Innovative pathways for an efficient co-design and extension of socio-environmental change between scientists and... others

Nils Ferrand

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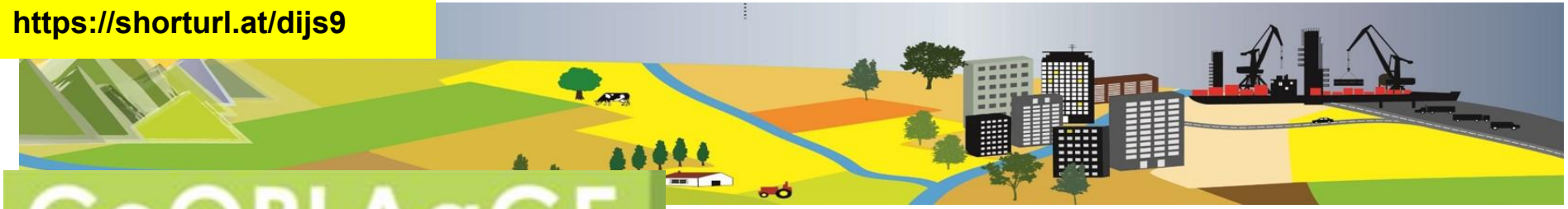

CoOPLAaGE

Innovative pathways for an efficient co-design and extension of socio-environmental change between scientists and… others

Nils Ferrand[ab], Wanda Aqua-Gaudi[c]

a. INRAe, UMR GEAU; b. INRIA, STEEP; c. UMR/JRU G-EAU

c. ***Wanda aka.*** *Emeline Hassenforder, Patrice Garin, Géraldine Abrami, Bruno Bonté, Raphaele Ducrot, Sylvie Morardet, Benjamin Noury, Julie Latune, Eva Perrier, Sarah Loudin, Patrice Robin, Laura Seguin, Julien Burte, Rémi Lombard-Latune, Caroline Lejars, Olivier Barreteau, Mélaine Aucante, Mariana Rios*

nils.ferrand@inrae.fr

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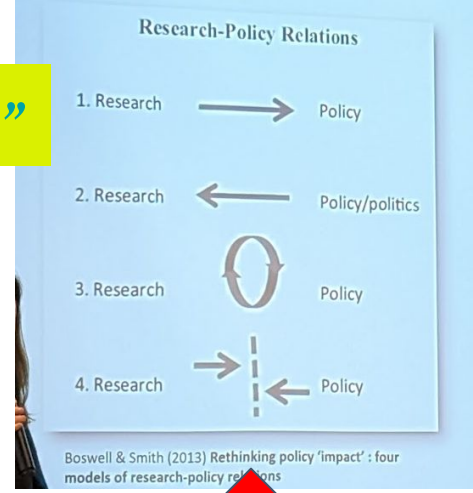
Today's key insights

- More knowledge, low impact ? What's next ?
  - Transformative science & its impact
- On multi-level participatory decision making
  - Who's who in transformative processes
- Changing ? What ? Where ?
- Steps, needs and options
- Ethical questions
- Discussion

"we"



"others"

INRAE Inria

nils.ferrand@inrae.fr / nils.ferrand@inria.fr

Background & design context

- French public research unit (Montpellier), multi-disciplinary, specialized in water management & governance, working internationally
  - Sub-group on engineering participatory methods
- Supporting public action with / for governments, NGOs, CBOs, local authorities, agencies
- A 25y action-research on complex systems management (origin in A.I. 90s' multi-agent models) with / by / for their stakeholders, incl. citizens, through **participatory modeling**
- A focus on autonomous adaptation and reflexive steering
- Combining physical and digital methods
- An ethical perspective on tools & intervention

nils.ferrand@inrae.fr / nils.ferrand@inria.fr

Our approach

Decision-making steps	Citizen's perspective	Participatory tools	Ex. in Uganda (2012-2014)
PREPARE PARTICIPATION	*We will respect our own rules*	**PrePar** Preparing design of the decision process	
DIAGNOSIS	*We know what is happening around us*	**Rock** Observing the river	
SCENARIO EXPLORATION	*Now we understand the big picture*	**Smag** Establishing a territorial diagnosis **Wat-A-Game** Modelling & role-playing-games	
DEFINITION OF OBJECTIVES AND PREFERENCES	*We know what we want*	**Just-A-Grid** Discussing justice principles	
IDENTIFICATION OF ACTIONS AND PLANS	*We, too, have good proposals to make*	**Cooplan** Building action plans	
CHOICE, PRIORISATION AND VOTE	*In democracy, our voice count*		
IMPLEMENTATION	*Let's do it!*		
MONITORING AND EVALUATION	*Are we getting there?*	**Encore-Me** Evaluating impacts	

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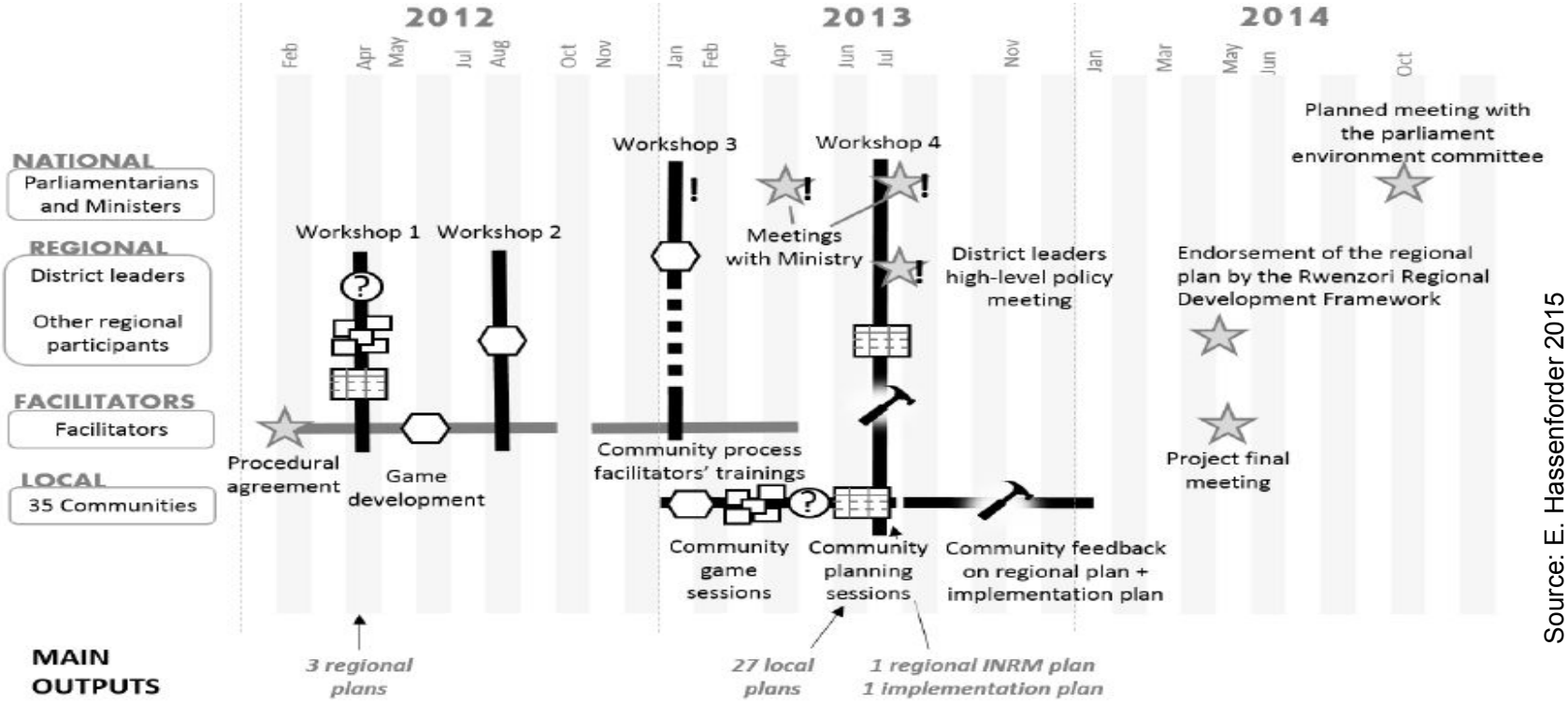
A science-policy-society co-creation process - in real



Source: E. Hassenforder 2015

e.g. Applying inNatural Resource Management in Africa (EC FP7 Afromaison 2011-2014)

Co-creating and using models of : - in policy design and implementation -

Process
Justice / equity

→

Actions & plans
as a system

↔

Situation
Management

nils.ferrand@inrae.fr / nils.ferrand@inria.fr

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Typical process in co-creation of action plan

Information

Monitoring & evaluation

Citizens observe the « CLE » (local water committee)

preparation

PREPAR : construction of the participatory plan and rules

Citizen diagnosis (autonomous workshops)

Proposal of actions (online - Cooplan) & action plans

Data processing ; synthesis ; promotion

Interreg Alpine Space

SPARE

Drôme, France

8 months | 6 months | 5 months | 3 months | 9 months

2016 | 2017 | 2018

5 public forums «Débat pour l'Eau »

INR

nus.terrang@inrae.fr / nus.terrang@inria.fr

Using CoOPLAN for Drôme water plan, France

COOPLAN co-creation of a complex action plan

nils.ferrand@inrae.fr / nils.ferrand@inria.fr

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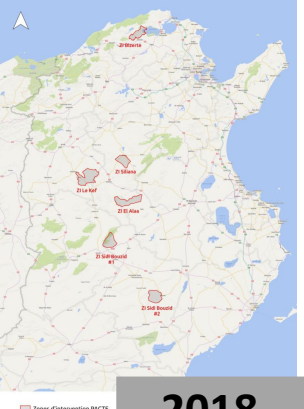

Example of the PACTE participatory process in Tunisia

CLIMATE CHANGE ADAPTATION PROGRAM FOR VULNERABLE AREAS IN TUNISIA

WITH THE POPULATION

WITH TERRITORIAL COMMITTEES

2018 | **2019** | **2020-2022** | **2022 à 2027**

PREPARATION

- Forming teams
- Engaging local stakeholders

DIAGNOSIS

- Characterization of territories with the population
- Identification of priority issues

PLANNING

- Gathering proposals for action
- Setting up territorial committees
- Building plans

IMPLEMENTATION

- Translating action plans into investments
- Implementation

30/11/23 !

[2022] Braiki et al. « Large-scale participation in policy design: citizen proposals for rural development in Tunisia » EURO Journal on Deci

nils.ferrand@inrae.fr / nils.ferrand@inra.fr

A co-creation flowchart

- Organization: groups, inclusion
- Goals & constraints
- Self Assessing Governance (SMAG)
- Discovering new participatory methods
- Setting Monitoring and Evaluation
- Participatory design of participation plan & rules
- Implementing local participation plan

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Interreg Alpine Space SPARE

nils.ferrand@inrae.fr / nils.ferrand@inria.fr


Pêcheur
Elevage
Gestionnaire

Toward Adaptation: Which role for Science ?

Urgent need for CHANGE is acknowledged (in / of / for socio-environmental systems) and known by policy makers:

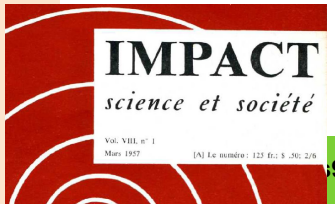
Scientific knowledge expands… but for which impact ?!

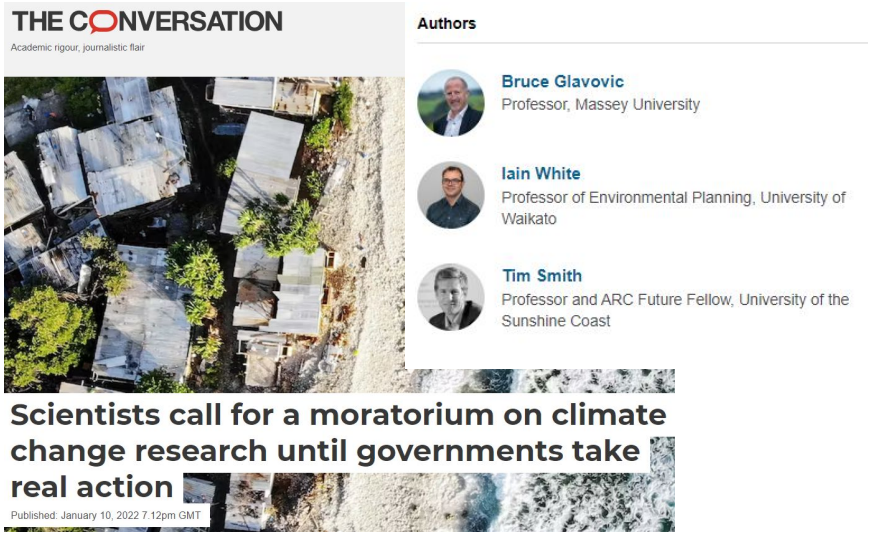
- Social & political "resistance" : multiple barriers (knowledge, social norms, uncertainty, vested power, distrust)

 Restructuring science – society – policy interactions

 Changing how scientists search *by / about / with / for* the "people"...

- Re-engineering postures, organizations, practices, curricula, evaluations
- Methods & tools for « strong » resilience (coadapting toward an expected future) ?





https://theconversation.com/scientists-call-for-a-moratorium-on-climate-change-research-until-governments-take-real-action-172690

If not by changing itself, how can Science improve its impact on the world most urgent challenges ?

