

# Why modelling?

## Conceptual modelling

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**Summer School 2016**

**The role of IPM in mitigating pest development under climate change—  
modelling approaches**

# OUTLINE

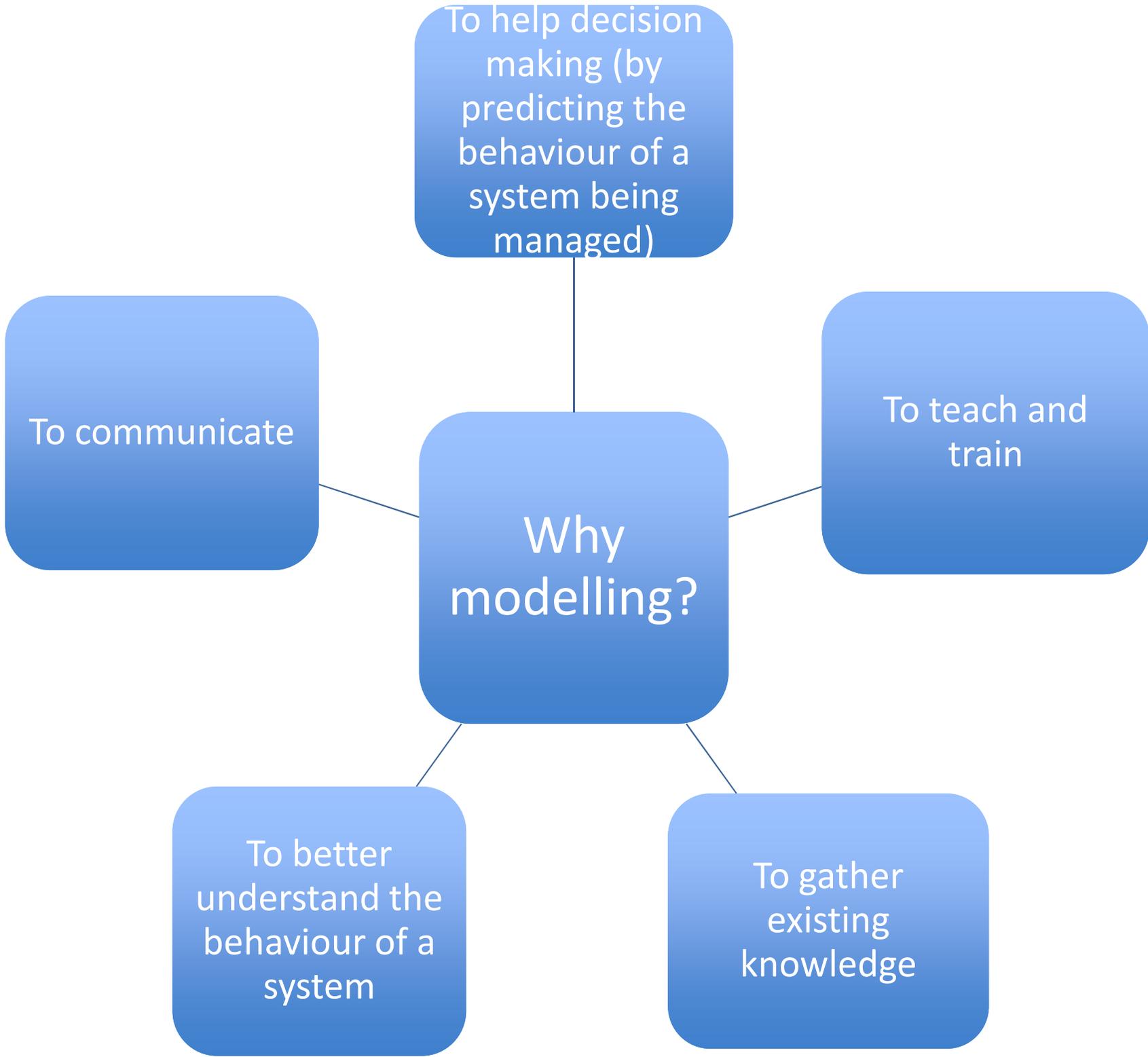
- 1) By way of introduction, a few questions and definitions...
- 1) The role of conceptual modelling
- 2) How to design conceptual models?
- 3) By way of conclusion: a common conceptual framework for the summer school?

