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

Nils Ferrand

► **To cite this version:**

Nils Ferrand. Innovative pathways for an efficient co-design and extension of socio-environmental change between scientists and... others. Doctoral. Advanced Training course on science-based policy advice in agriculture and environment, ILVO, Ghent, Belgium. 2023, pp.1-65. hal-04330563

HAL Id: hal-04330563

<https://hal.inrae.fr/hal-04330563>

Submitted on 8 Dec 2023

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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

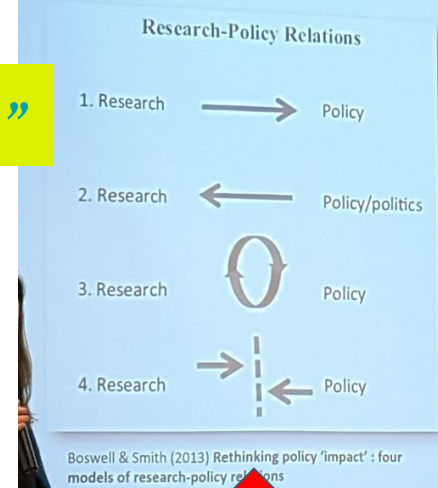
*c. **Wanda aka.** Emeline Hassenforder, Patrice Garin, Géraldine Abrami, Bruno Bonté, Raphaele Ducrot, Sylvie Morardet, Benjamin Noury, Julie Latune, Eva Perrier, Sarah Loudin, Patrice Robin, Laura Seguin, Julien Burte,*

Rémi Lombard-Latune, Caroline Lejars, Olivier Barreteau, Mélaïne Aucante, Mariana Rios

Today's key insights

“we”

- 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



“others”



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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



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Our approach

Decision-making steps

PREPARE PARTICIPATION

DIAGNOSIS

SCENARIO EXPLORATION

DEFINITION OF OBJECTIVES AND PREFERENCES

IDENTIFICATION OF ACTIONS AND PLANS

CHOICE, PRIORISATION AND VOTE

IMPLEMENTATION

MONITORING AND EVALUATION

Citizen's perspective



We will respect our own rules



We know what is happening around us



Now we understand the big picture



We know what we want



We, too, have good proposals to make



In democracy, our voice count



Let's do it!



Are we getting there?



Participatory tools

PrePar
Preparing design of the decision process



Rock
Observing the river



Smag
Establishing a territorial diagnosis
Wat-A-Game
Modeling a role-playing-games



Just-A-Grid
Discussing justice principles



Cooplan
Building action plans



Encore-Me
Evaluating impacts

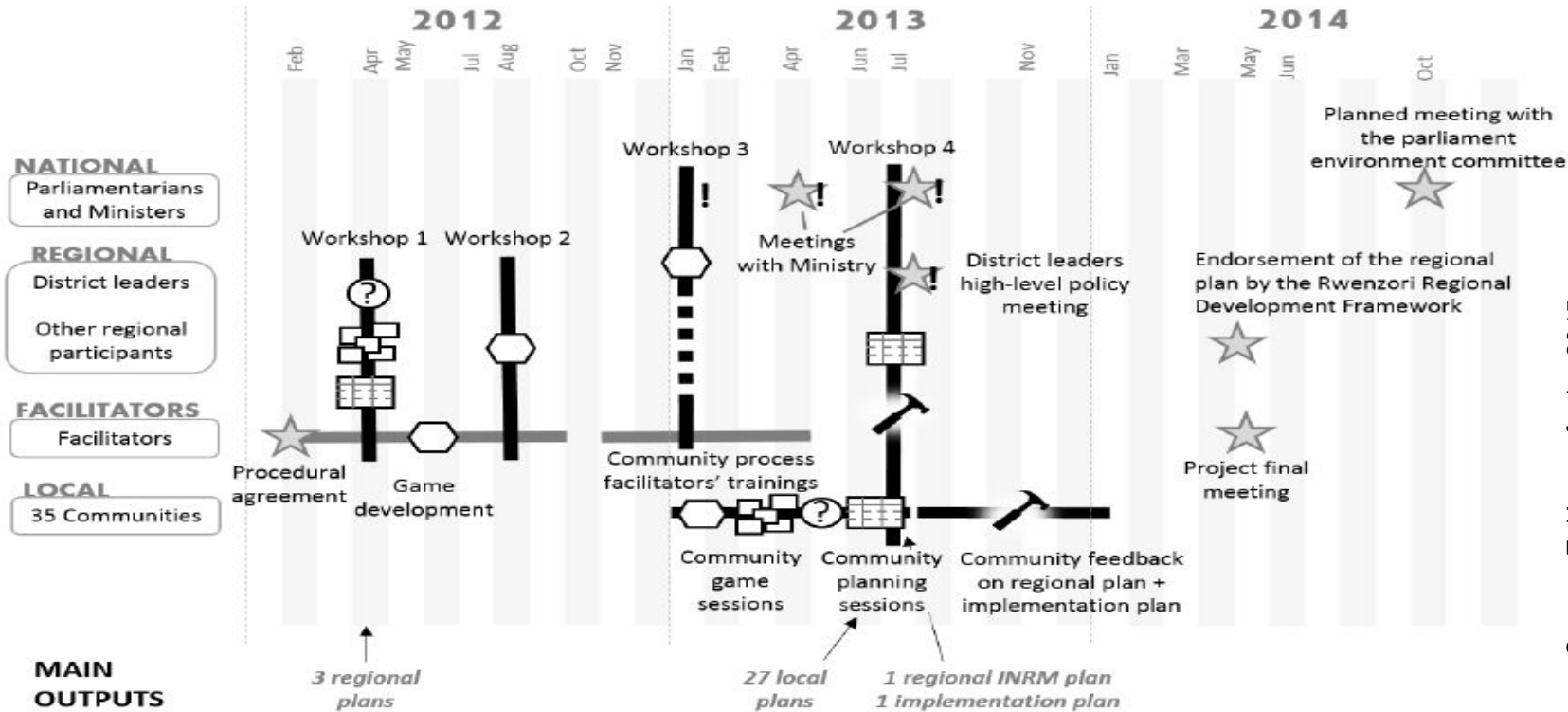


Ex. in Uganda (2012-2014)



COOPLAGE

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





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

Fogera (Ethiopia) *Agriculture intensification and soil degradation in uncertain land tenure context*

Procedural agreement **Focal issue** **Actions identification** **Planning** **Role-playing-game** **Implementation plan**

Rwenzori (Uganda) *Proposal and validation of INRM plan in context of overexploitation of land and resources*

Source: E. Hassenforder, 2015

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

Process
Justice / equity



Actions & plans
as a system



Situation
Management



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Typical process in co-creation of action plan



Interreg
Alpine Space
SPARE
EUROPEAN REGIONAL DEVELOPMENT FUND



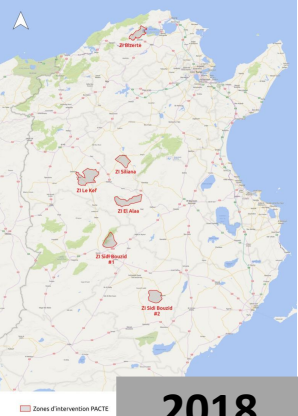
Drôme,
France

INR

Using CoOPLAN for Drôme water plan, France

COOPLAN co-creation of a complex action plan





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

DIAGNOSIS

PLANNING

IMPLEMENTATION

- Forming teams
- Engaging local stakeholders

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

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

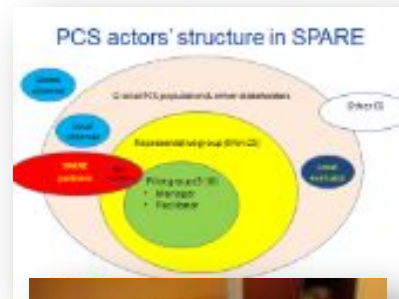
- Translating action plans into investments
- Implementation

30/11/23 !