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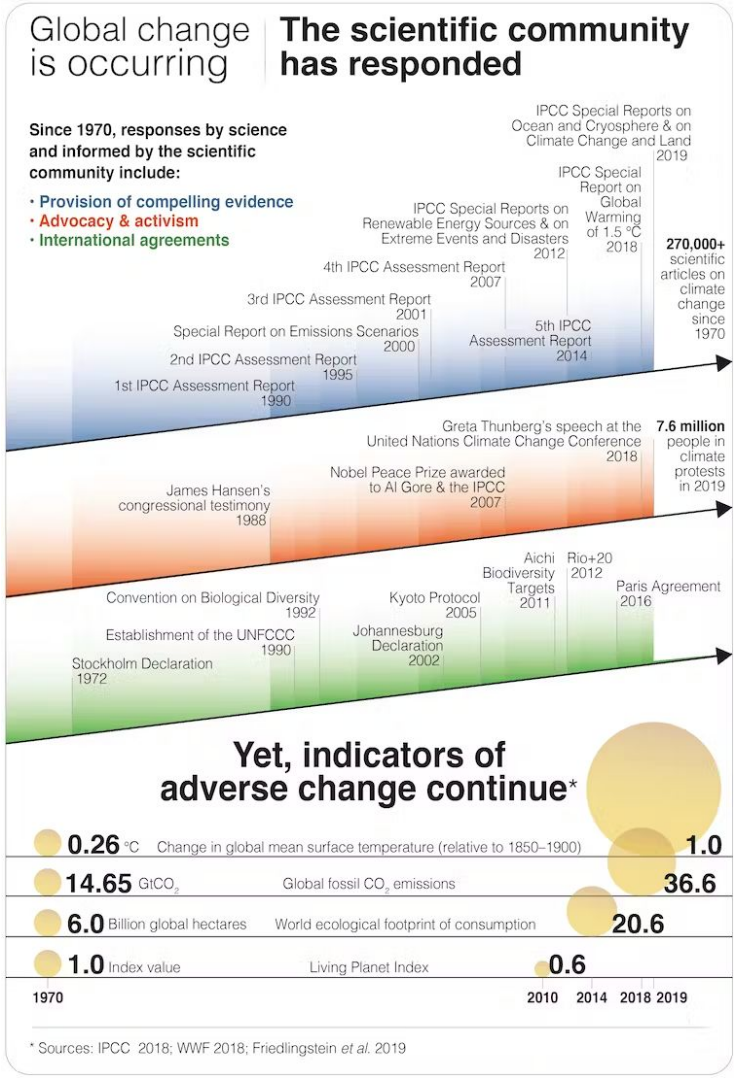
nils.ferrand@inrae.fr / nils.ferrand@inria.fr



Toward transformative sciences

"*a specific type of science that does not only observe and describe societal transformation processes, but rather initiates and catalyses them. Transformative science aims to improve our understanding of transformation processes and to simultaneously increase societal capacity to reflect on them*",

Schneidewind U., M. Singer-Brodowski, K. Augenstein, F. Stelzer, 2016, Pledge for a Transformative Science: A Conceptual Framework. *Wuppertal Papers* No. 191. Wuppertal Institut, p. 6.

\+ Action-Research, Intervention Research

cf. FutureEarth France hub meeting june 28-29, 2023 → " Sustainability sciences and (in)actions: rethinking our practices"

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nils.ferrand@inrae.fr / nils.ferrand@inria.fr

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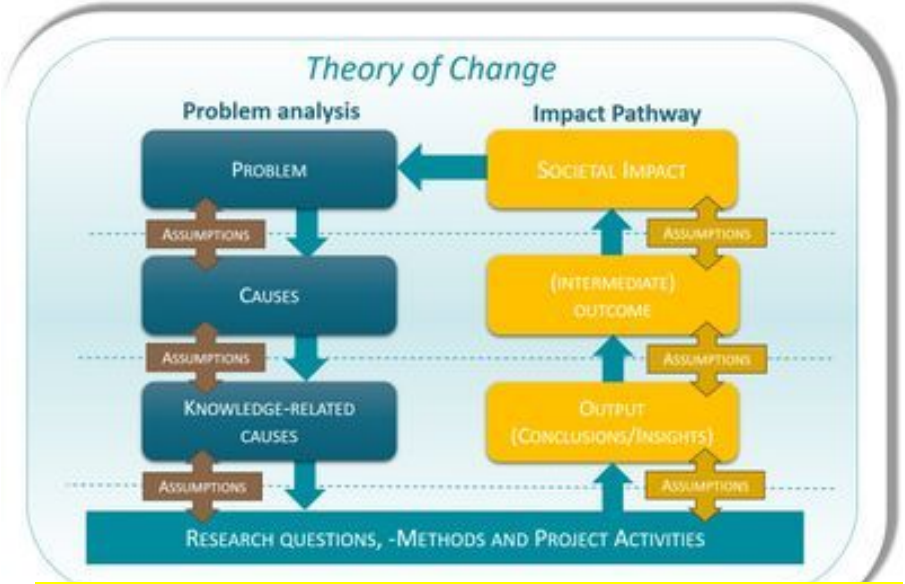
A copernician revolution for “classical” scientists: endorsing societal impact !

- (re)Consider & endorse impact
  - Impact pathway assessment
- Change posture
  - Take the transformation due to knowledge as the topic
  - Or the knowledge on the transformation challenges
- Reckon extended roles of stakeholders in / by research
  - To be specified. To be agreed. See below.
  - Accept the transaction cost
- Accept to lose full (some) control



Source: NWO,Dutch Research Council https://impact.nwo.nl/en/working-with-an-impact-plan/theory-the-impact-pathway

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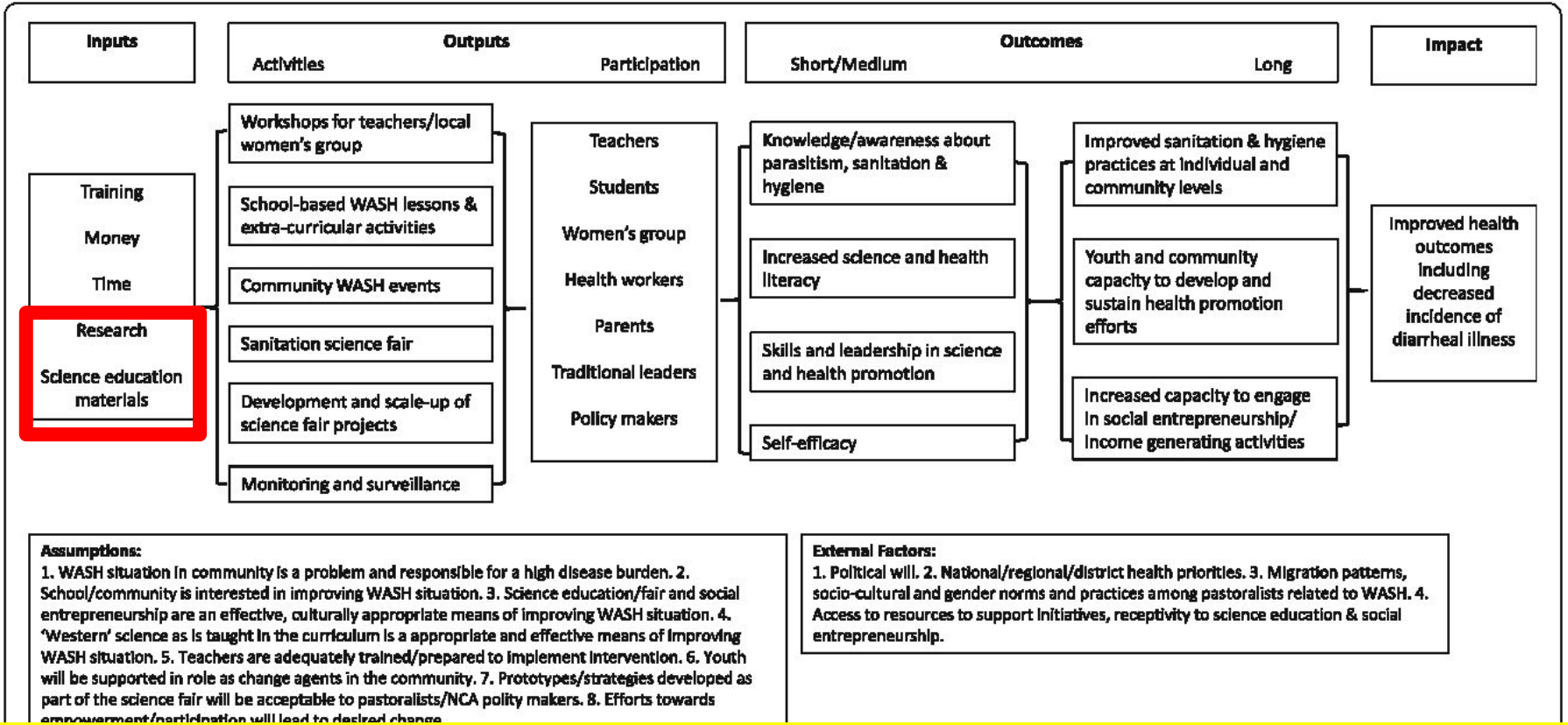
e.g. Impact pathway of participatory WASH process



Hetherington, E., Eggers, M.S., Wamoyi, J., Hatfield, J.M., Manyama, M.F., Kutz, S.J., & Bastien, S. (2017). Participatory science and innovation for improved sanitation and hygiene: process and outcome evaluation of project SHINE, a school-based intervention in Rural Tanzania. *BMC public health*.

Science engaging “other” stakeholders

- Science « produces » knowledge about the observable « world » (anthropocenic) and its processes :
  - biophysical environment, technology, humans, societies, co-evolution, participation, science (STS)

But scientific activity (« production ») is **a social process engaging various people** (multidisciplinarity, gender & age, countries, status incl. students, technicians, « guinea pigs », funders) inside and outside the labs

→ Participation tackles the inclusion of people in processes which usually exclude them: inputs, decision and action in…

family, society, health, education, business, work conditions, strategic development, **policy making, politics,** public affairs, commons, media, science, innovation

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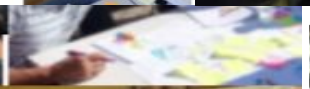
“Lay people” in action & research…

→ Roles ?



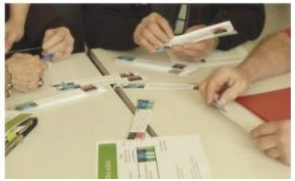










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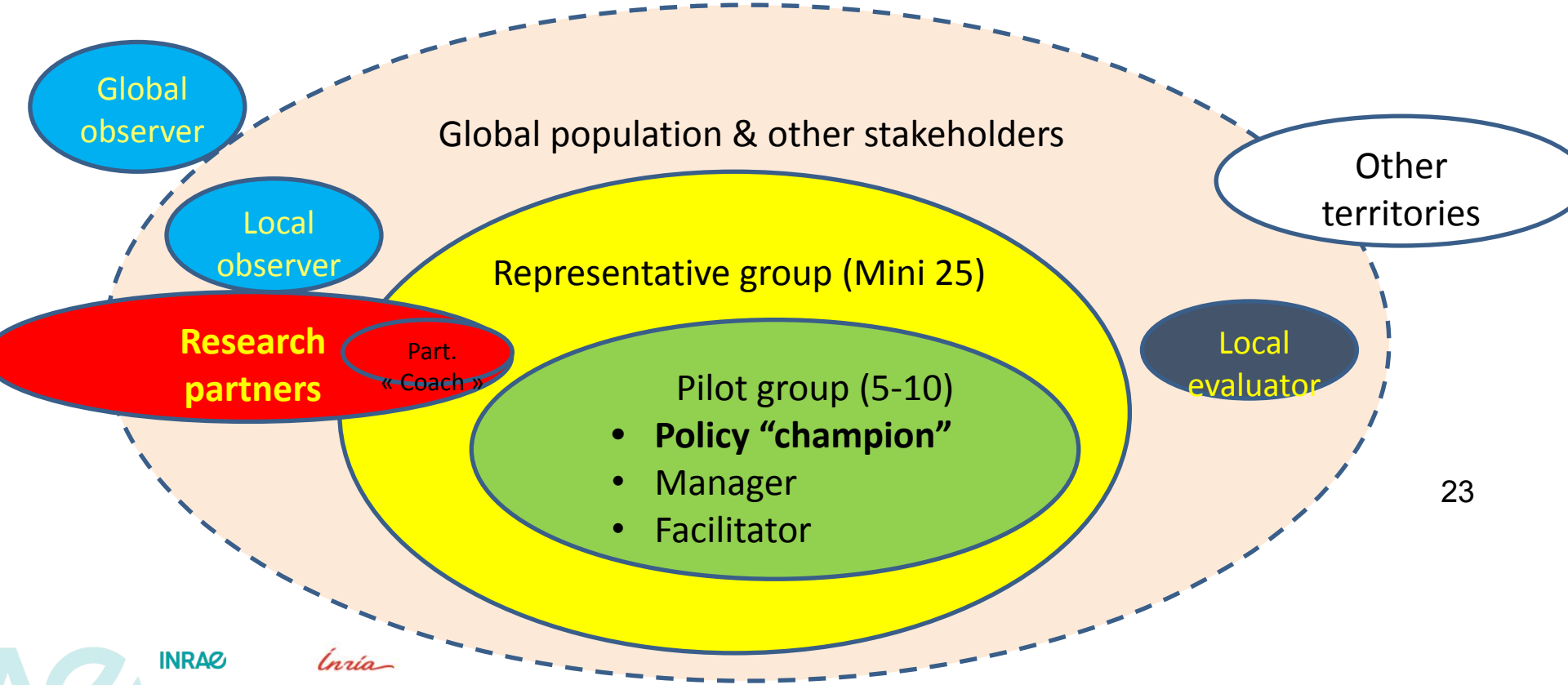
Actors' structuring