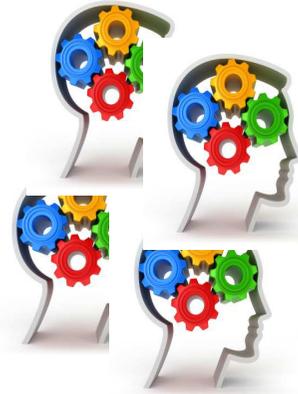
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What is a model?

Why modelling?

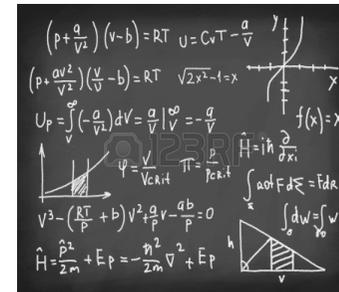




**Expert knowledge**



**Scientific and technical literature**



**Simulation models**



**Observations**



**Experiments**

Experiments always precede modelling

Do you agree? Please comment...

# Definitions

## **Model**

- a simplified representation of reality

## **Concept**

- an abstract or generic idea generalised from particular instances

## **Conceptual model**

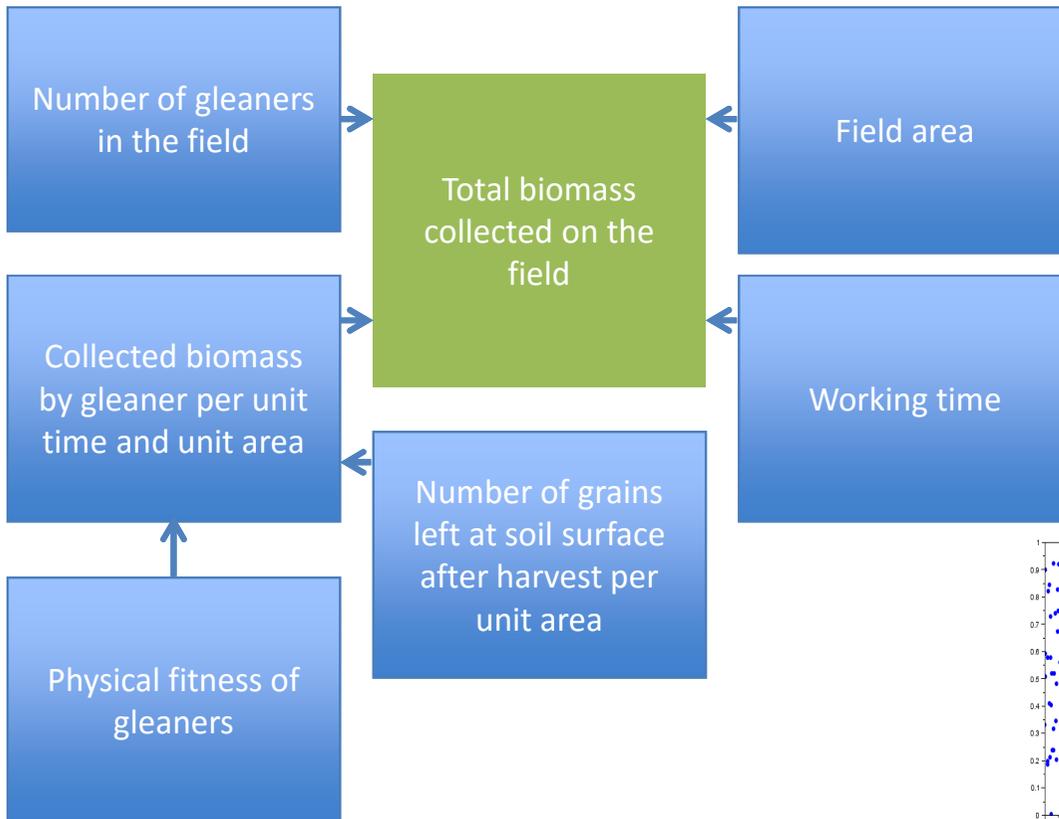
- representation of the relationships between the underlying concepts of a system behaviour

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# Modelling

- Simplified representation of reality



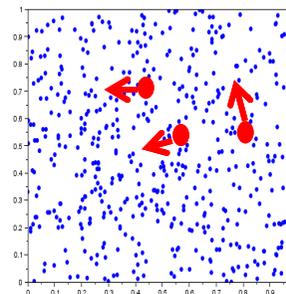
$$B_{field} = n_g v(F_\varphi, d) S \Delta t$$