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





Pêcheur

Elevage

Gestionnaire











Toward Adaptation: Which role for Science ?

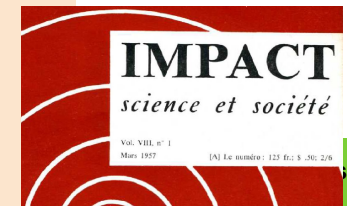


Urgent need for CHANGE is acknowledged (in / of / for socio-environmental systems) and known by policy makers:

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) ?



Authors



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Scientists call for a moratorium on climate change research until governments take real action

Published: January 10, 2022 7:12pm GMT

<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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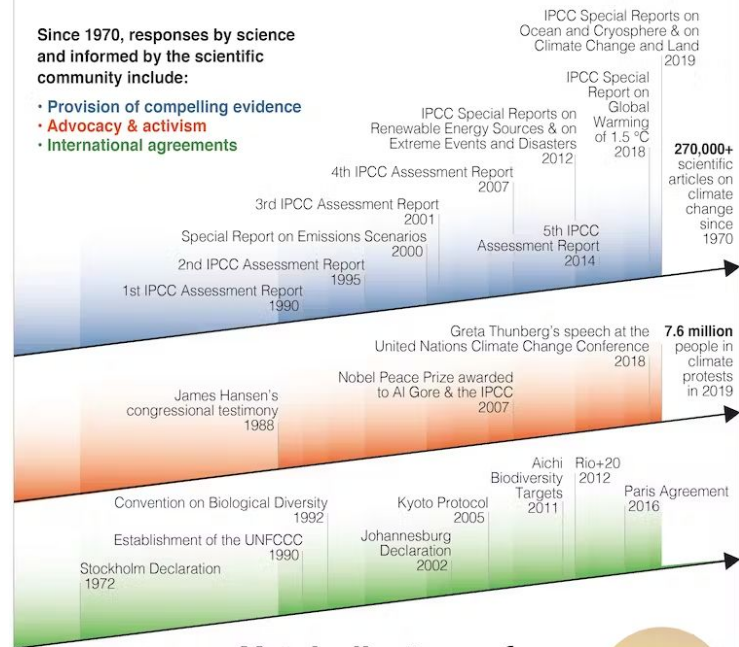
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Global change is occurring

The scientific community has responded

Since 1970, responses by science and informed by the scientific community include:

- Provision of compelling evidence
- Advocacy & activism
- International agreements



Yet, indicators of adverse change continue*

0.26 °C	Change in global mean surface temperature (relative to 1850–1900)	1.0
14.65 GtCO ₂	Global fossil CO ₂ emissions	36.6
6.0 Billion global hectares	World ecological footprint of consumption	20.6
1.0 Index value	Living Planet Index	0.6
1970		2010 2014 2018 2019

* Sources: IPCC 2018; WWF 2018; Friedlingstein et al. 2019

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”

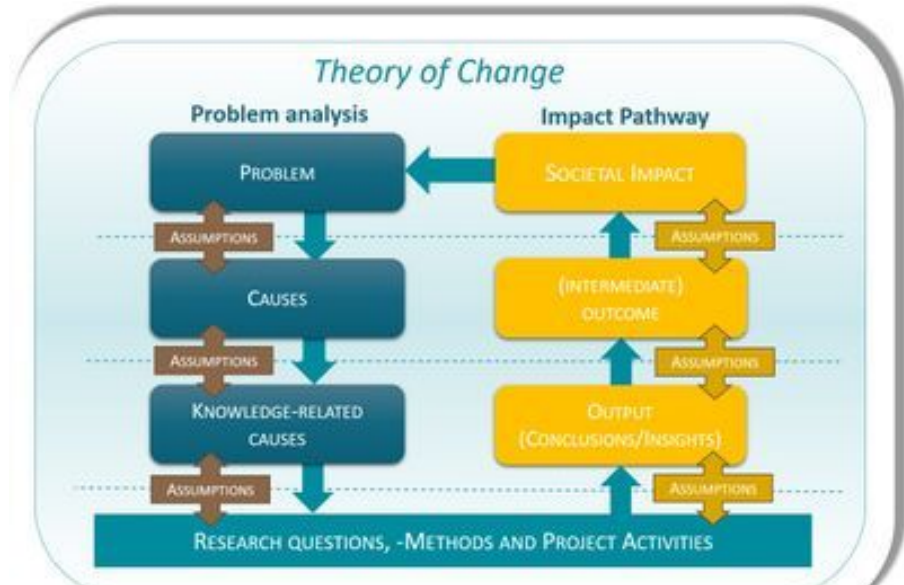


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A copernician revolution for “classical” scientists: endorsing societal impact !

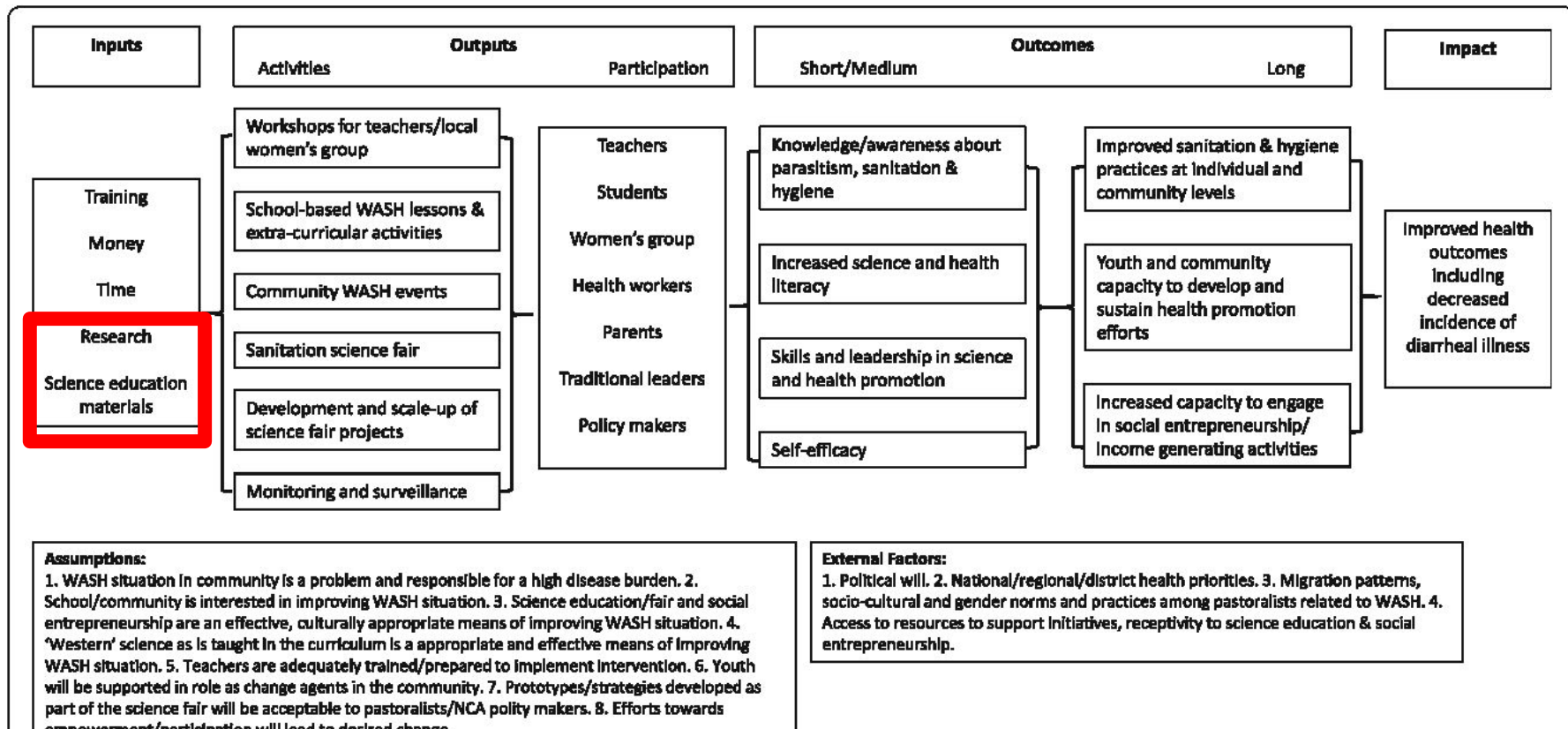
- (re)Consider & endorse impact
 - Impact pathway assessment
- Change posture
 - Take the transformation due to knowledge as the topic
 - Or the knowledge on the transformation challenges
- Reckon extended roles of stakeholders in / by research
 - To be specified. To be agreed. See below.
 - Accept the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