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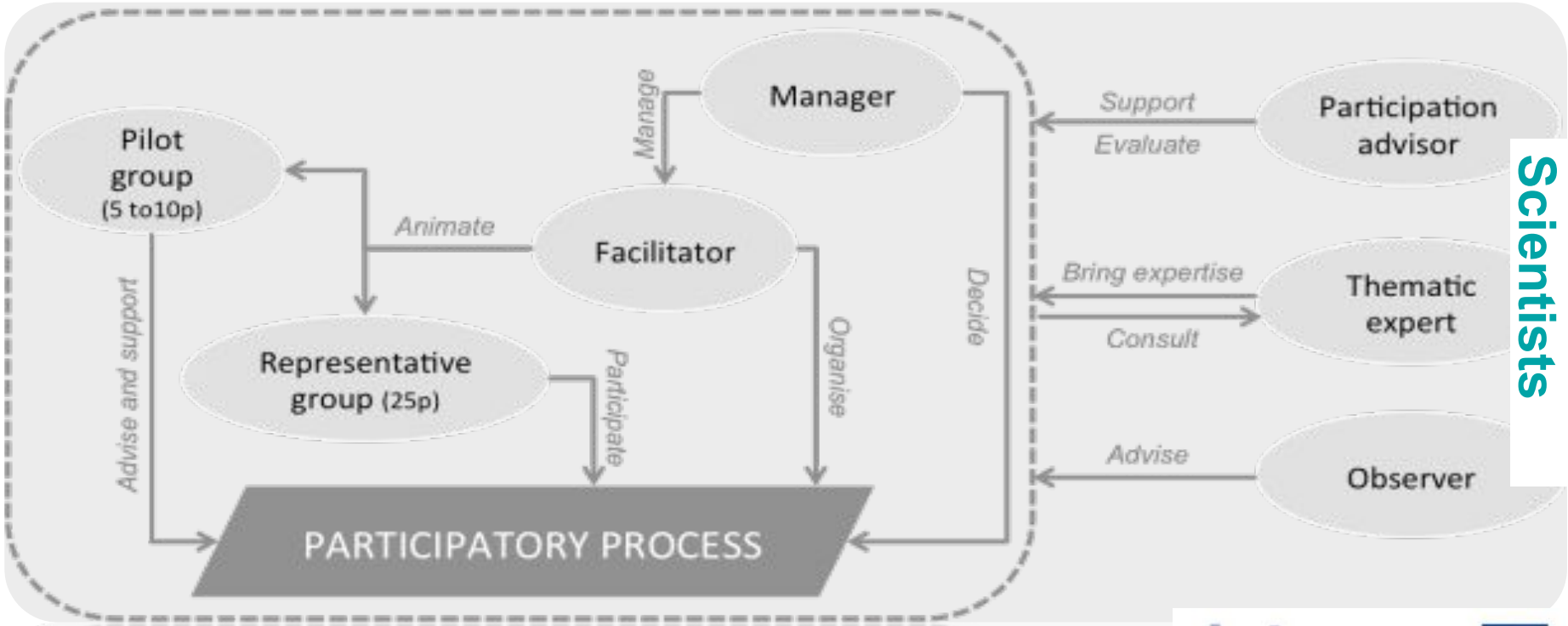
Roles in co-creation processes ?



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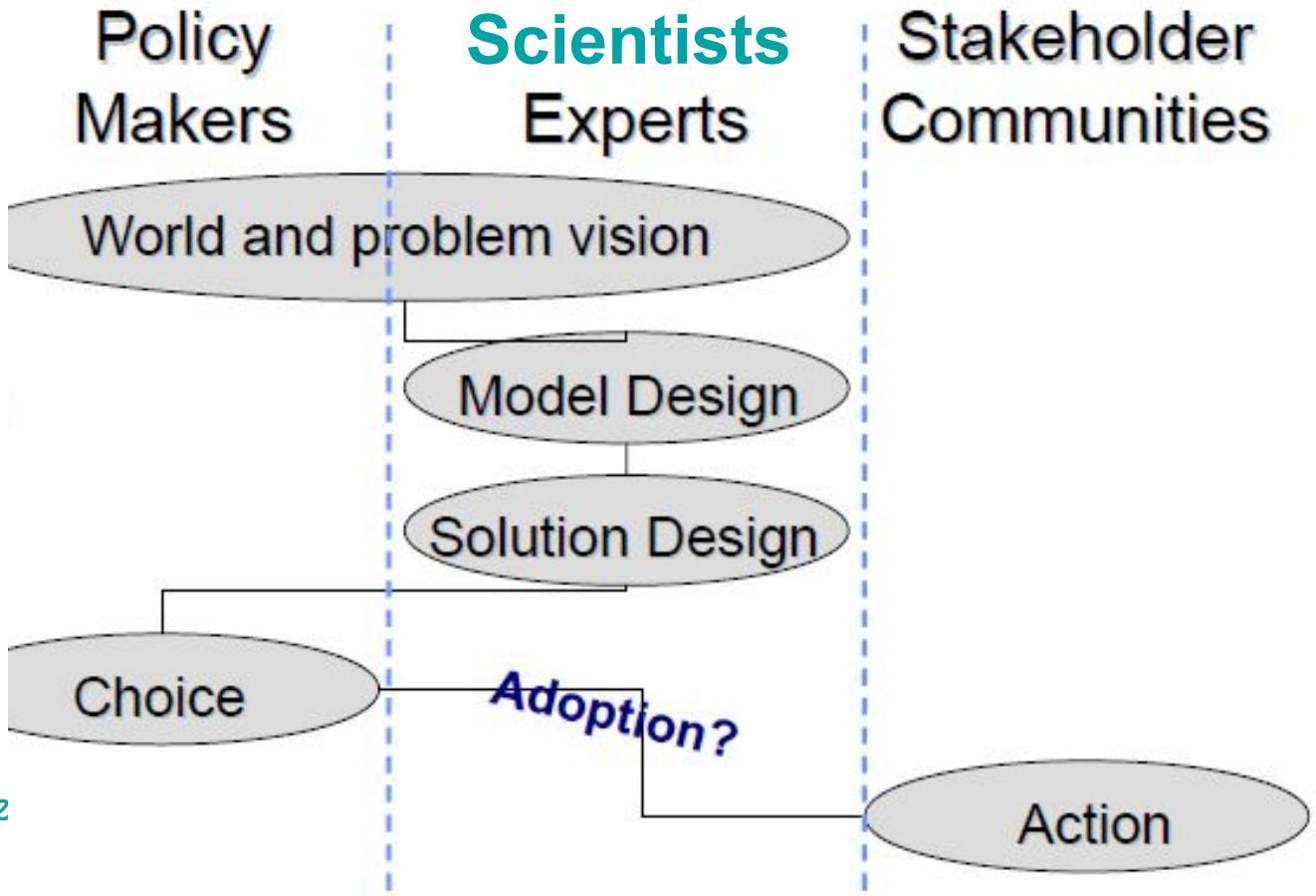
The standard model of policy design: acceptology



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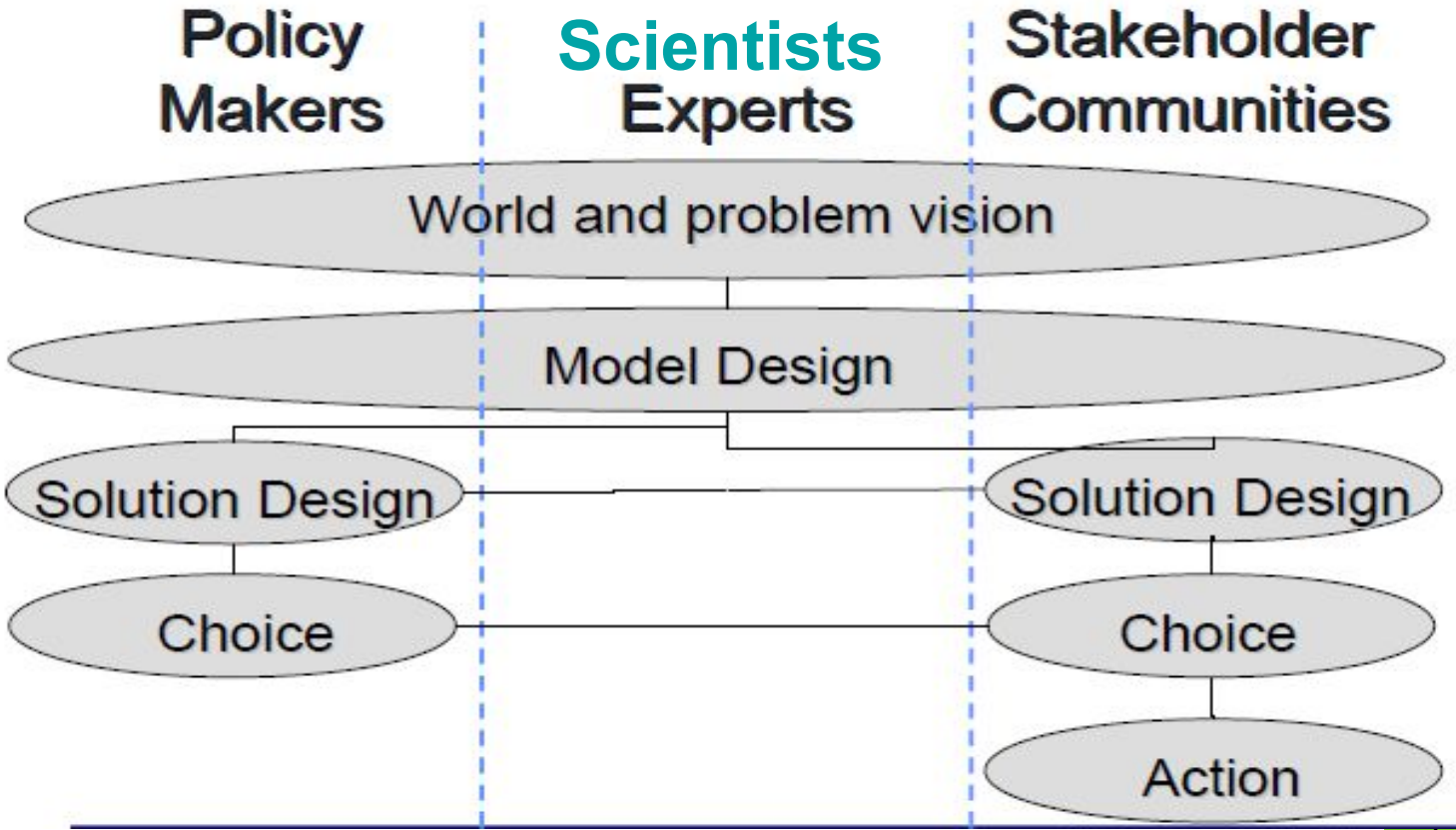
… toward co-design & implementation

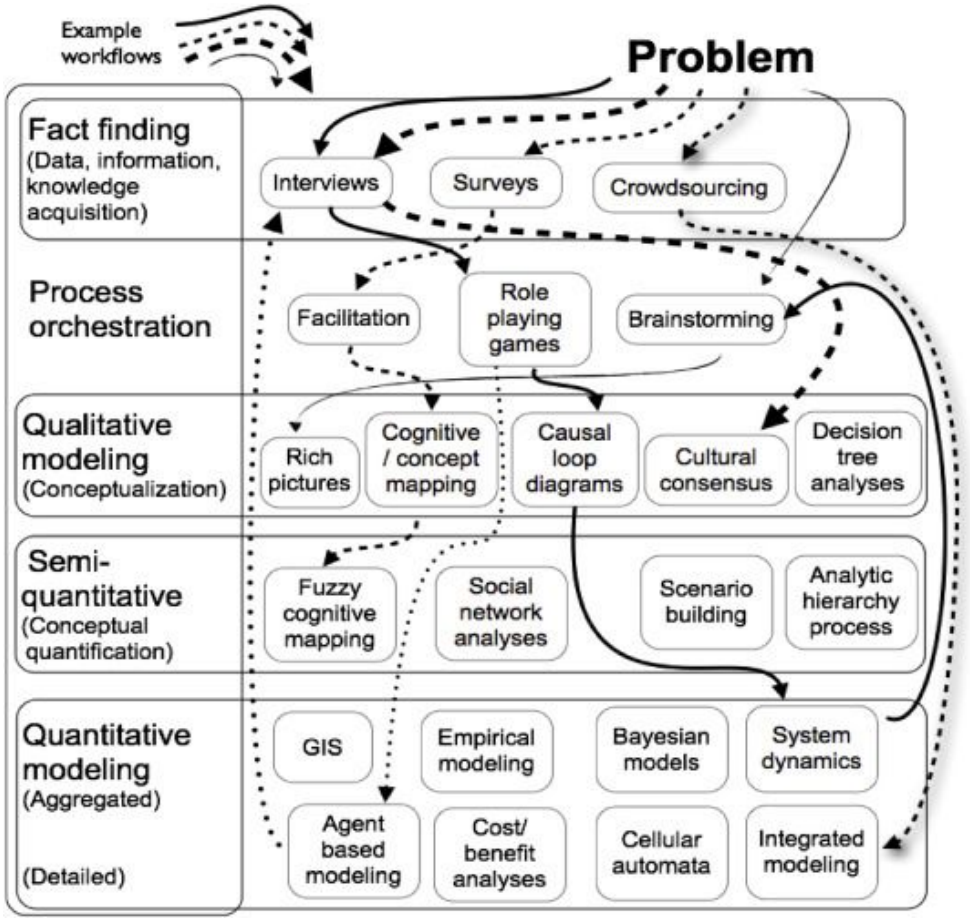


Co-designing = participatory modeling

Participatory modeling as co-construction of models with non-scientists for the needs of:

- knowledge structuring and discovery
- social transformation

Our challenge → which meta-models / methods ?