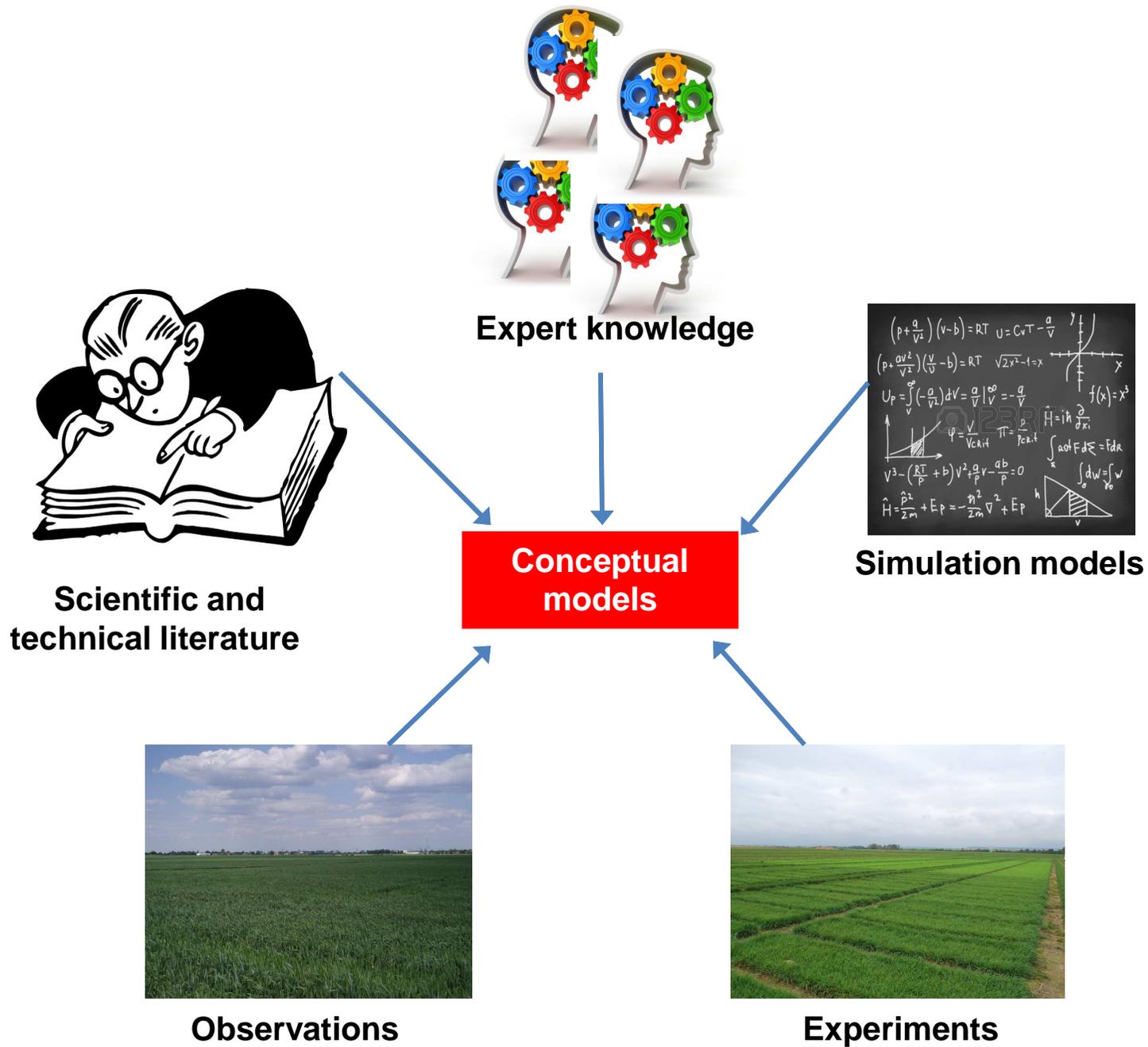
*Breton et al (1859)*

$$B_{field}(t) = n_g S \int_0^t v(F_\varphi(t), d) dt$$

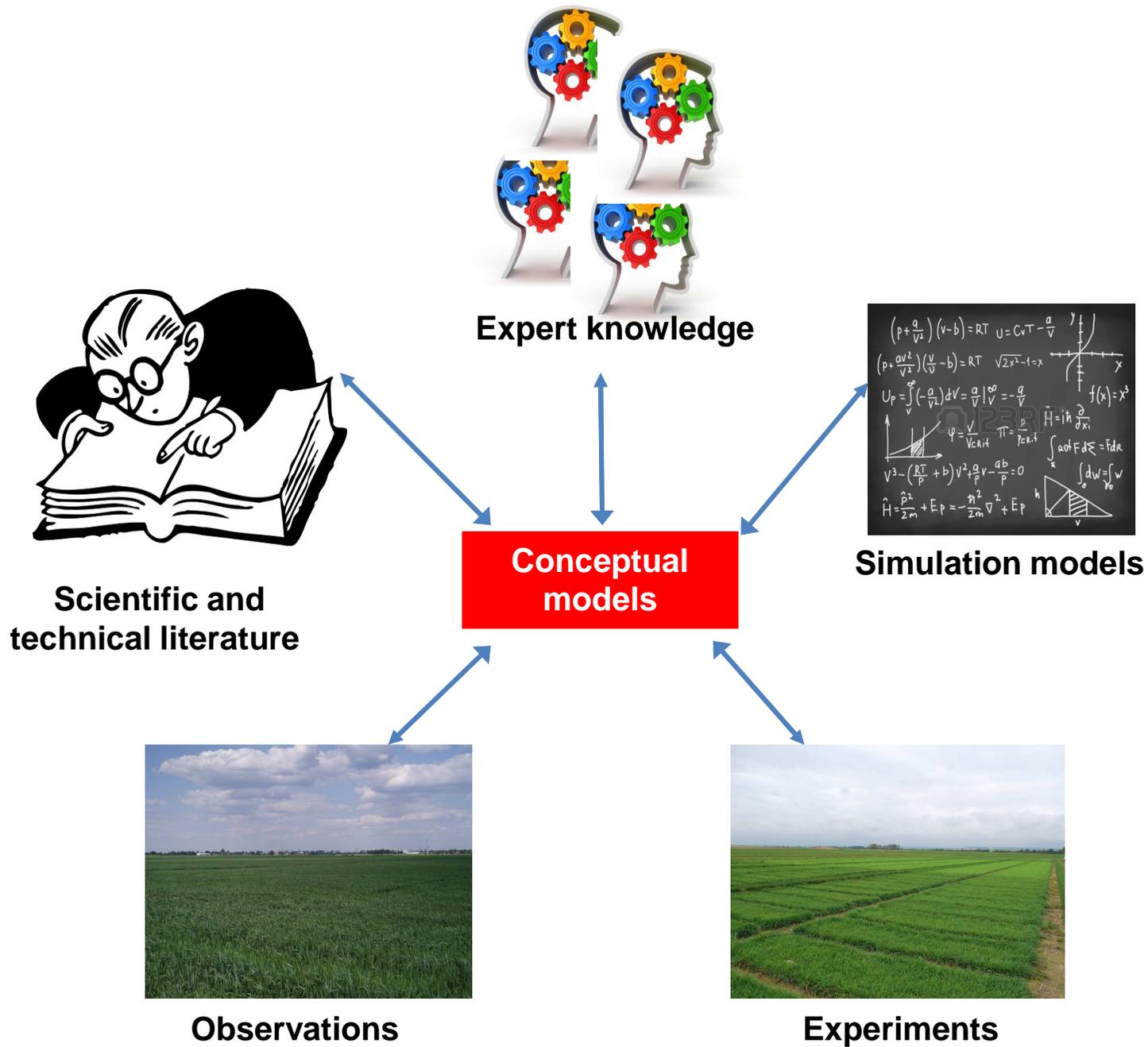
*Millet et al (1857)*

*Spatially explicit representation of grain distribution at soil surface after harvest (2D isotropic model) linked to an Individual-Based Model (non coordinated brownian trajectories). Stochastic simulations performed under Mathematica® (Wolfram Research Inc, 2014)*





The different sources of knowledge contribute to define conceptual models...

