitations**
(R. Miller, DIS'96, Spring)
- . **Technical limits:**
 - 1) **“I claim that there is an abyss between validation practice and statistical theory”**
Jack Kleijnen, WSC 2000
 - 2) **Identified V&V techniques (RPG) address the software supporting the simulation more than the simulation itself**

3. A System Engineering definition

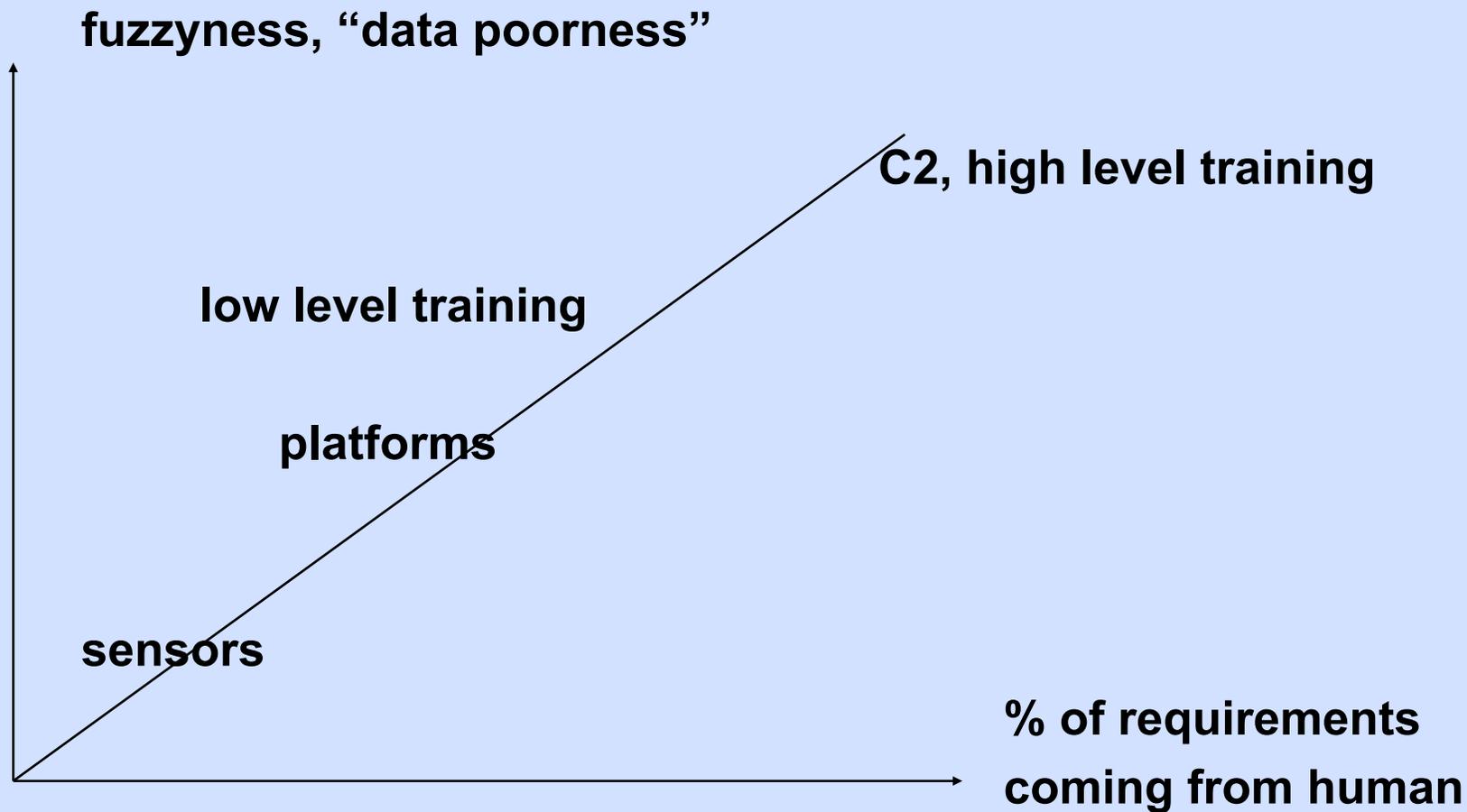
IEEE/ETA 12207.1 proposal for Validation

“is the process of determining that the requirements and the final as-built system or software product fulfil its specific intended use”.