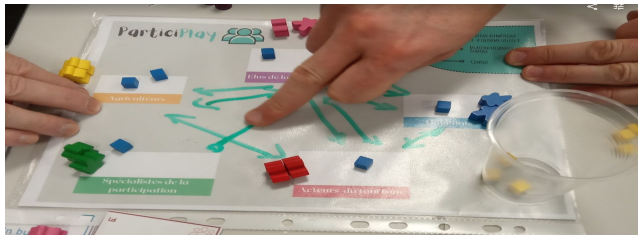


Voinov A., Jenni K., Gray S., Kolagani N., Glynn P., Bommel P., Prell C., Zellner M., Paolisso M., Jordan R., Sterling E., Schmitt Olabisi L., Giabbanelli P.J., Sun Z., Le Page C., Elsawah S., BenDor T., Kubacek K., Laursen B., Jetter A., Basco-Carrera L., Singer A., Young L., Brunacini J., Smajgl A.. 2018. Tools and methods in participatory modeling: Selecting the right tool for the job - Environmental Modelling and Software, 109 : p. 232-255. DOI: 10.1016/j.envsoft.2018.08.028

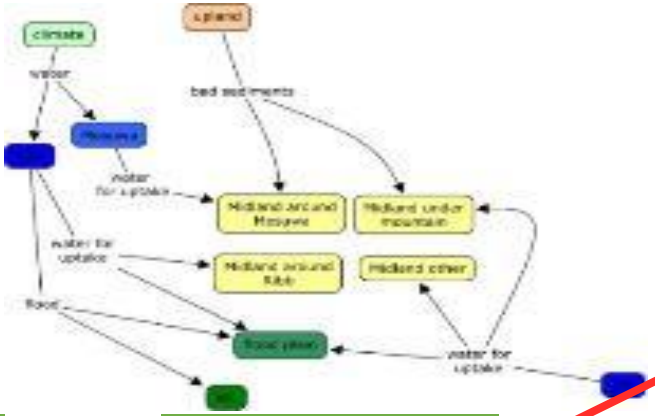
Models and modeling in transformative research

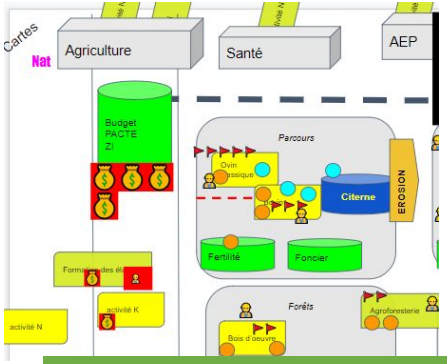
Vinck, D. (2009). From Intermediary Object towards Boundary-Object: Accounting for the Work of Equipment. *Revue d'anthropologie des connaissances*, 3,N1, 51-72. https://www.cairn-int.info/journal--2009-1-page-51.htm.

- Models as:
  - Boundary **objects**
  - Rationalization substrate for decisions and policies
  - Imaginaries about the world and the future
  - Support for simulation!
- Modeling as:
  - A social learning process (transformative by itself)
  - Co-construction of imaginaries and social norms
  - Boundary **process** in conflicts
  - A legitimation & improvement process for the models



Opening the process of modeling & simulation



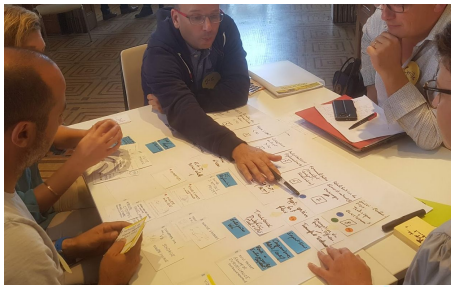


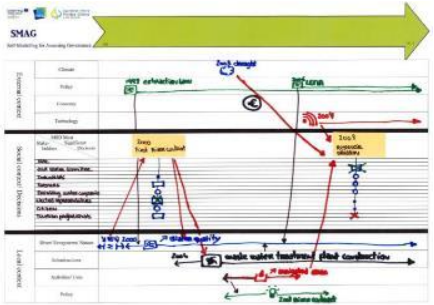
Stakeholders' inputs

Co-Modeling

Computer simulation (multi-agent / syst. dyn)

Role playing games





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nils.ferrand@inrae.fr / nils.ferrand@inria.fr

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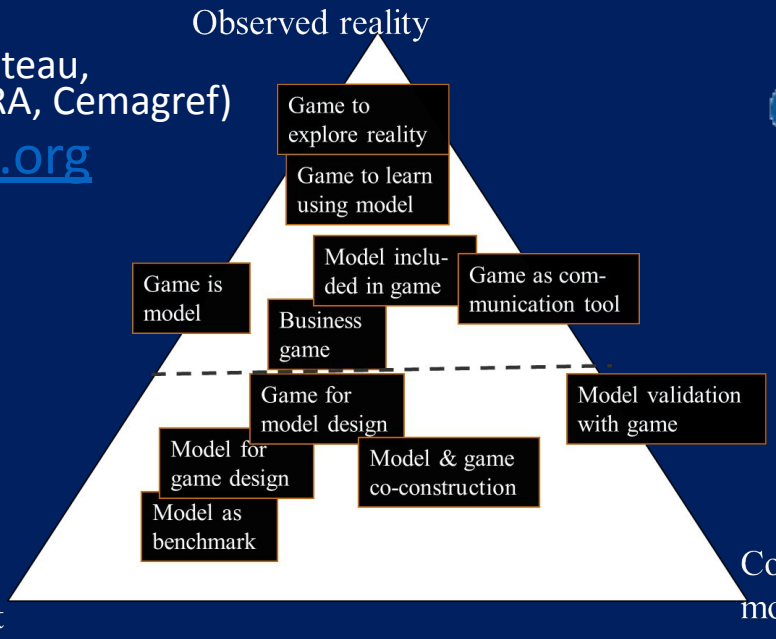
Building on Companion Modeling

- Participatory modeling & simulation coupled
- A different "posture" which legitimates all points of view, even when they are contradictory, and reliaise science, society & policy
- Developed and structured since 1993 by a group of (French) researchers

  F. Bousquet, M. Etienne, O. Barreteau,
  C Le Page, M. Antona (CIRAD, INRA, Cemagref)
  - http://www.commod.org
- Coupling modeling, field interactions & social experiments



CommOd

http://www.commod.org

- Barreteau O., Antona M., D'Aquino P., Aubert S., Boissau S., Bousquet F., Daré W., Etienne M., Le Page C., Mathevet R., Trébuil G., Weber J.. 2003. Our companion modelling approach - *Journal of Artificial Societies and Social Simulation*, 6 (2)

⇒ A post-normal approach

S. Funtowicz, J. Ravetz. Environmental problems, post-normal science, and extended peer communities. *Études et Recherches sur les Systèmes Agraires et le Développement*, 1997, pp.169-175. ⟨hal-01231607⟩

ComMod

http://www.commod.org

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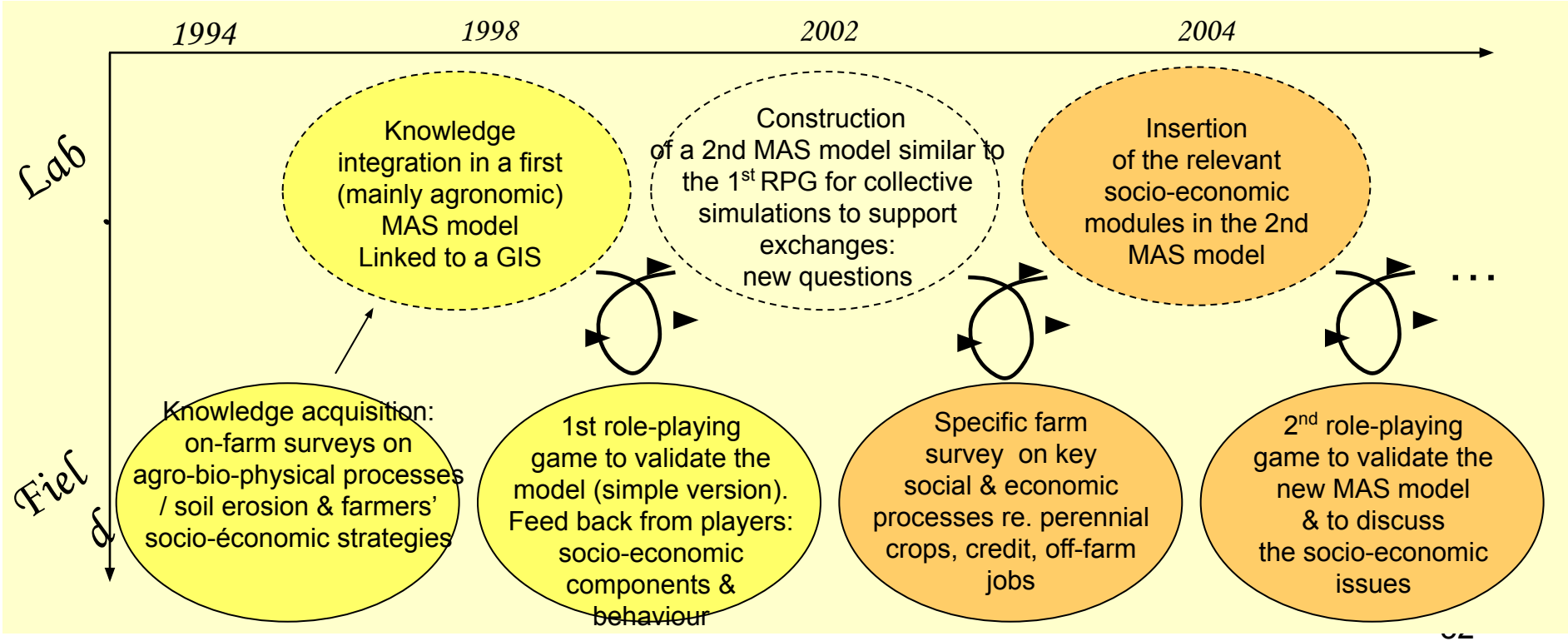
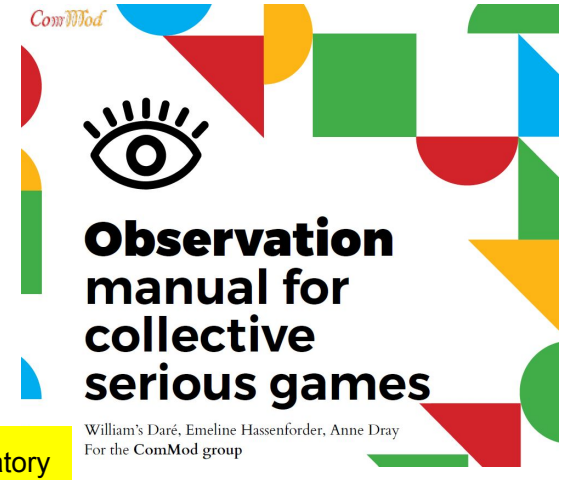
e.g. An iterative and continuous process

Barnaud, C., Trébuil, G., Promburom, P. & Bousquet, F. (2008). La modélisation d'accompagnement pour une gestion concertée des ressources renouvelables en Thaïlande. *Économie rurale*, 303-304-305, 39-59. https://doi.org/10.4000/economierurale.512



Crookall D., Becu N. 2020. Companion modelling and participatory simulation: A glimpse. EGU General Assembly 2020. **Poster**



Daré W., Hassenforder E., Dray A. 2020. Observation manual for collective serious games. CIRAD, Montpellier, 68 p.

Thematic

- Agriculture
- Biodiversity
- Water
- Livestock
- Forest
- Peri-urban area
- Other thematics

Social dynamics

- Conflict
- Credit
- Dialogue
- Institution building
- Learning
- Market
- Migration

Geographical

- Africa
- Amérique du Nord
- Asia
- France
- Oceania
- South America

nils.ferrand@inrae.fr / nils.ferrand@inria

Let’s co-create your / our thinking…

During 2 mins, with you closest neighbor, please consider what / with whom can be (co-created = co-modeled / explored / assessed) for the needs of socio-environmental transformation

⟶ be creative and open-minded !

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nils.ferrand@inrae.fr / nils.ferrand@inria.fr

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Co-designing… = modeling what ?