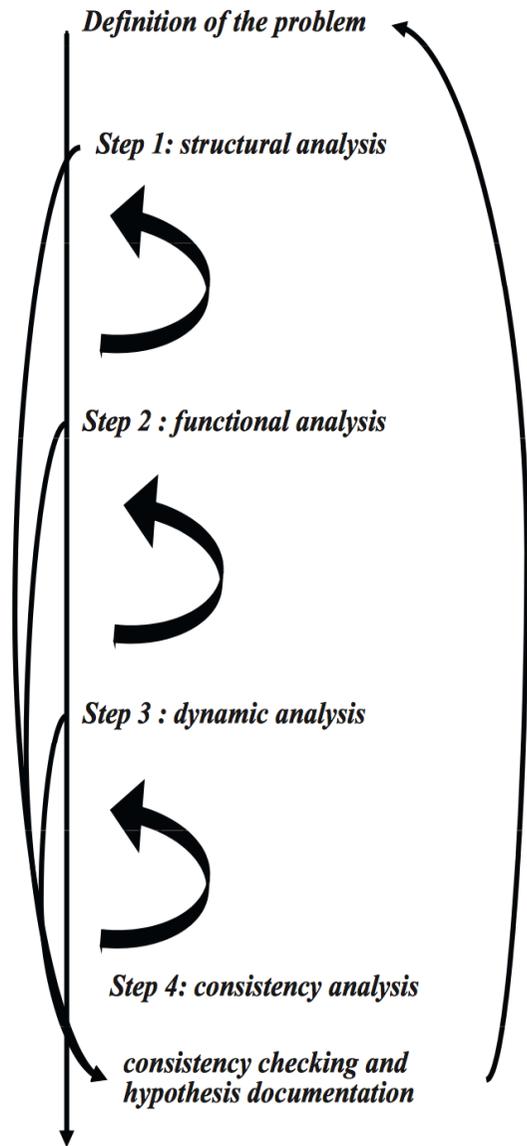


The different sources of knowledge contribute to define conceptual models... which, in return, impact the sources of knowledge