e.g. Impact pathway of participatory WASH process



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)

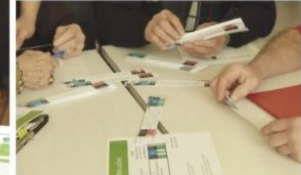
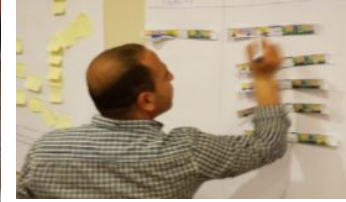
But scientific activity (« production ») is a **social process engaging various people** (multidisciplinarity, gender & age, countries, status incl. students, technicians, « guinea pigs », funders) inside and outside the labs

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

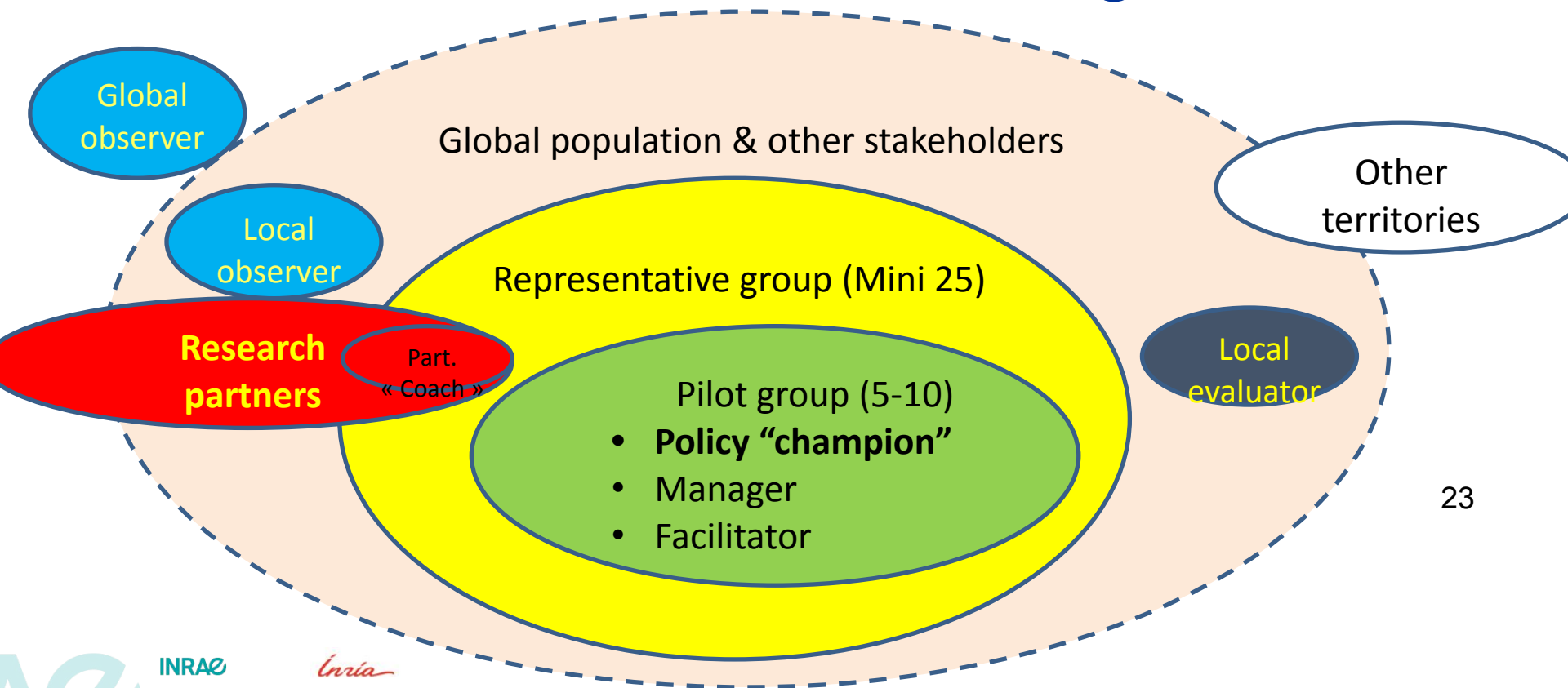
family, society, health, education, business, work conditions, strategic development, **policy making, politics**, public affairs, commons, media, science, *innovation*

INRAE

“Lay people” in action & research... → Roles ?



Actors' structuring



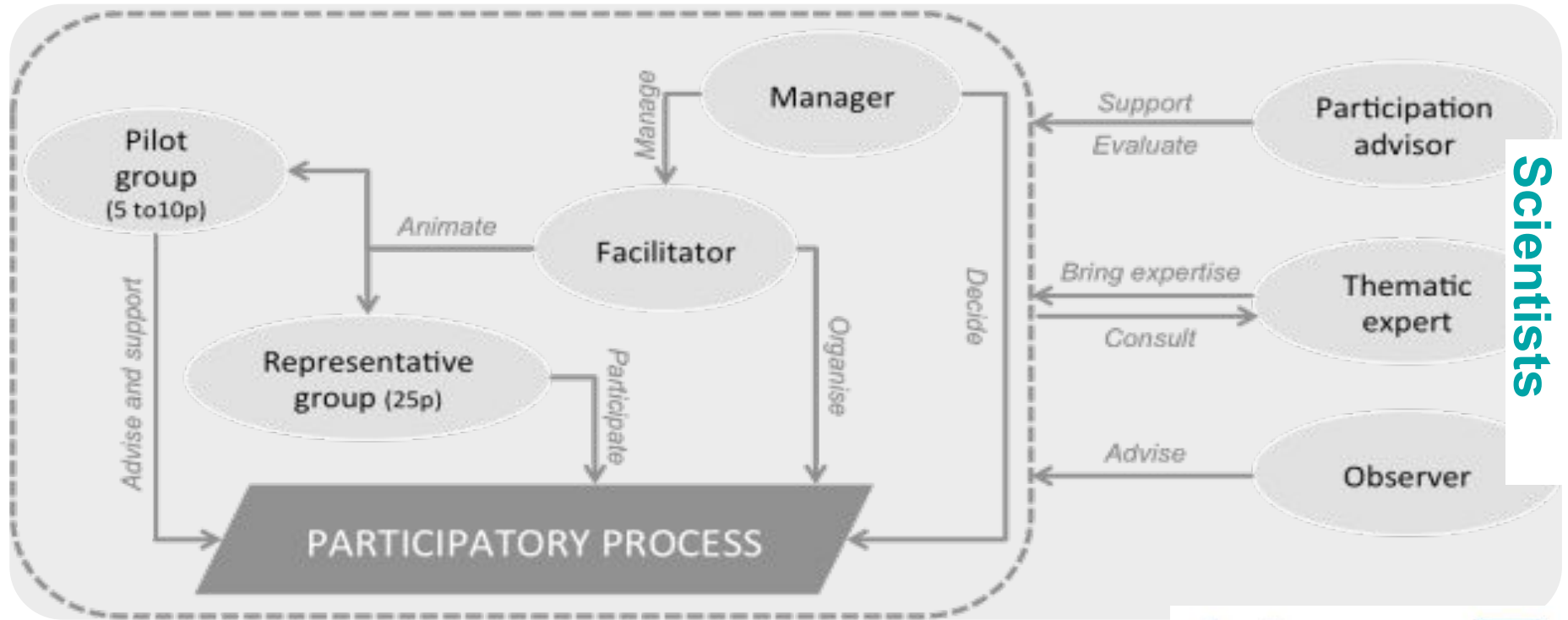
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Roles in co-creation processes ?