- socio-environmental systems & their dynamics
  - “where *we* live, what *we* do in/with our environment, how it changes and may adapt”
- science-policy-society co-design procedures
  - “what-when-how *we* should think and decide together”
- values, principles, social justice orientations
  - “what makes *us* acting, how should *we* share”
- strategies and action plans, feasible and efficient
  - “ what-when-where *we* should act/launch/make together”
- co-monitoring, evaluation and adaptive steering protocols
  - “ what-how can *we* know about where we are and drive”

INRAE Inria

nils.ferrand@inrae.fr / nils.ferrand@inria.fr

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Our approach

Decision-making steps	Citizen's perspective	Participatory tools	Ex. in Uganda (2012-2014)
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SCENARIO EXPLORATION	*Now we understand the big picture*	**Smag** Establishing a territorial diagnosis **Wat-A-Game** Modelling & role-playing-games	
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IDENTIFICATION OF ACTIONS AND PLANS	*We, too, have good proposals to make*	**Cooplan** Building action plans	
CHOICE, PRIORISATION AND VOTE	*In democracy, our voice count*		
IMPLEMENTATION	*Let's do it!*		
MONITORING AND EVALUATION	*Are we getting there?*	**Encore-Me** Evaluating impacts	

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nils.ferrand@inrae.fr / nils.ferrand@inria.fr

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CoOPLAaGE

An integrated suite of participatory methods, tools and protocols to codesign decision procedure, simulate and explore changes, implement evaluate and adapt

PrePar

Preparing design of the decision process

SMAG

Self assessment of past gouvernance

Wat-A-Game

Modeling & role-playing-games

Just-A-Grid

Discussing justice principles

Cooplan

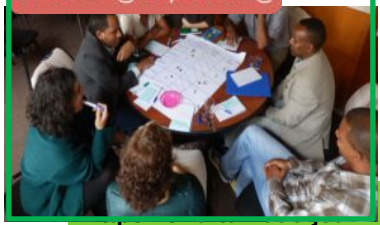
Building action plans

Encore-Me

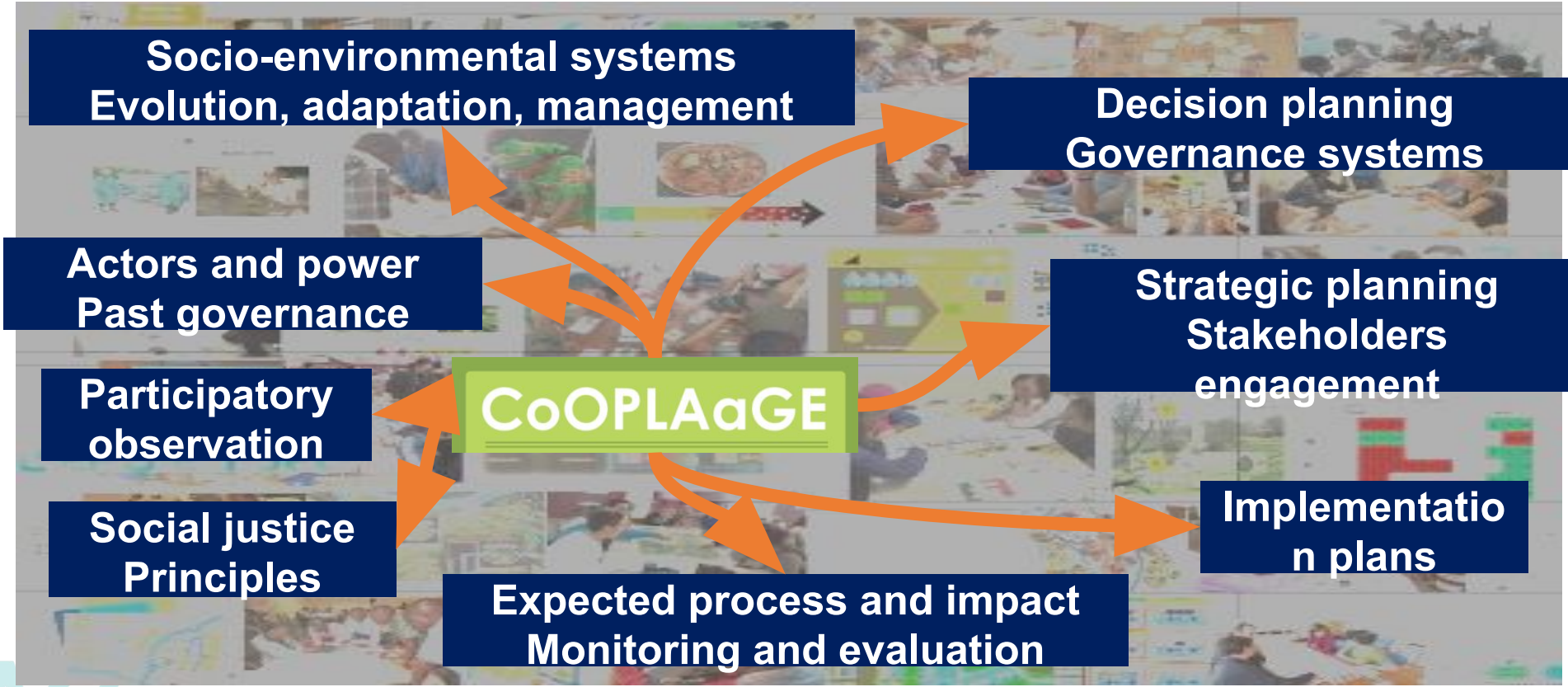
Evaluating impacts

Scoolplaage

Learning by doing



A wide scope of participatory modeling



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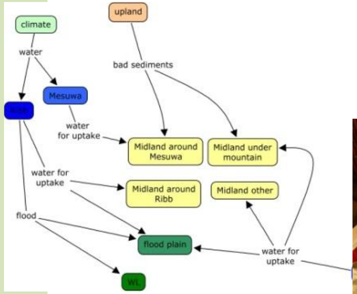
Help modeling… whatever is worth representing, discussing and changing for / by participants

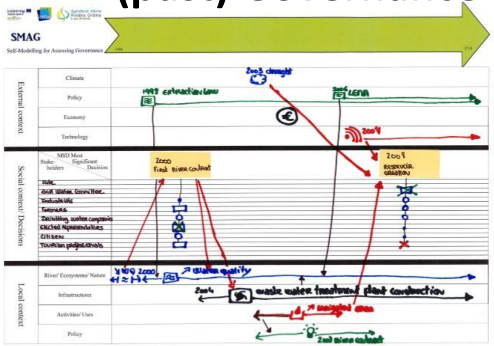
Historically: Socio-ecological systems (> 180 case studies !)



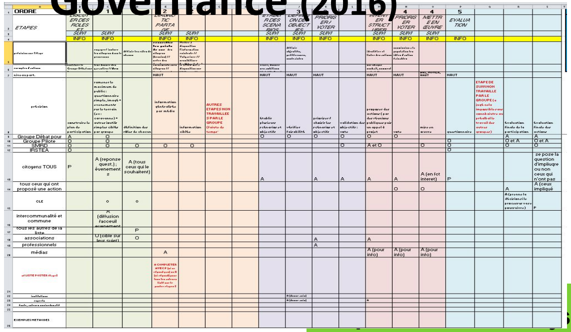
Since 2006:

Integrated management plans (2006)

(past) Governance (2017)



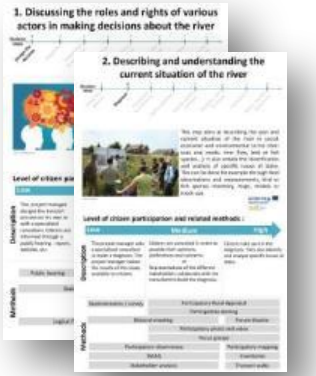
(target) Participatory Governance (2016)



Co-creating participatory processes

- **PrePar** Participatory design of… participation plan
- **RePar** Participatory design of… participation research

Clarify objectives → Identify stakeholders → Chose steps of decision and actions → Define roles of stakeholders at each steps → Discuss participatory methods



PrePar Matrix

>> Participation Plans
>> Participation Charters

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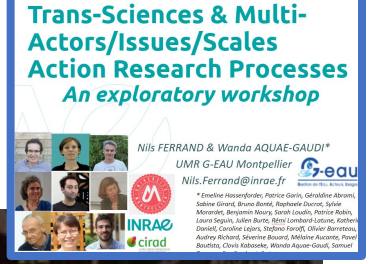
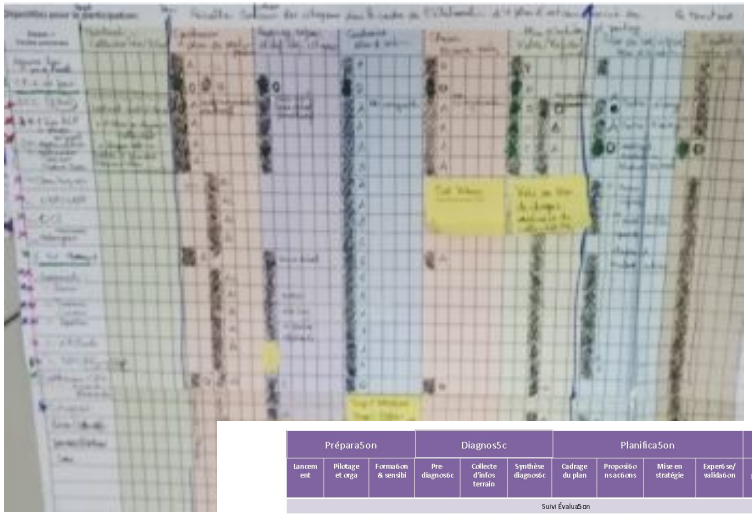
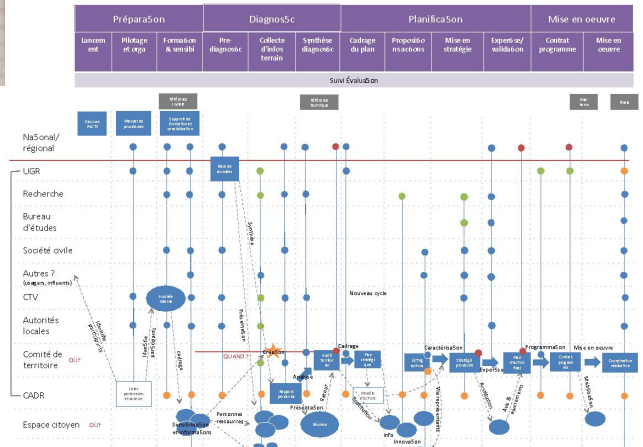
Stakeholders' roles' categories & mapping → modeling participatory research!





Trigger, steer
Analyze
Request
Inform
Propose
Observe (measure)
Negociate, decide
Discuss, debate
Experiment, test
de**V**elop
Gather
Write
Fund
…others to be discussed and ~~chosen~~…