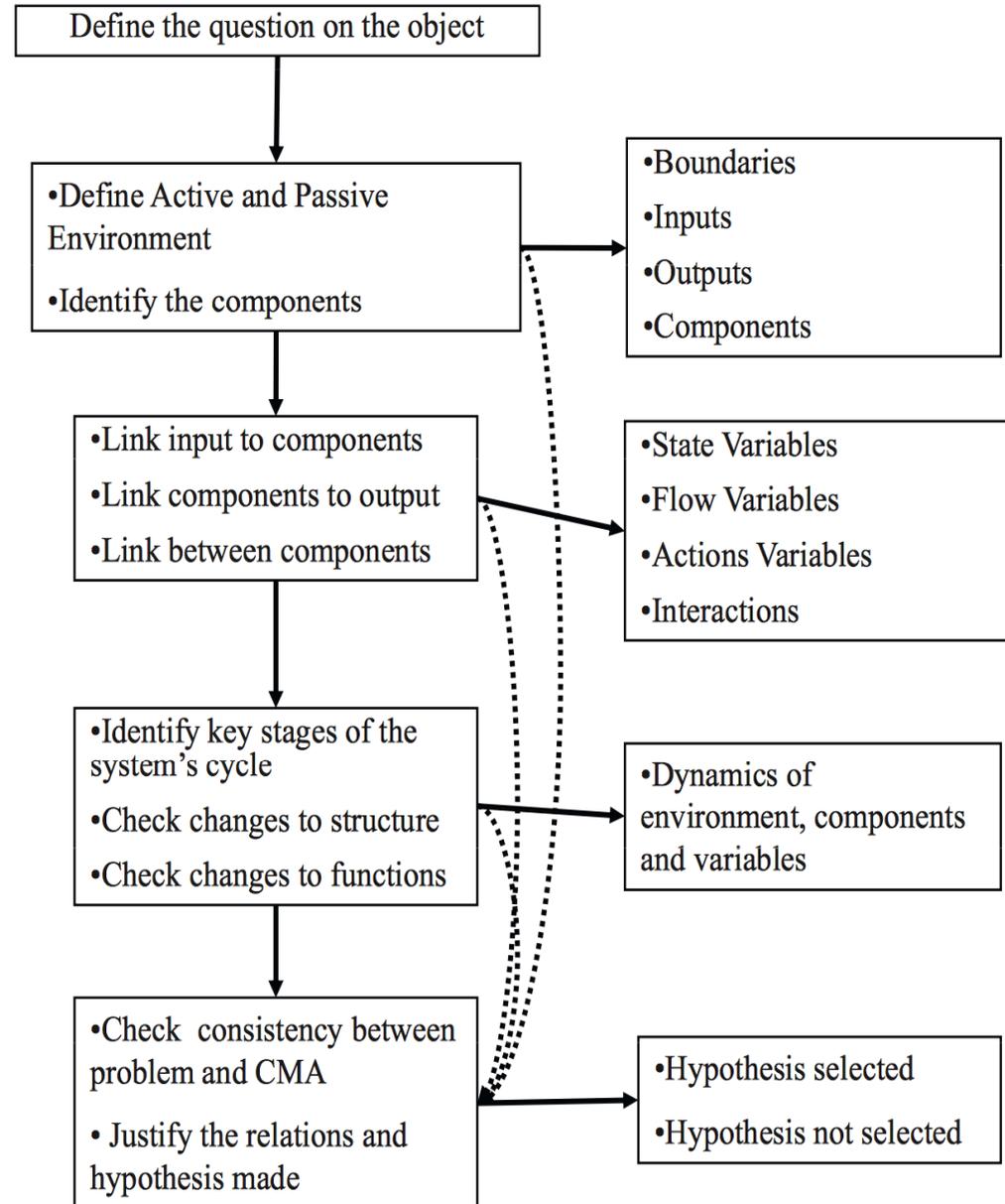
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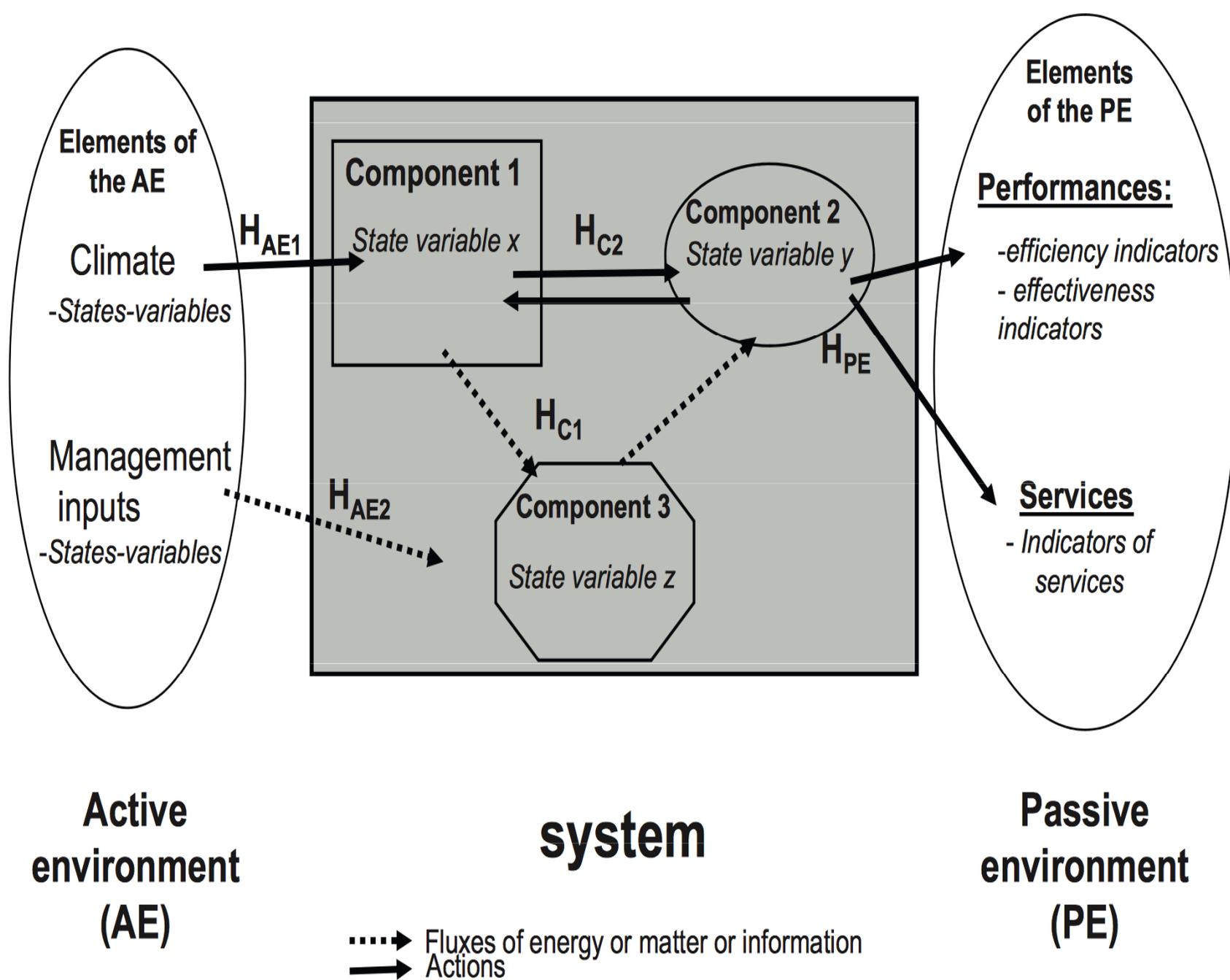
# Conceptual Modeling of an Agrosystem (CMA)