Scientists



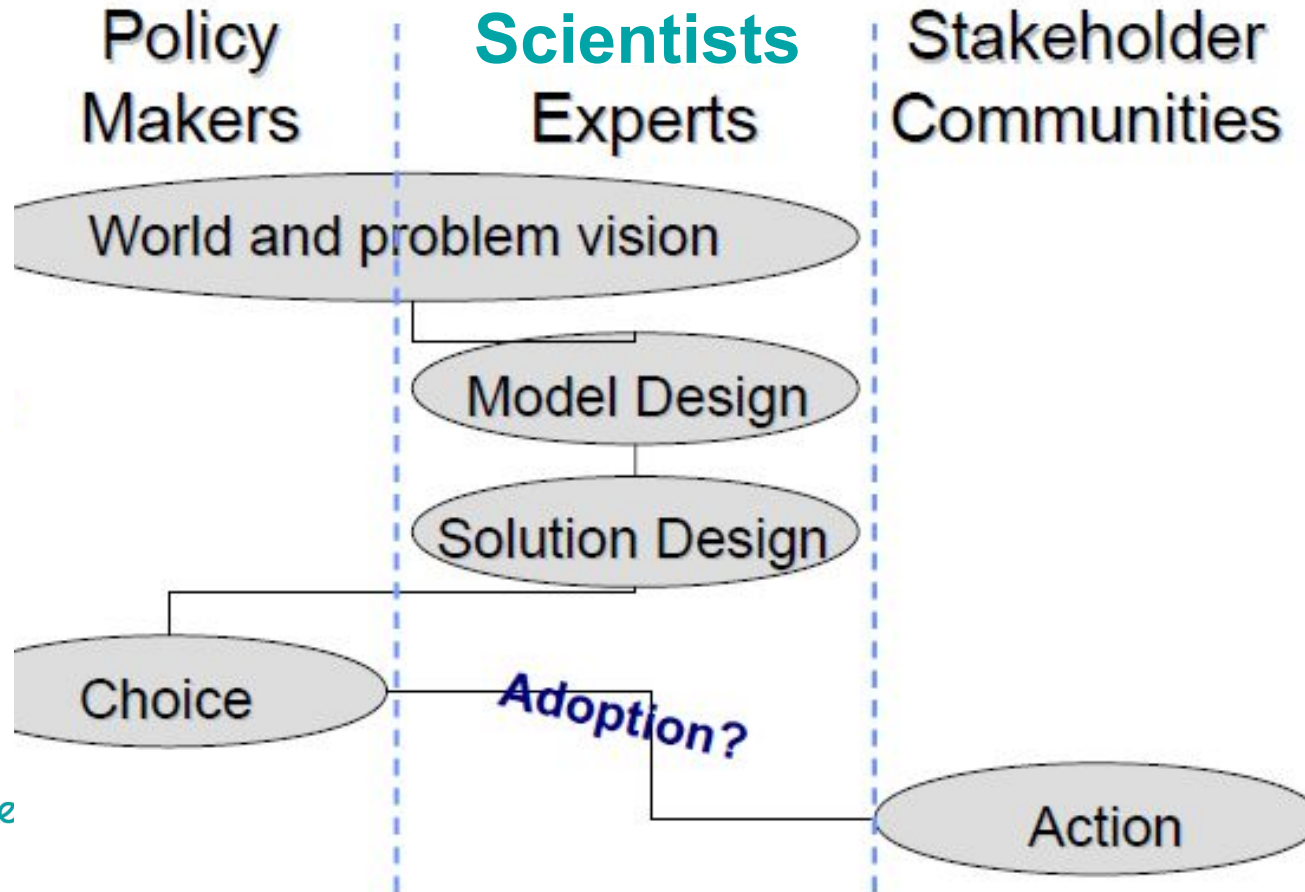
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INRIA

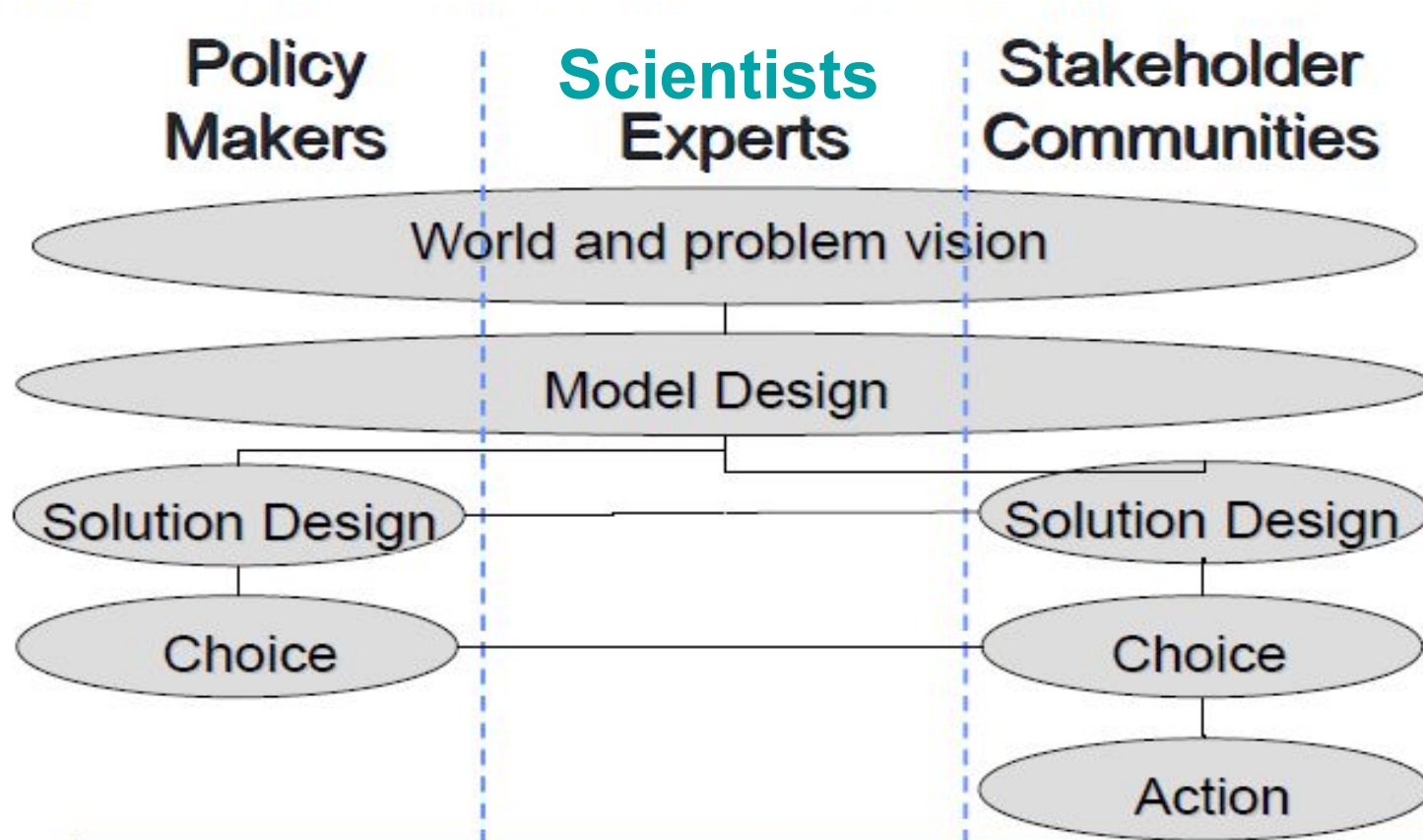
nils.ferrand@inrae.fr / nils.ferrand@inria.fr