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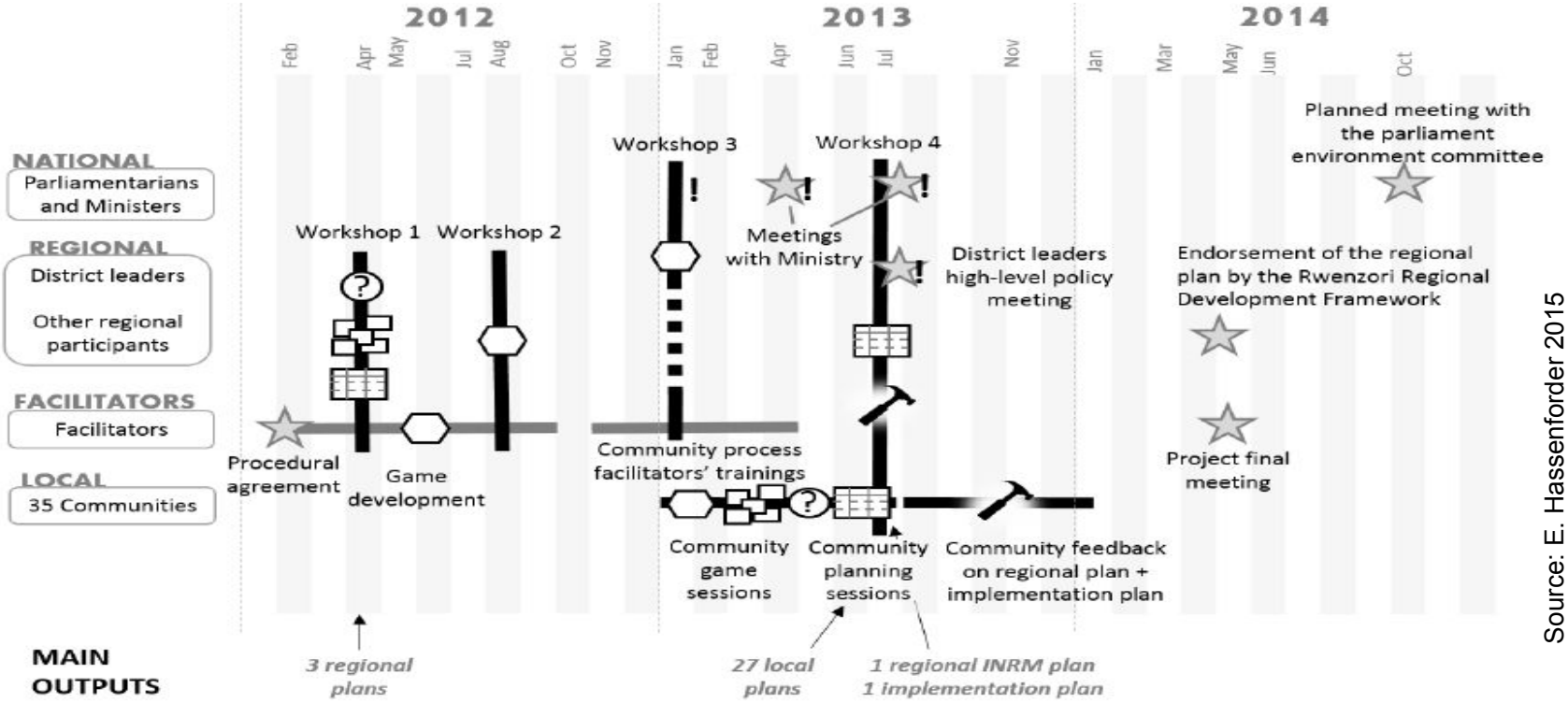
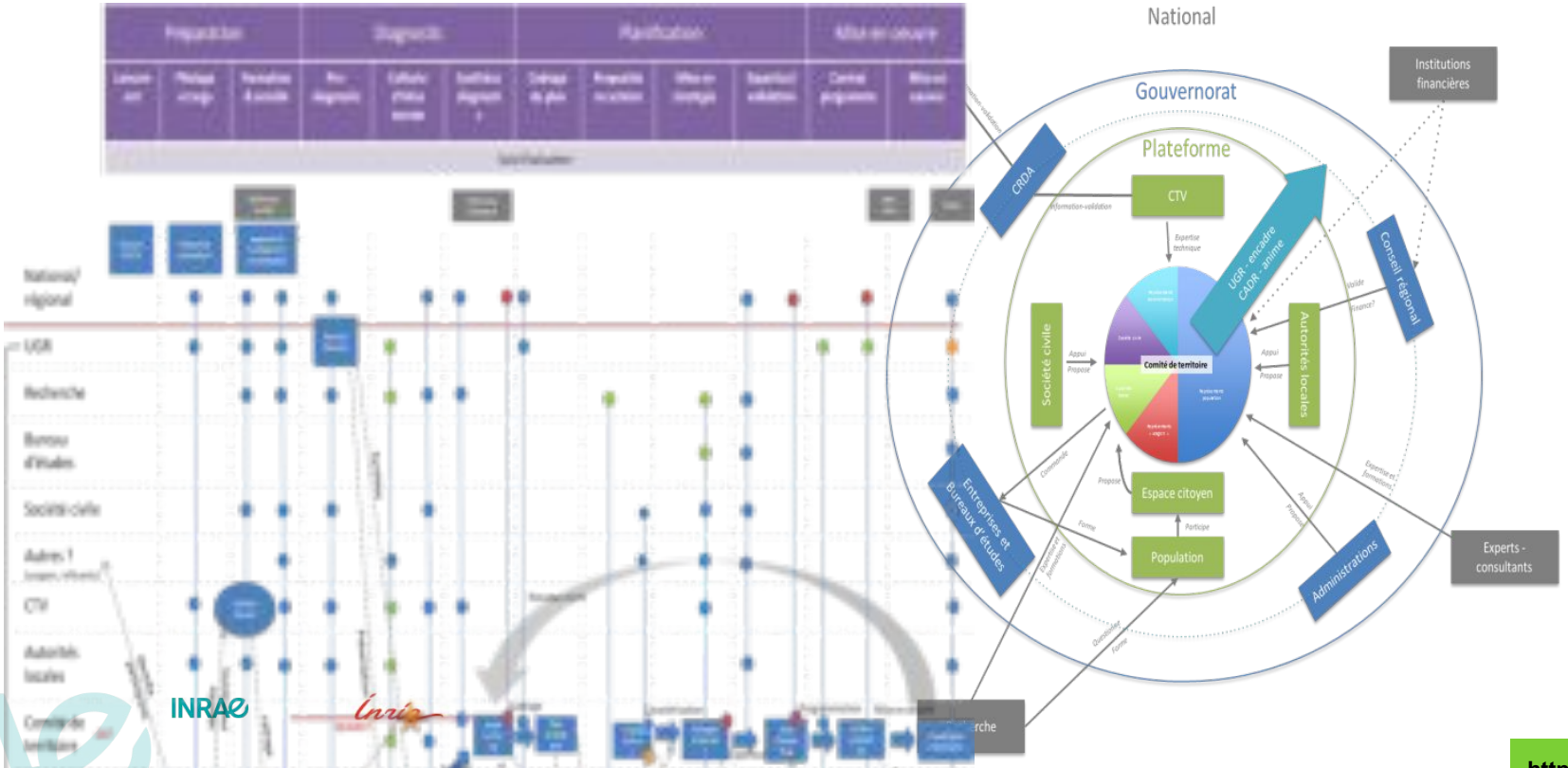
Model of the Ugandan process



Source: E. Hassenforder 2015

Tunisia (PACTE AFD CIRAD) Dual modeling of process & governance structure



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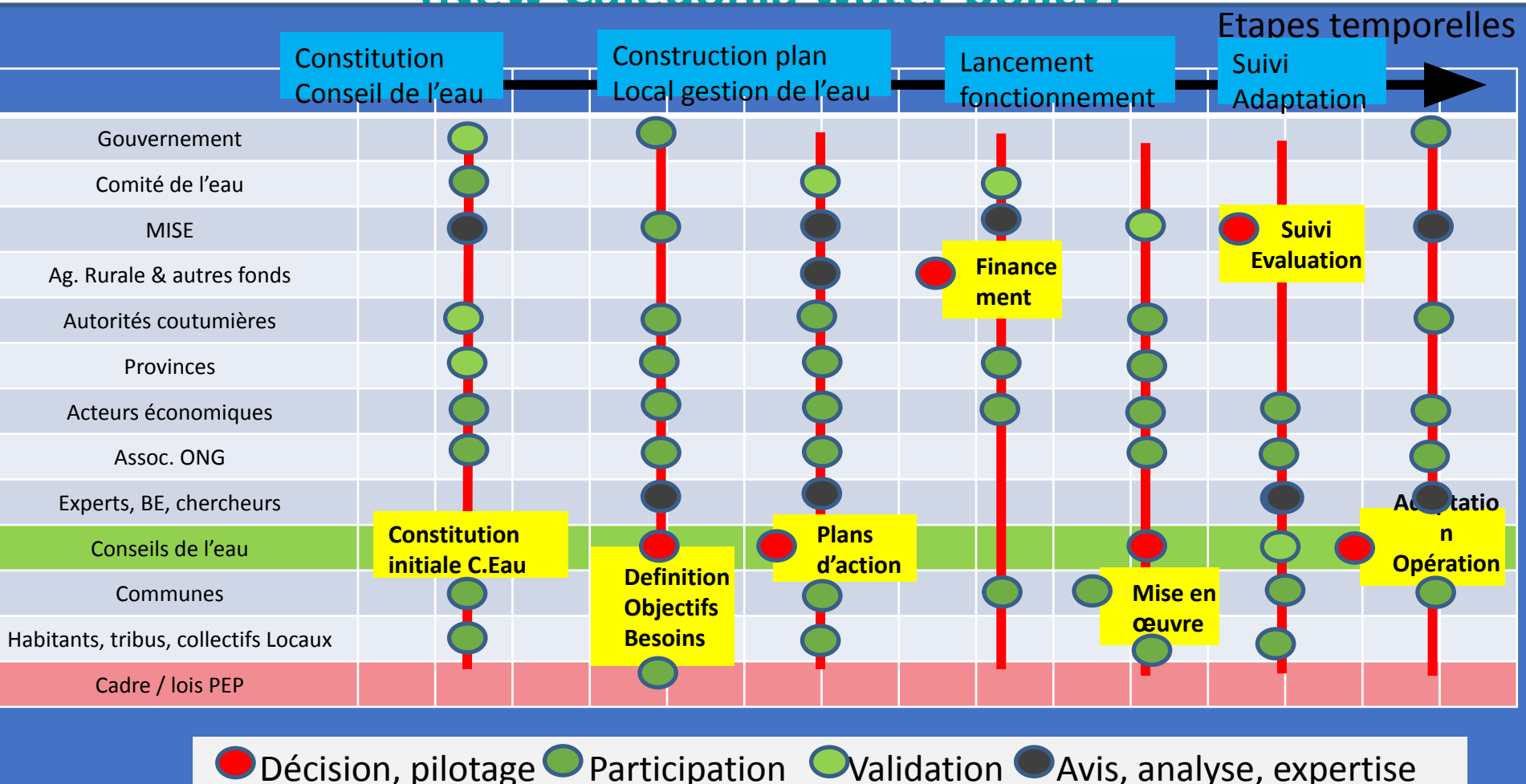
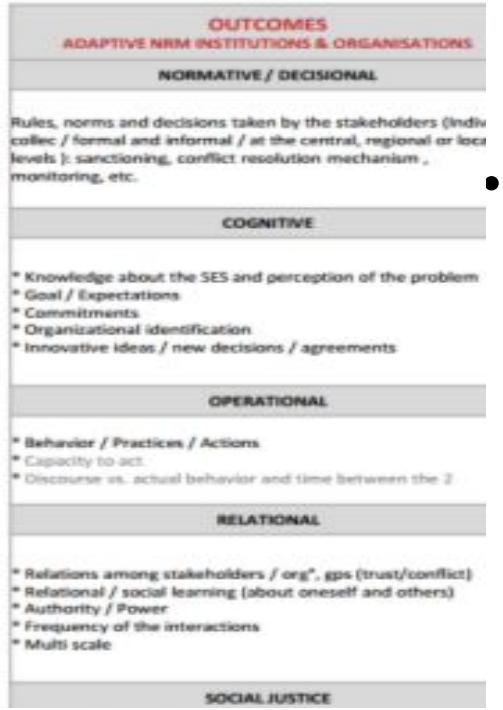
Part. modeling of a new governance system (New-Caledonia water policy)

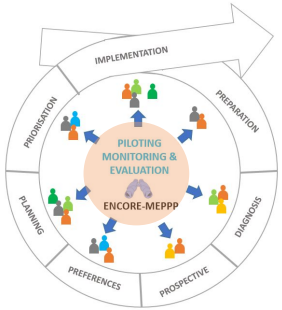


Co-creating a reflexive model of self-transformation

- Using the ENCORE framework : External / Normative / Cognitive / Operational / Relationnal / Equity (Ferrand, Le Bars, 2004)
- Toward endo-evaluative participation



Source: E. Hassenforder 2015



The ENCORE-MEPPP tool

for monitoring & evaluation & steering

MONITORING & EVALUATION

CONTEXT

PROCESS

OUTPUTS / OUTCOMES / IMPACTS

- **E** XTERNAL
- **N** ORMATIVE
- **C** OGNITIVE
- **O** PERATIONAL
- **R** ELATIONAL
- **E** QUITY

- [2006] Ferrand, N., & Daniell, K. A. **Comment évaluer la contribution de la modélisation participative au développement durable ?** *Séminaire DDT*. Lille, France.
- [2015] Hassenforder, E., Pittock, J., Barreteau, O., Daniell, K.A., Ferrand, N., "**MEPPP Framework: A framework for monitoring and evaluating participatory planning processes**" *Environmental management,* 2015, 57 (1), 79-96. DOI 10.1007/s00267-015-0599-5. Lien
- [2016] Hassenforder, E., Ducrot, R., Ferrand, N., Barreteau, O., Daniell, K.A., Pittock, J. "**Four methodological challenges in the monitoring and evaluation of environmental participatory processes: example from the Rwenzori Region, Uganda**"*Journal of environmental management* 2016, 180, 504-516. Lien

nils.ferrand@inrae.fr / nils.ferrand@inria.fr

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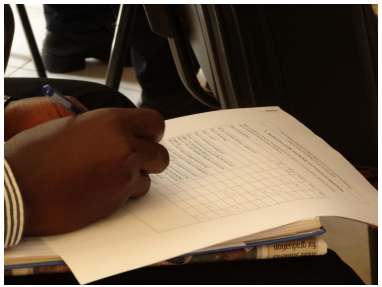
Example of using ENCORE-MEPPP in the Rwenzori, Uganda

2012-2015



AFROMAISON
www.afromaison.net

PUNCTUAL

Attendance lists
Pictures and videos
Interviews
Expectations
Participant observation
Questionnaires

EX-ANTE

Baseline studies
Document review
Stakeholder analysis
Interviews

EX-POST

Interviews

LONG TERM

Regular contacts with the team and key stakeholders

Workshop 1 April 2012
Workshop 2 August 2012
Workshop 3 January 2013
Workshop 4 July 2013

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PERMANENT

Logbook

nils.ferrand@inrae.fr / nils.ferrand@inria.fr

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CoOPLAdGE

wat a game

irstea

nils.ferrand@inrae.fr / nils.ferrand@inria.fr

Wat-A-Game (WAG)
A toolkit for participatory modeling & role-playing games

→ « Let-them » model their own catchment on the table
→ Include their own roles, resources, activities, events
Get a shared model (playable) of their hydrosocial system

→ INIWAG : introduction / discovery kit-bag
→ CREA-WAG : creative process, step by step
→ WAG-LIB : a library of past case studies (> 80)
→ INFO-WAG : knowledge management
→ INTER-WAG : computer

irstea INRAE Inria
nils.ferrand@inrae.fr / nils.ferrand@inria.fr

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The Crea-WAG tool

Participatory modeling toward transition tools

Functional mapping

5 STEPS – 1 WEEK

1. **Framing:** specify the main issue, the stakes and constraints.
2. **Conceptual model:** articulate the main components of your system: space, actors, resources, activities, etc.
3. **Prototype:** specify the game board, the roles, the natural and social processes, the activities, etc
4. **Calibration**: quantify activities, initial settings, scenarios, processes, etc.
5. **Test:** organise a game session and its debriefing

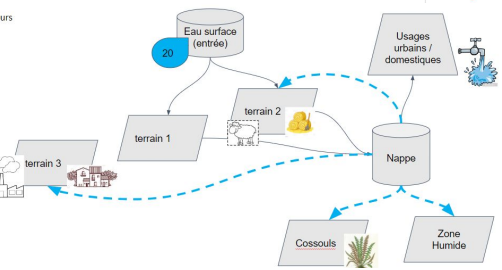
Design by playing !