. Consequences:

- the requirements are the means of anchoring the development**
- the requirements, ultimately, are validated against the “intended use” (a very abstract being :-) !)**

Observation of the Requirements state of the art



Differences in purposes

- . **IEEE definition fits the production of “reasonably” stable artefacts (systems, software) and their uses**
- . **Simulation products are designed and used to cover both:**
 - **stable uses: T&E, design, low level training**
 - **agile, versatile concept exploration: decision making, doctrine, etc ... on “unknown worlds”**

4. A socio-technical perspective

“C’est toujours nous qui formulons les questions à poser à la Nature”

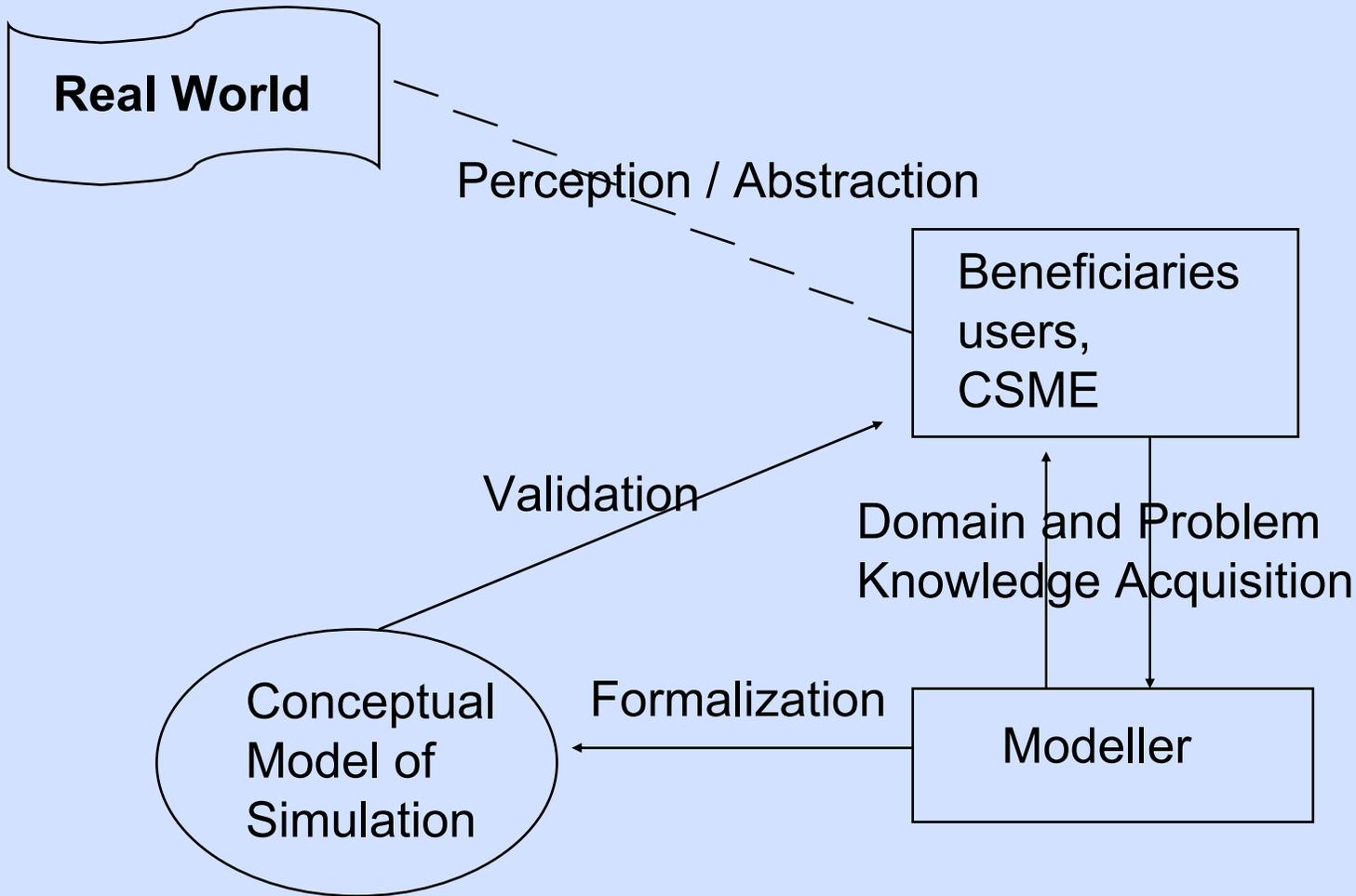
J.L. Le Moigne

“Objectivity is a subject’s delusion that observing can be done without him”

Von Foerster

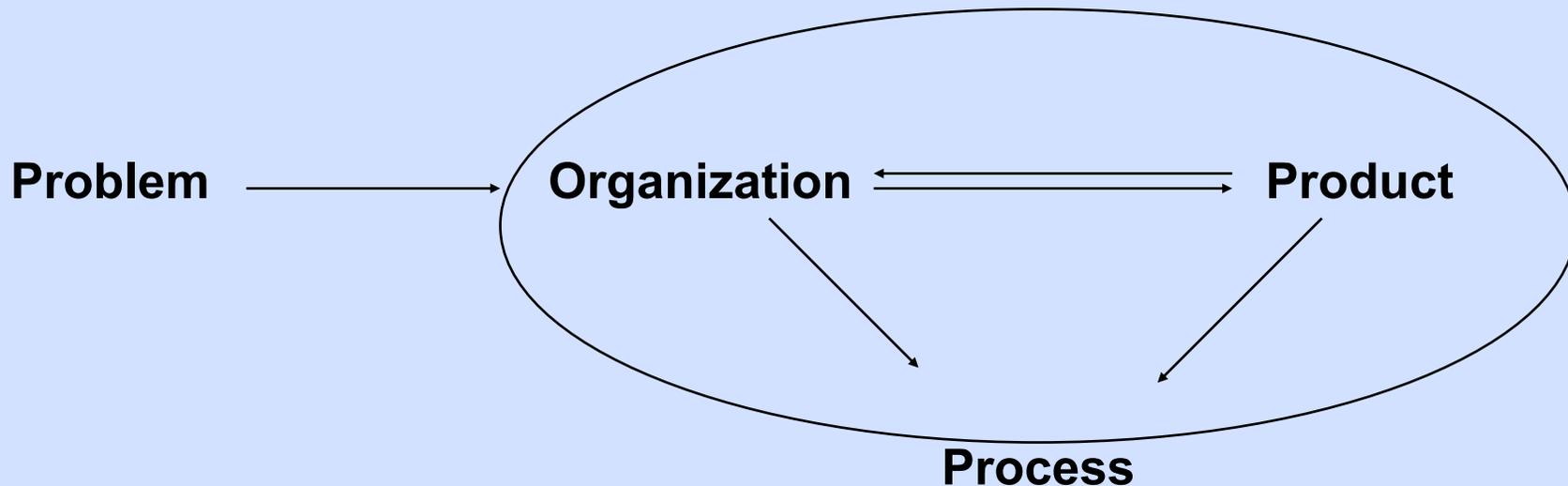
Principles of a Constructivist Theory of Knowledge

Just one box more (wrt IEEE def)



Validation is not against “intended uses” but against “identified beneficiaries”