The standard model of policy design: acceptology



... toward co-design & implementation

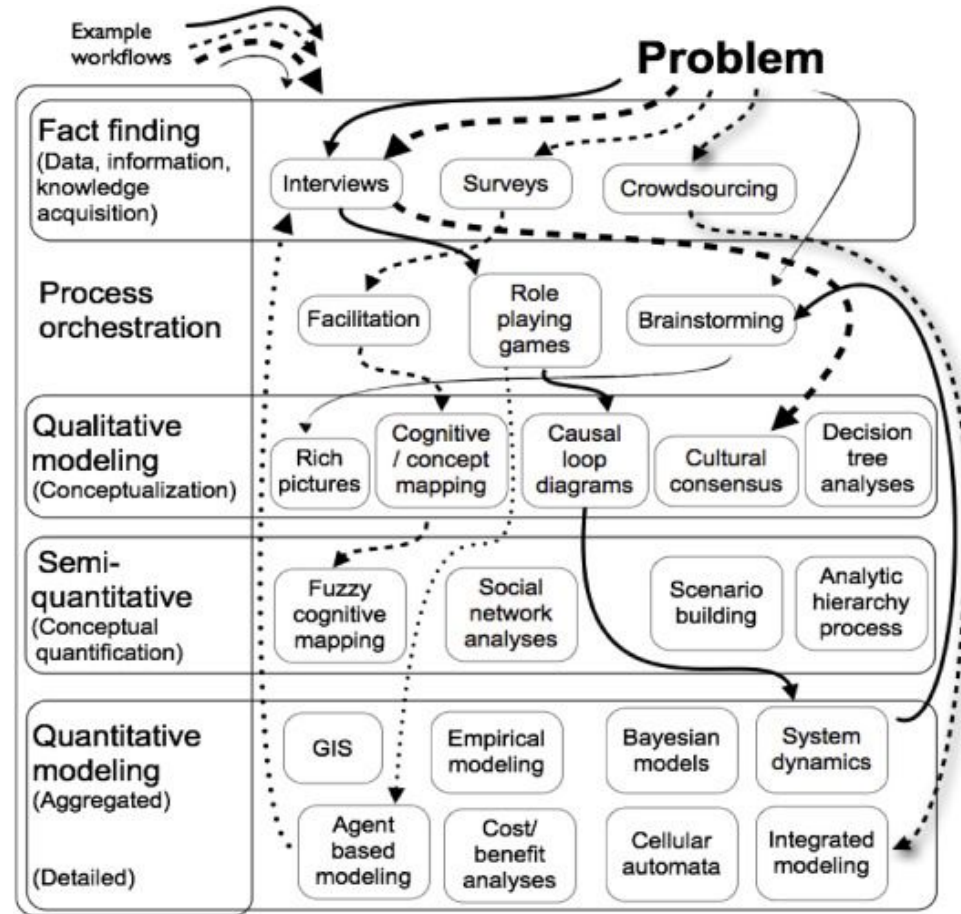


Co-designing = participatory modeling

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

- knowledge structuring and discovery
- social transformation

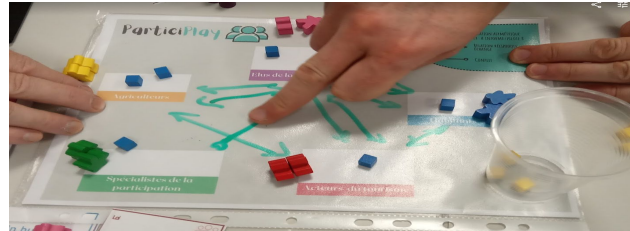
Our challenge → which meta-models / methods ?



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>.

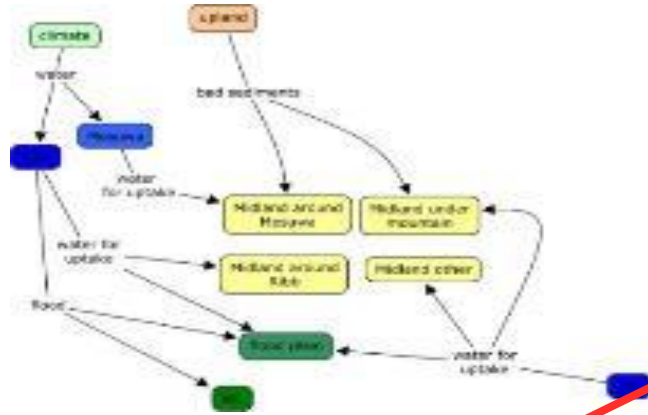
- **Models as:**
 - Boundary **objects**
 - Rationalization substrate for decisions and policies
 - Imaginaries about the world and the future
 - Support for simulation!
- **Modeling as:**
 - A social learning process (transformative by itself)
 - Co-construction of imaginaries and social norms
 - Boundary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



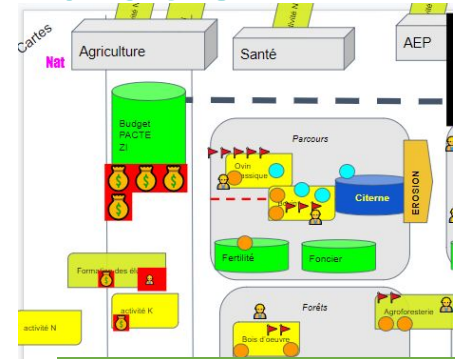
Opening the process of modeling & simulation



Stakeholders' inputs



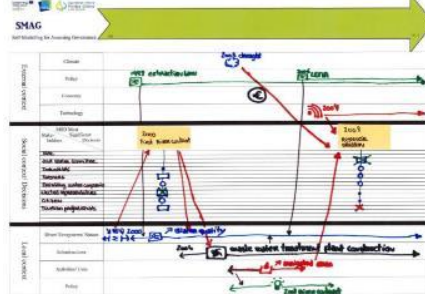
Co-Modeling



Computer simulation (multi-agent / syst. dyn)