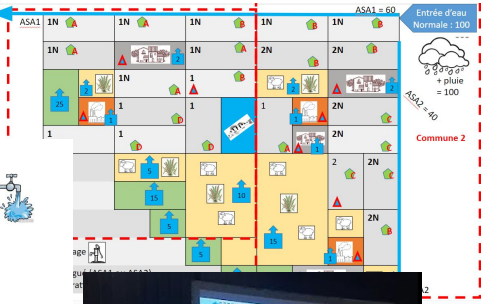
- At this stage, it is possible (and good) to try the game
  - start placing post-its on the game-board
  - try to circulate resources, even if the calibration is not done

Trying circulating resources with an uncalibrated prototype, Embu, Kenya, Feb 2014

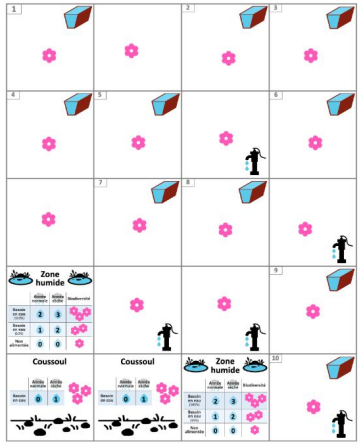
nils.ferrand@inrae.fr / nils.ferrand@inria

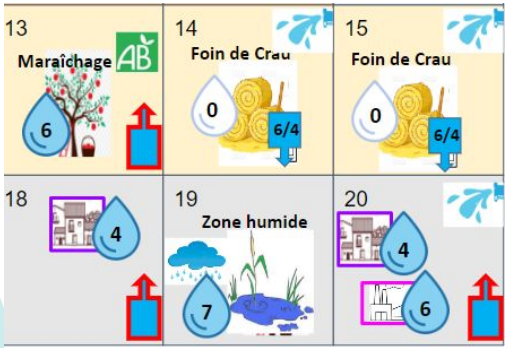
Crea-WAG in the Crau Watershed management

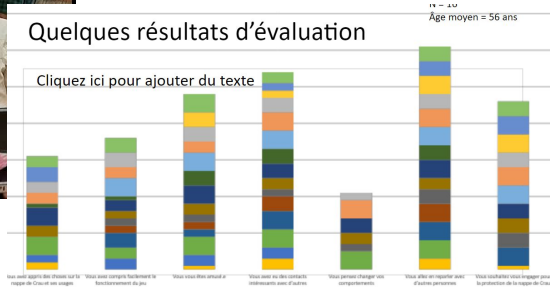




MARAÎCHAGE ARBORICULTURE		Année normale	Année sèche
Coût d'installation : 12W	total	Coût de mise en culture	6W	8W
Place nécessaire : 1 case		Besoin en eau	6E	8E
		Bénéfices	12W	13W
Passage en bio	1/2	Coût de mise en culture	3W	4W
Coût initial	5W	Besoin en eau	3E	4E
Besoin en eau	-1E	Bénéfices	5W	5W
Bénéfices	+1W			







nils.ferrand@inrae.fr / nils.ferrand@inria.fr

WAG-ing the Inn (Switzerland)

nils.ferrand@inrae.fr / nils.ferrand@inria.fr

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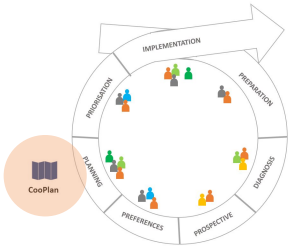
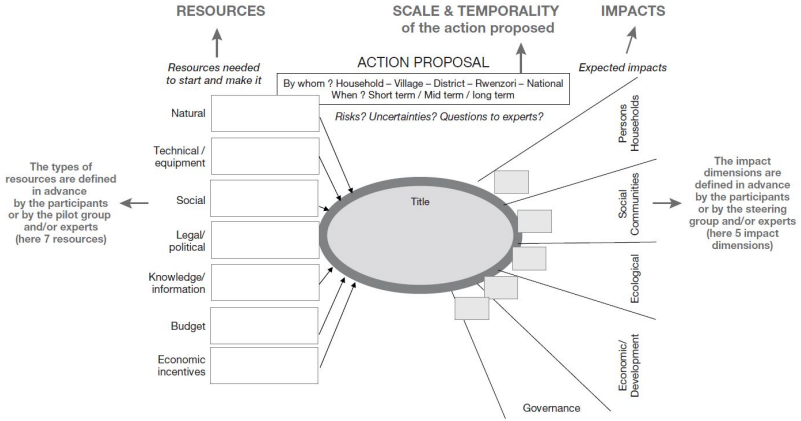


CO-creating action plans with CoOPLAN

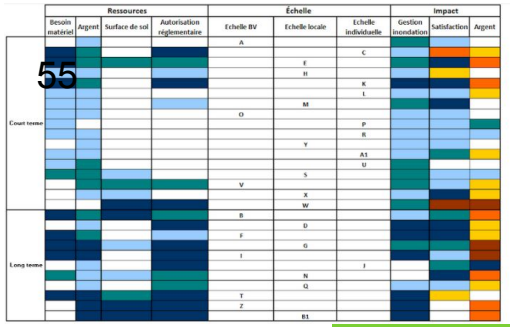
for participatory planning

#	Step	Goals
1	**Organization**	Organize the conditions of the process
2	**Normative framing**	Define boundaries and objectives, what the plan aims at changing
3	**Action proposals**	Get participants to propose ideas of actions
4	**Actions' synthesis**	Organize action proposals in thematic clusters
5	**Common framework for describing action proposals**	Select relevant scales, resources and impacts for describing action proposals (i.e. define the content of the action sheets)
6	**Detailed actions' description**	Fill the action sheet for each action proposal
7	**Comparative dialog**	Share and improve action sheets
8	**Consistency/Harmonization**	Global comparison of action proposals to check consistency
9	**Plans' design**	Select and gather actions in a logical, temporal, and spatial manner to build an action plan
10	**Plans' assessment**	Analysis of the plan to assess feasibility and efficiency
11	**Testing plans**	Test plans by simulation or robustness analysis
12	**Plan selection**	Integrate and choose one final unified plan
13	**Finalization**	Officialize the final plan

Based on 2 meta-models:



Action sheet



Integration matrix

[2024] Ferrand, N., Kabaseke, C., Muhumuza, M., Tibasiima, T., Hassenforder, E. « CoOPlan multi-scale participatory planning process: applications in Uganda and elsewhere" inTransformative Participation for Socio-Ecological Sustainability - Around the CoOPLAGE pathways, Hassenforder, E. and Ferrand, N. (eds) Chapter 18

nils.ferrand@inrae.fr / nils.ferrand@inria.fr

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Example of using CoOPLAN in Drôme, France

3 months (Jan-March 2018)

PROCESS

Online collection of action proposals

132 proposals from 75 participants

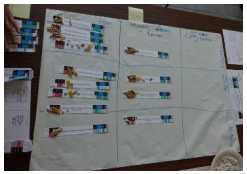
+ expert assessment

3 Comparative dialog workshops

184 proposals discussed, 41 participants

1 workshop for designing the plans

10 participants



OUTPUTS

189 action proposals

3 versions of action plans

1 final report & thematic synthesis for the local water committee

56

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Interreg Alpine Space

SPARE

Syndicat Mixte Rivière Drôme & ses affluents

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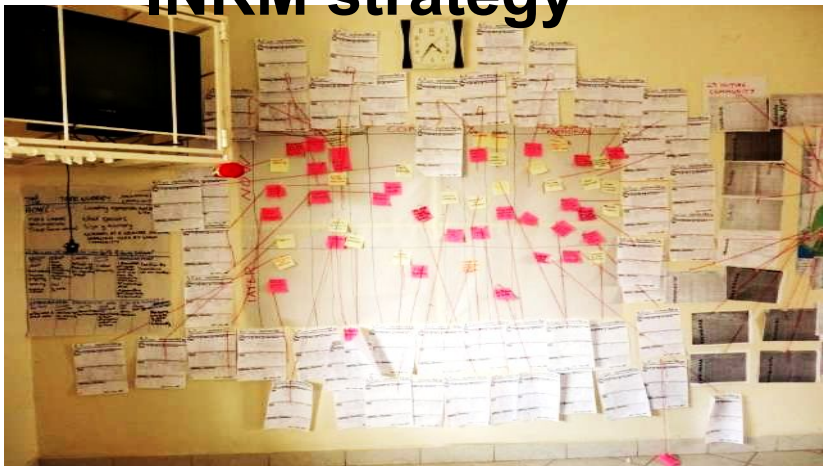
CoOPLAN in Uganda

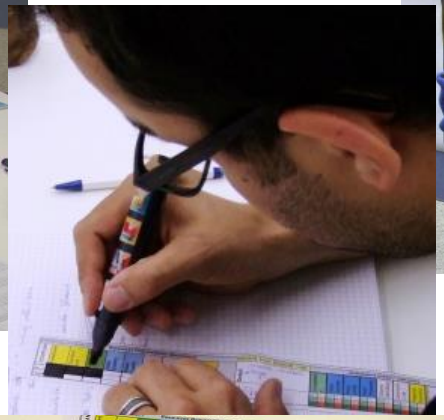
27 communities strategies

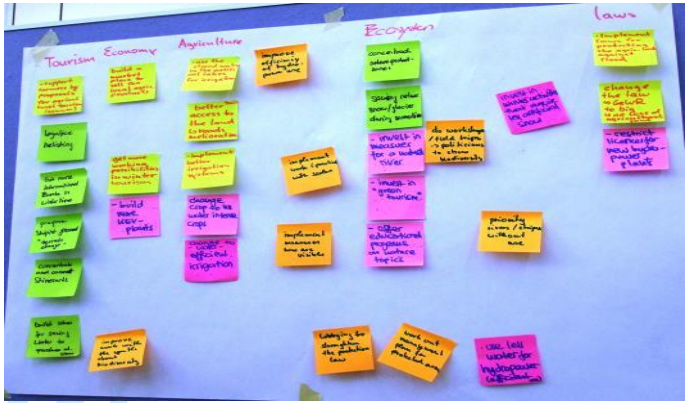
3 meso-level strategies

Proposed regional INRM strategy



COOPLAN-ing the Inn





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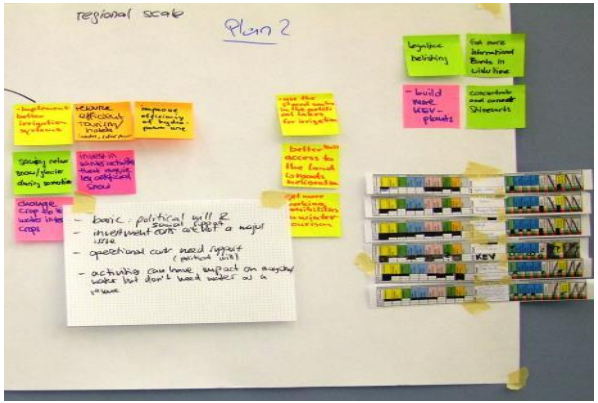
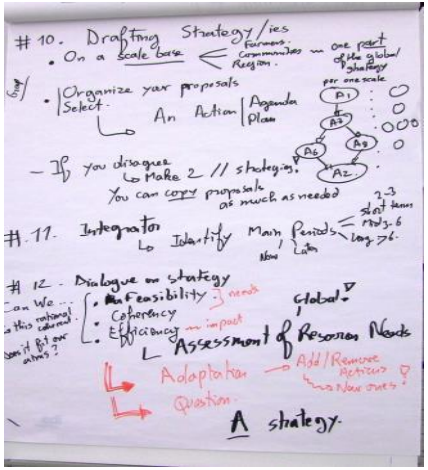
COOPLAN Integrating Strategies