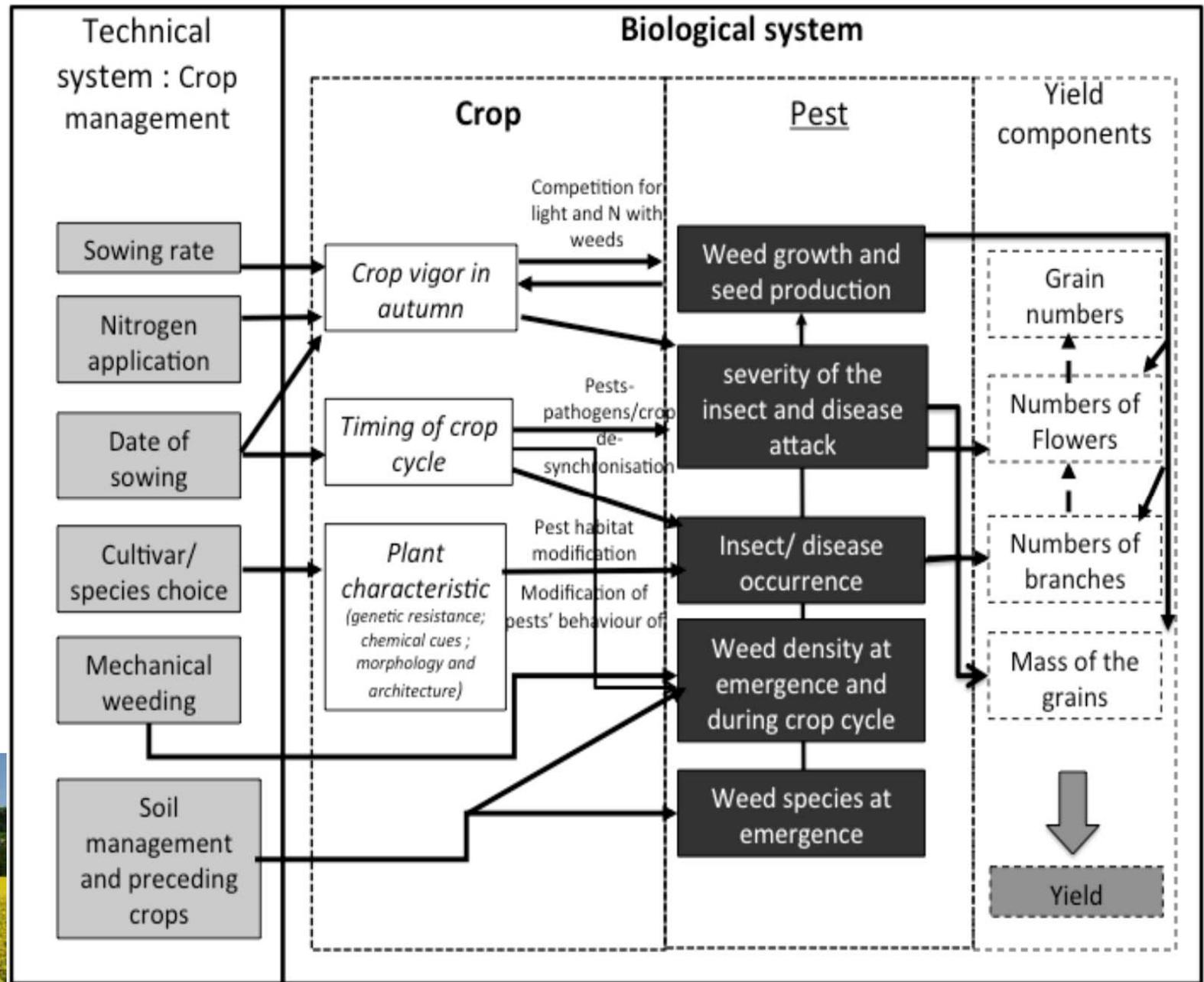
## The method



## The product



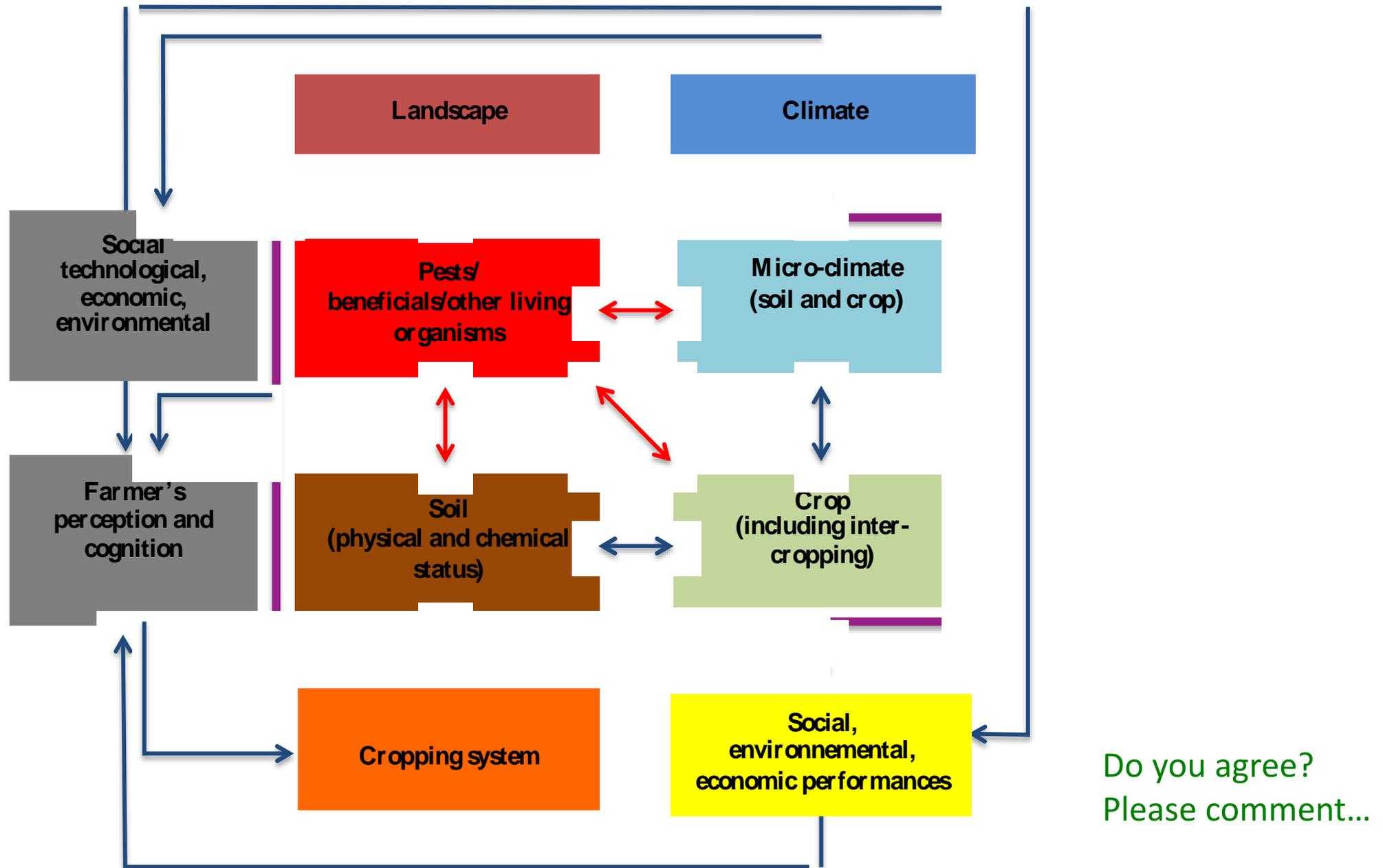
# Example of a conceptual model central to a research program on IPM of oilseed rape combining experiments, expert knowledge, diagnosis in commercial fields, simulation models and literature review



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# This conceptual model embodies all models that will be used during the practical work of the summer school.



# CONCLUSION

- 1) **Conceptual models are essential to knowledge production and decision support *sensu lato*.**
- 2) **They are not set in stone: they depend on available knowledge and of the objectives pursued.**
- 3) **They are not always explicated!**
- 4) **There are various tools to create them: paper+pencil+eraser, softwares (Word, PPT,...), UML (structural diagrams, behaviour diagrams), Mind Maps**
- 5) **There are some methods to help design them (e.g. Lamanda et al, 2012)**