Role playing games



Building on Companion Modeling

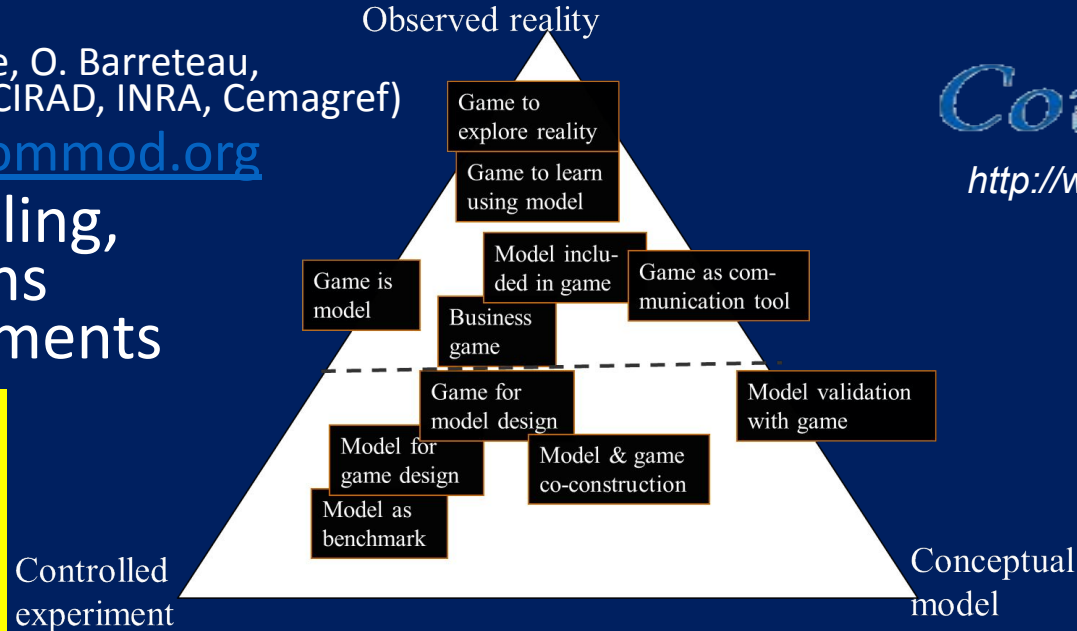
- Participatory modeling & simulation coupled
- A different “posture” which legitimates all points of view, even when they are contradictory, and reliaise science, society & policy
- Developed and structured since 1993 by a group of (French) researchers

F. Bousquet, M. Etienne, O. Barreteau,
C Le Page, M. Antona (CIRAD, INRA, Cemagref)

- <http://www.commod.org>

- Coupling modeling,
field interactions
& social experiments

- 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)