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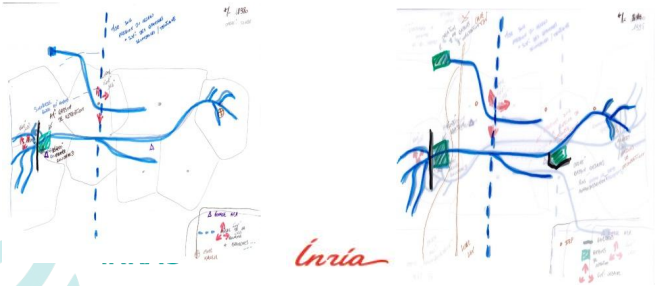
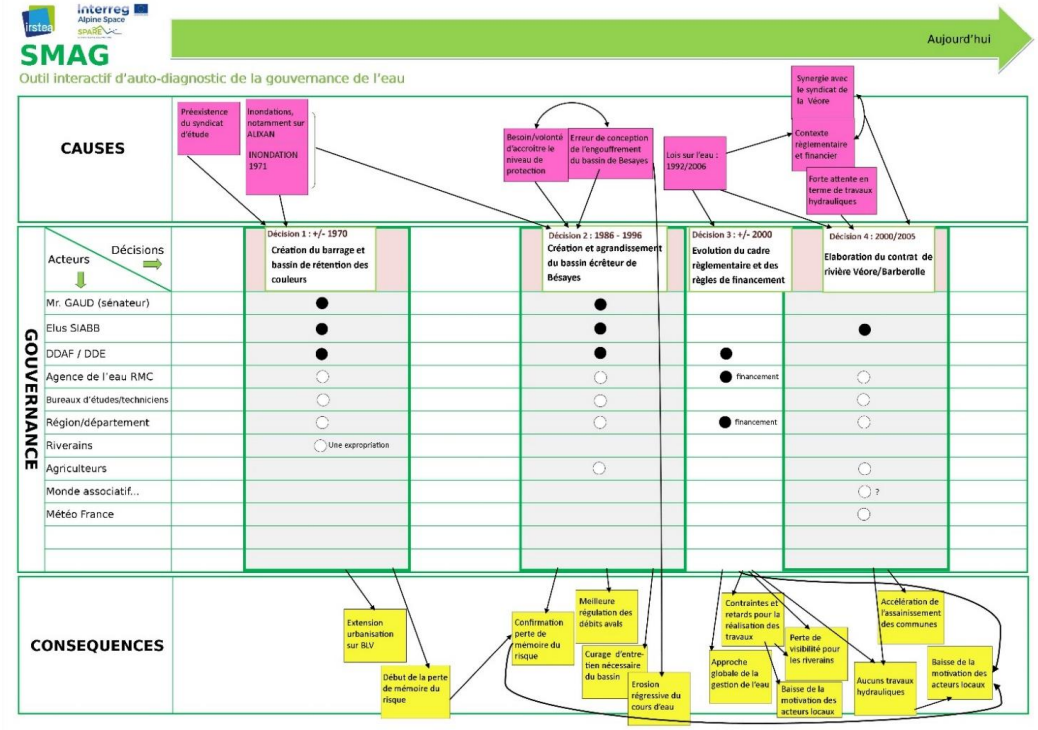
Part. modeling of past governance (SMAG)

France, Barberolle water governance

Crédit : Syrine Ben Slimane





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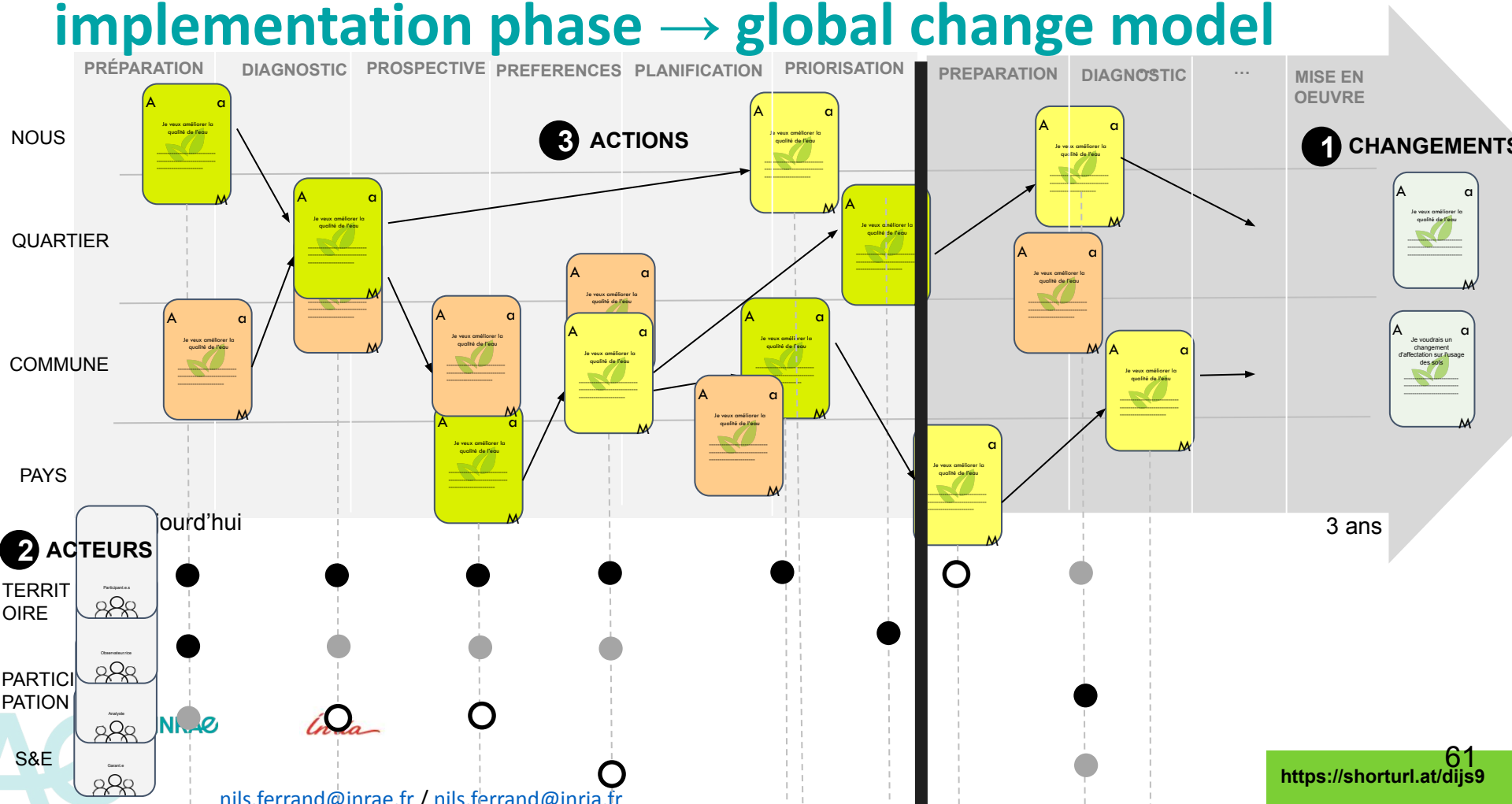
ChangeO'Log : part. modeling with part. decision and implementation phase → global change model



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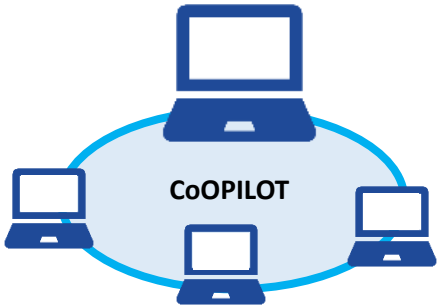
Coupling co-creation arena / stages

CoOPLAGE

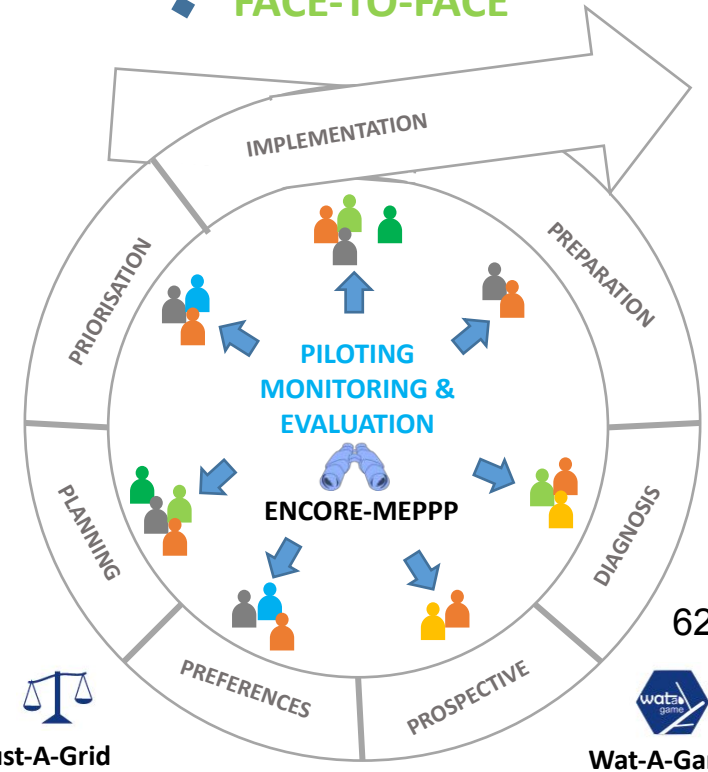
http://cooplaage.watagame.info

DIGITAL

FACE-TO-FACE



Faciliting the process online



PrePar

Engineering the participatory process, engaging stakeholders, regulating

ROCK

Discussing and anticipating observation and data needs

SMAG

Analyzing past governance

CooPlan

Collecting action proposals and integrating them into feasible strategies

Just-A-Grid

Debating social justice principles

Choosing and monitoring indicators, to co-pilot the process

Wat-A-Game

Co-constructing models of the territory and exploring scenarii through participatory simulation (role playing)

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nils.ferrand@inrae.fr / nils.ferrand@inria.fr

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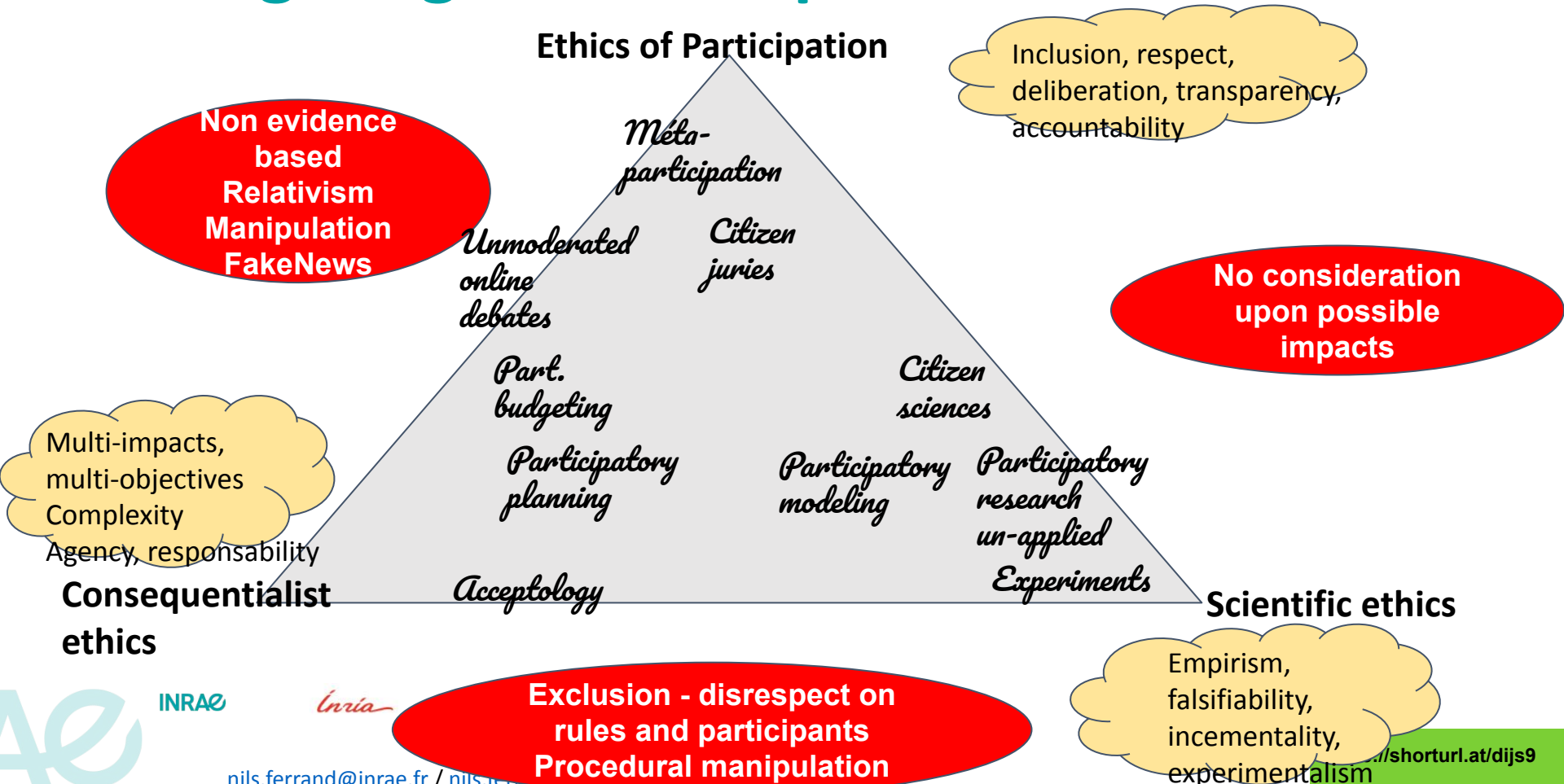
“Navigating” ethics & processes



UPCOMING

CoOPLAGE book

Transformative Participation for Socio-Ecological Sustainability
Around the CoOPLAGE pathways

CoOPLAGE Comics…

Thank you !

nils.ferrand@inrae.fr
emeline.hassenforder@cirad.fr

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Conclusion & perspectives

- Adaptation of the scientific postures is required to enhance impact ⟶ reconsidering relations with stakeholders, investing resources therefore, reducing “pure” scientific aspirations
- Participatory modeling is a central paradigm to support such evolution as an encounter between scientific knowledge, procedural solutions and the contributions of all stakeholders. & it’s a transformative process by itself (social learning).
- Meta-modeling is the medium for scientific intervention
- 3 ethical regimes are relevant ⟶ to be implemented

Thank you. Questions ?

INRAE Inria

nils.ferrand@inrae.fr / nils.ferrand@inria.fr

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