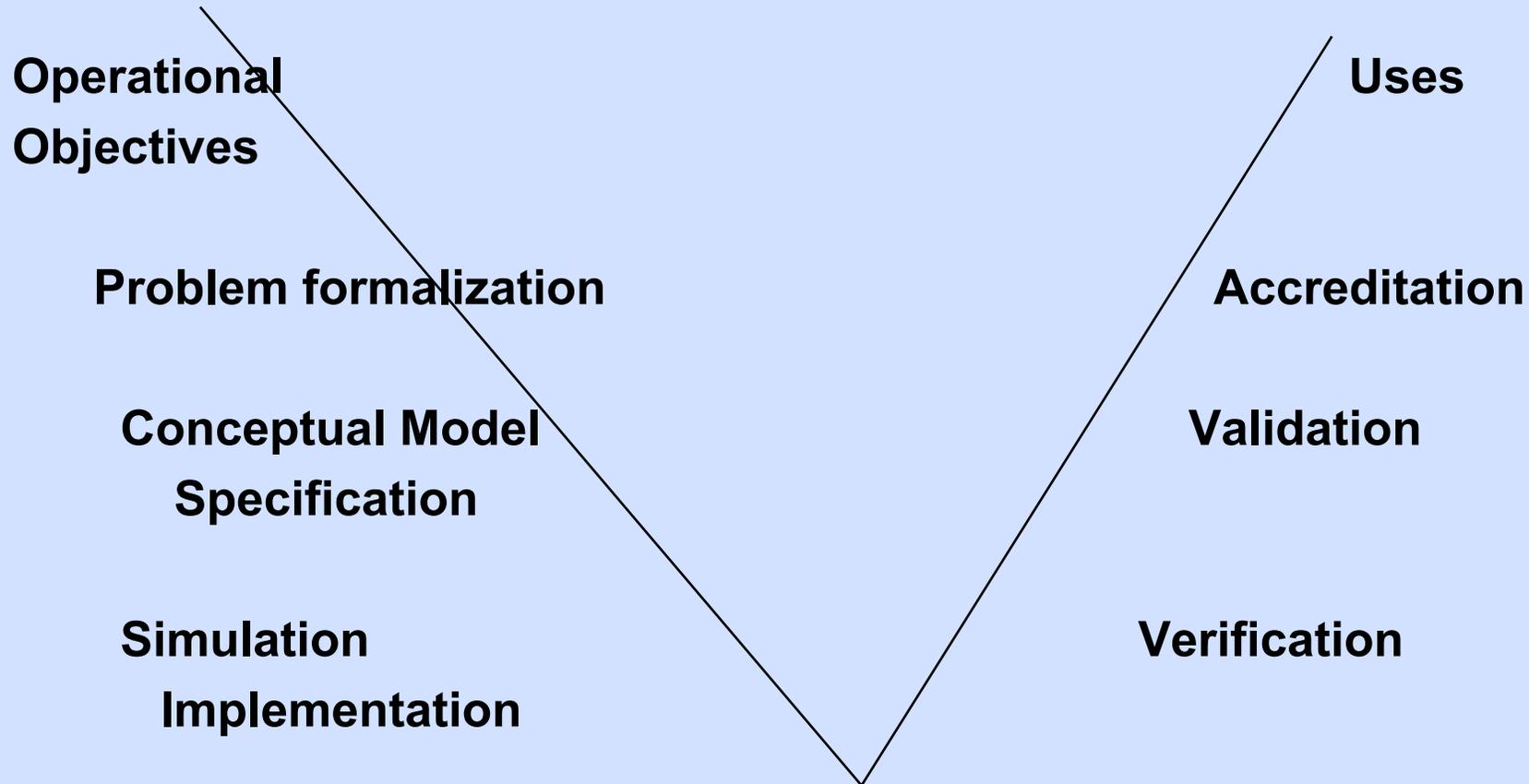
Pre-eminence of organizational work



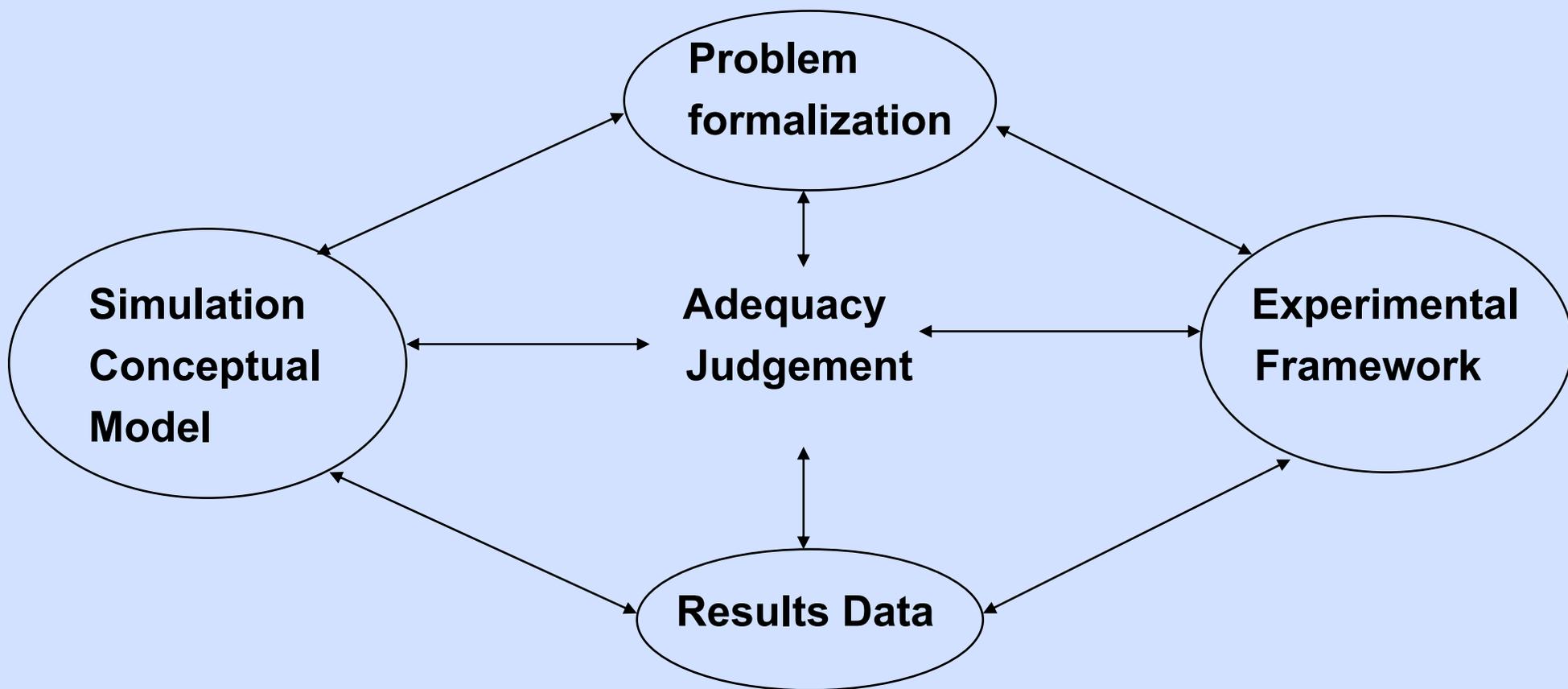
The “3-pillars” methodology

Organization = agents, roles, responsibilities, obligations, resources, activities must be identified

VV&A stepwise approach



Validation step model



5. Conclusions

- . Difficulties have their origin in the concepts underlying VV&A approaches.**
- . New paradigms are needed to stress that Validation is a decision-making activities based on socio-technical data related to:**
 - fitness for purpose**
 - just good enough**
 - confidence assessment (argument-based confidence).**

Conclusions (Cont'd)

. **Short/medium term answers:**

- **organization formalization supporting the global life-cycle.**
- **technical approaches related to RE, KE, structured reasoning, argument-based approaches, multi-criteria decision making, etc...**