Commod

<http://www.commod.org>

⇒ 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

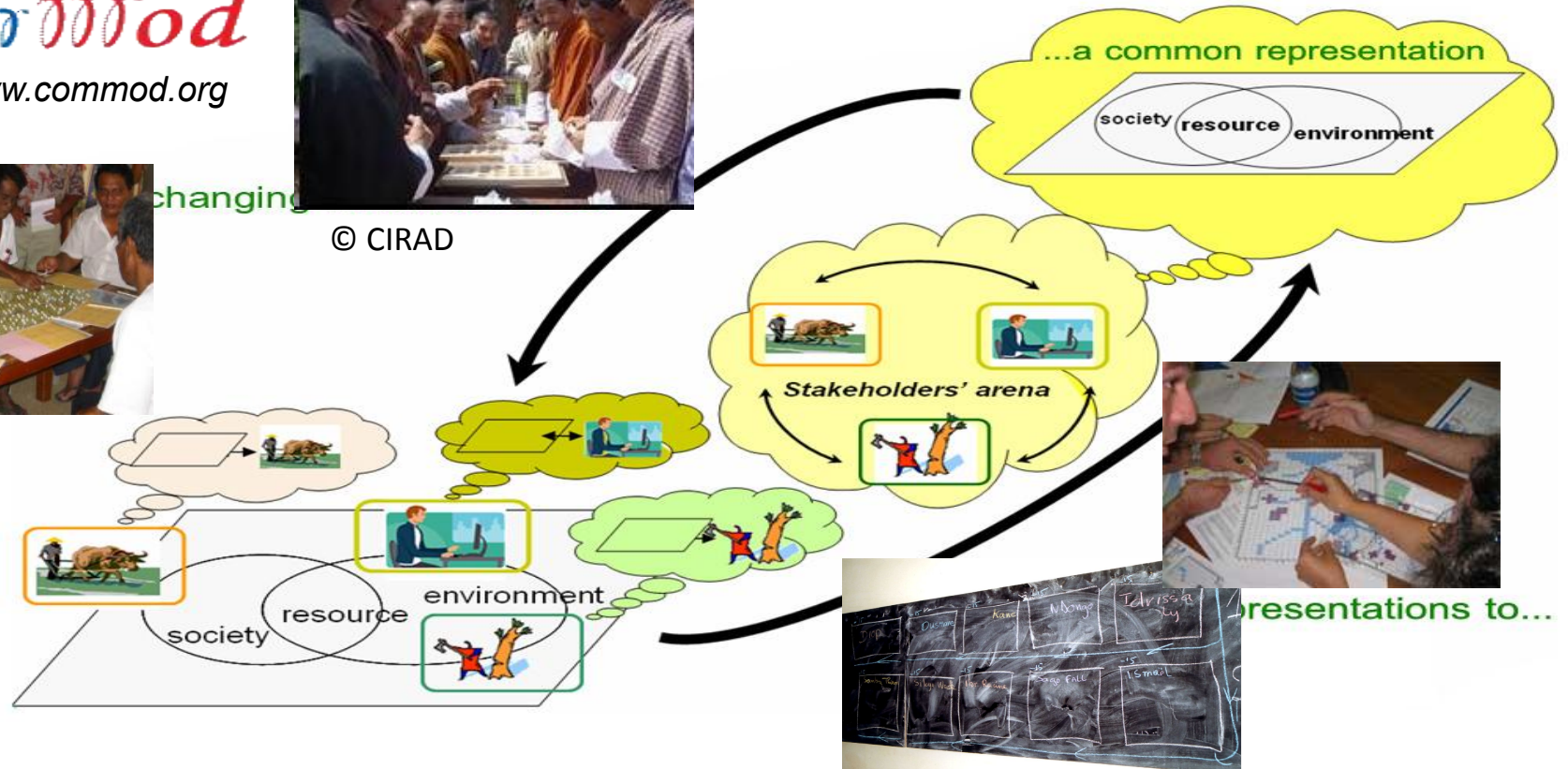
<http://www.commod.org>



© CIRAD



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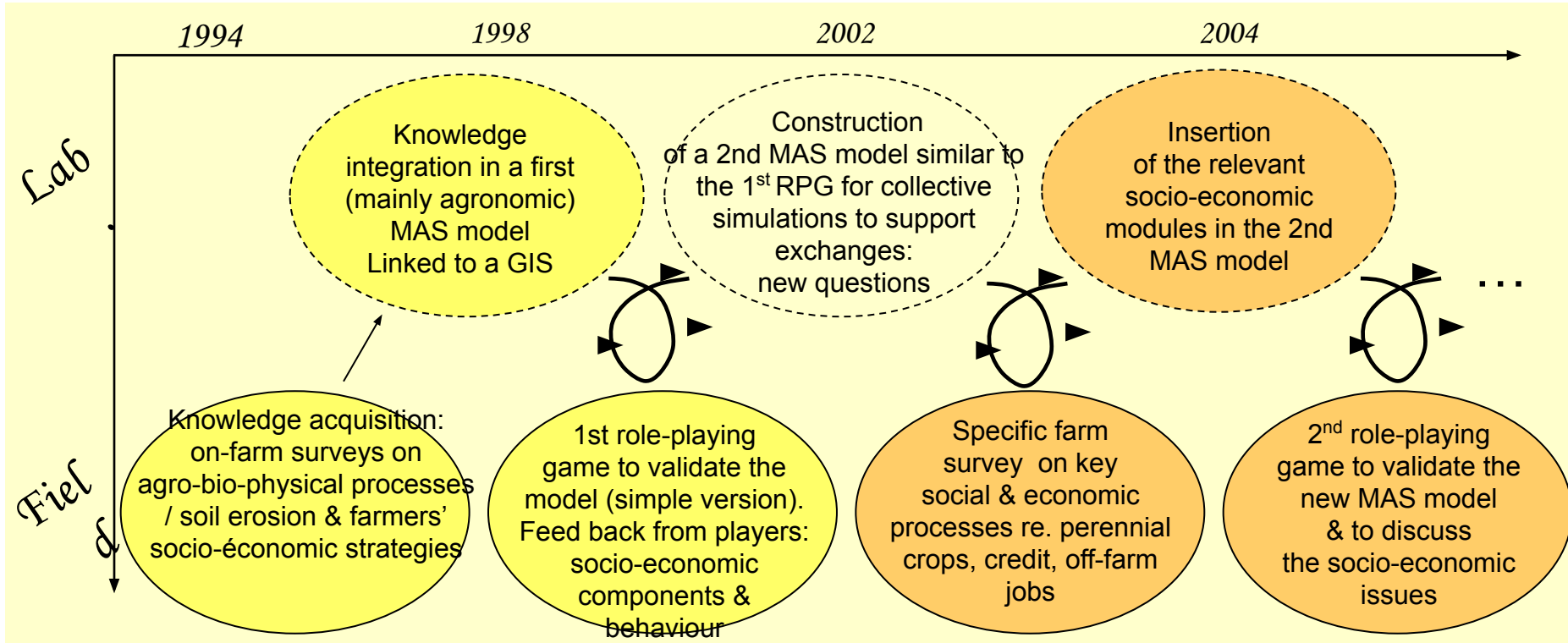
presentations to...



© CIRAD

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>





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

Experiential learning & multimodal communication

CLUG (Feldt et al. 1972)

STAR POWER (Shin, 1969)

Scoring

Tradin

HEX (Duke, 1978)

Project DIALS (Crookall, late 1980s)

SNUS (Duke et Cary, 1975)

ComMod

Observation manual for collective serious games

William's Daré, Emeline Hassenforder, Anne Dray
For the ComMod group

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.

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 !*



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”



Our approach

Decision-making steps

PREPARE PARTICIPATION

DIAGNOSIS

SCENARIO EXPLORATION

DEFINITION OF OBJECTIVES AND PREFERENCES

IDENTIFICATION OF ACTIONS AND PLANS

CHOICE, PRIORISATION AND VOTE

IMPLEMENTATION

MONITORING AND EVALUATION

Citizen's perspective



We will respect our own rules



We know what is happening around us



Now we understand the big picture



We know what we want



We, too, have good proposals to make



In democracy, our voice count



Let's do it!



Are we getting there?



Participatory tools

PrePar
Preparing design of the decision process



Rock
Observing the river



Smag
Establishing a territorial diagnosis
Wat-A-Game
Modeling a role-playing-games



Just-A-Grid
Discussing justice principles



Coplan
Building action plans



Encore-Me
Evaluating impacts



Ex. in Uganda (2012-2014)



COOPLAGE

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



Wat-A-Game



Modeling & role-playing-games



Just-A-Grid



Discussing justice principles



Encore-Me



Evaluating impacts



Cooplan



Building action plans



SMAG



Self assessment of past governance

Scoolplaage



Learning by doing



A wide scope of participatory modeling

Socio-environmental systems
Evolution, adaptation, management

Decision planning
Governance systems

Actors and power
Past governance

Strategic planning
Stakeholders engagement

Participatory observation

CoOPLAaGE

Social justice
Principles

Implementation plans

Expected process and impact
Monitoring and evaluation

Co-creating participatory processes

- ~ PrePar Participatory design of... participation plan
- ~ RePar Participatory design of... participation research

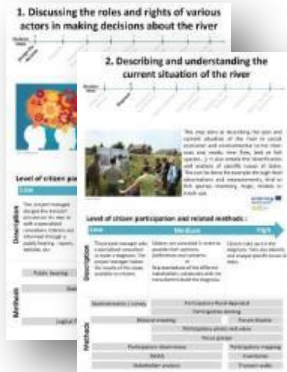
Clarify objectives

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!

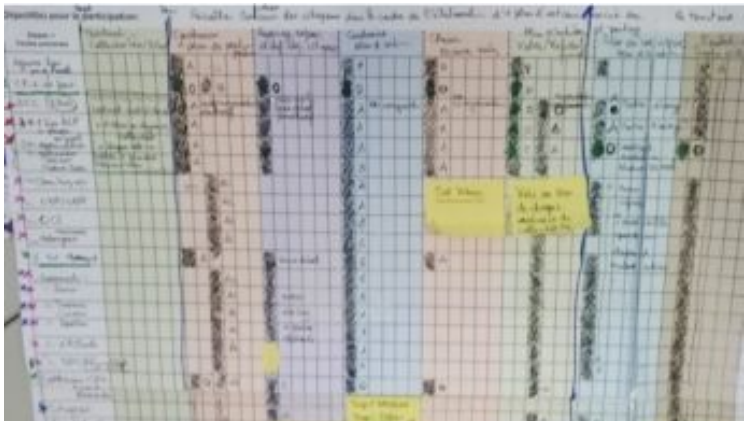
- Trigger, steer
- Analyze
- Request
- Inform
- Propose
- Observe (measure)
- Negotiate, decide
- Discuss, debate
- Experiment, test
- deVelop
- Gather
- Write
- Fund
- ...others to be discussed and chosen...

Trans-Sciences & Multi-Actors/Issues/Scales Action Research Processes
An exploratory workshop

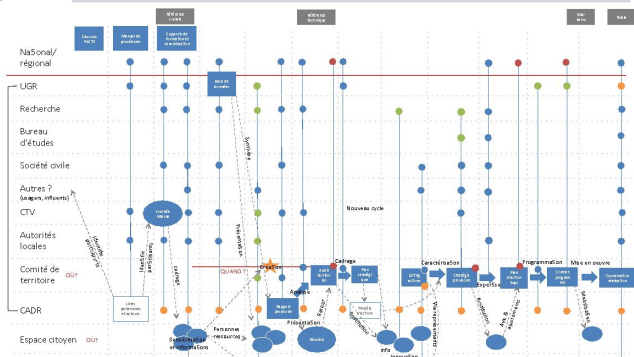
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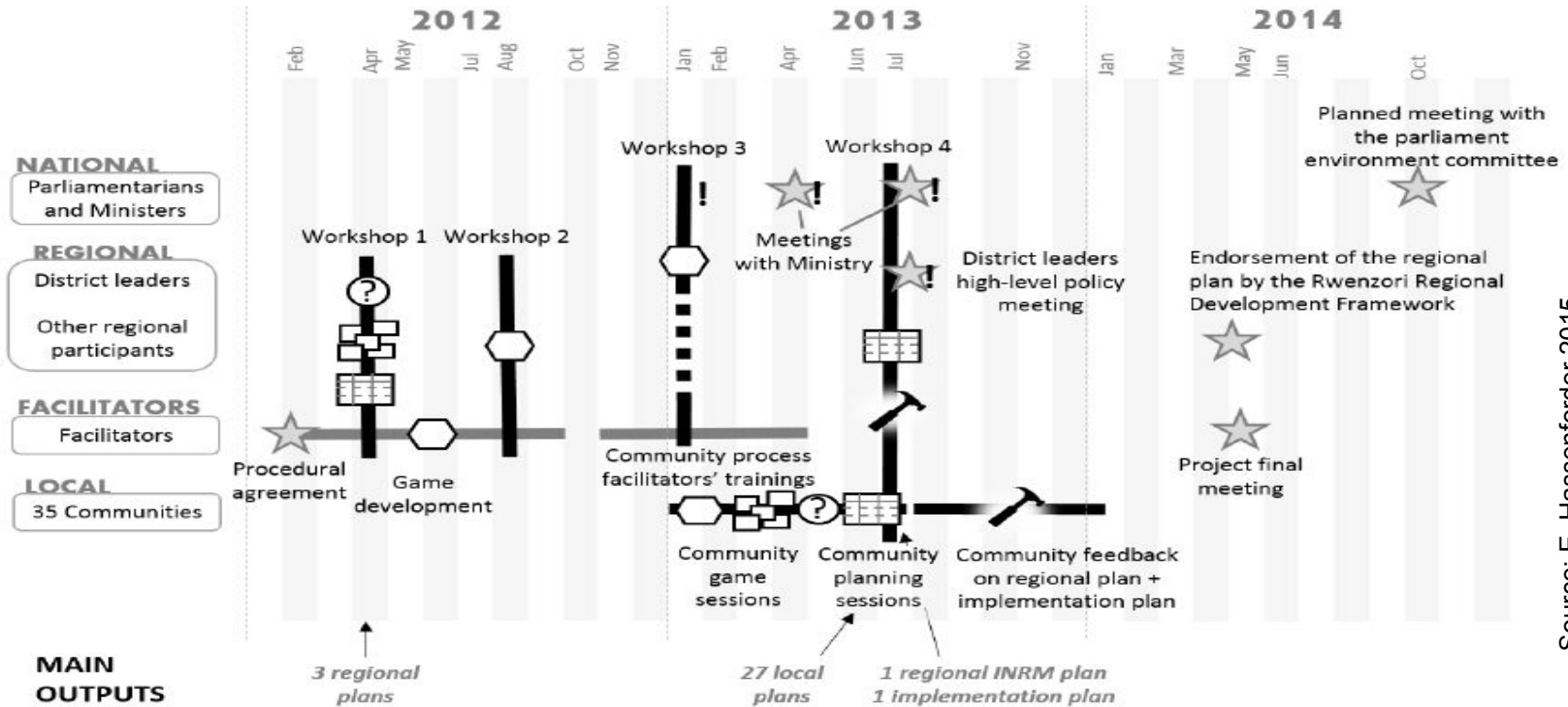
* Emeline Asselineau, Patrice Gaurin, Coralie Abram, Sabine Girard, Elvira Baud, Raphaël Couron, Sylvie Morellet, Benjamin Houry, Sarah Louati, Patrice Robin, Laure Soguel, Julien Baret, Hedi Lombard-Luciani, Anthony Duvell, Caroline Lohr, Stefano Parodi, Olivier Barthelemy, Audrey Richard, Stéphanie Besson, Mélanie Accouze, Pascal Bouffier, Clémence Kibouché, Wanda Aquae-Gaudi, Samuel



Préparation			DiagnoSc			Planification			Mise en oeuvre		
Lancement	Pilotage et orga	Formation & sensibil	Pre-diagnostic	collecte d'infos terrain	Synthèse diagnostic	Cadrage du plan	Propositions d'actions	Mise en stratégie	Expérimentation	Contrat programme	Mise en oeuvre



Model of the Ugandan process

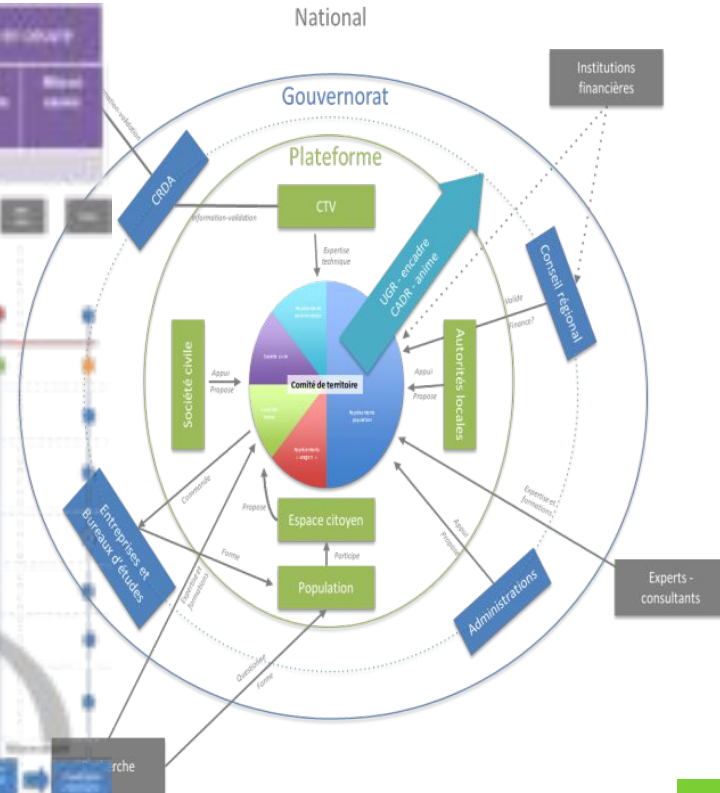
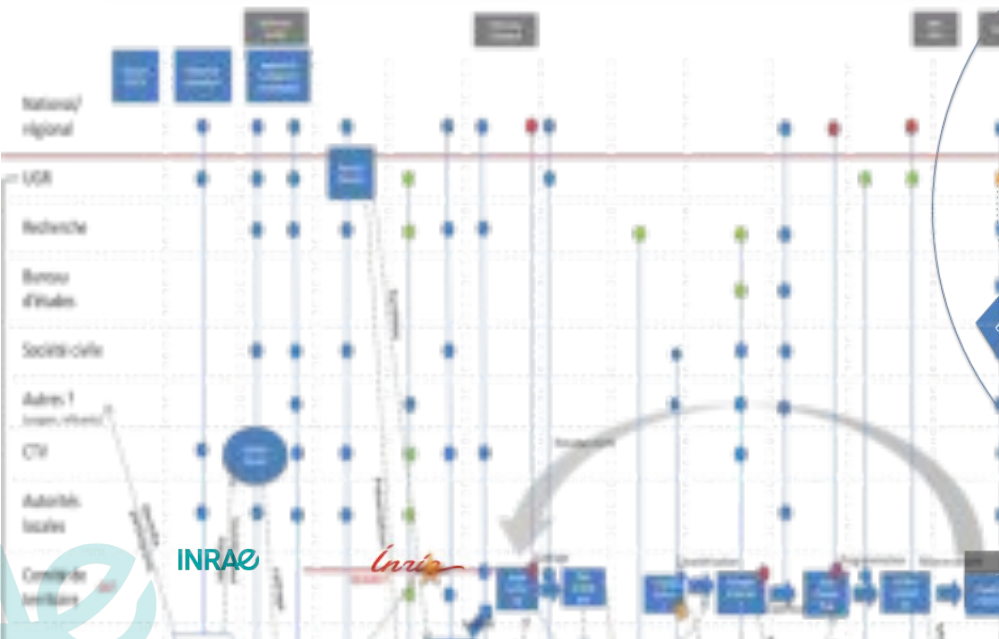


CAPTION

- ★ Discussion, meeting (including Procedural agreement Phase 1)
- ⊙ Focal issue (Phase 2)
- ⊞ Action proposal (Phase 3)
- ⊞ Planning (Phase 4)
- ⊞ Test of the plan using game (Phase 5)
- ⊞ Implementation plan (Phase 6)

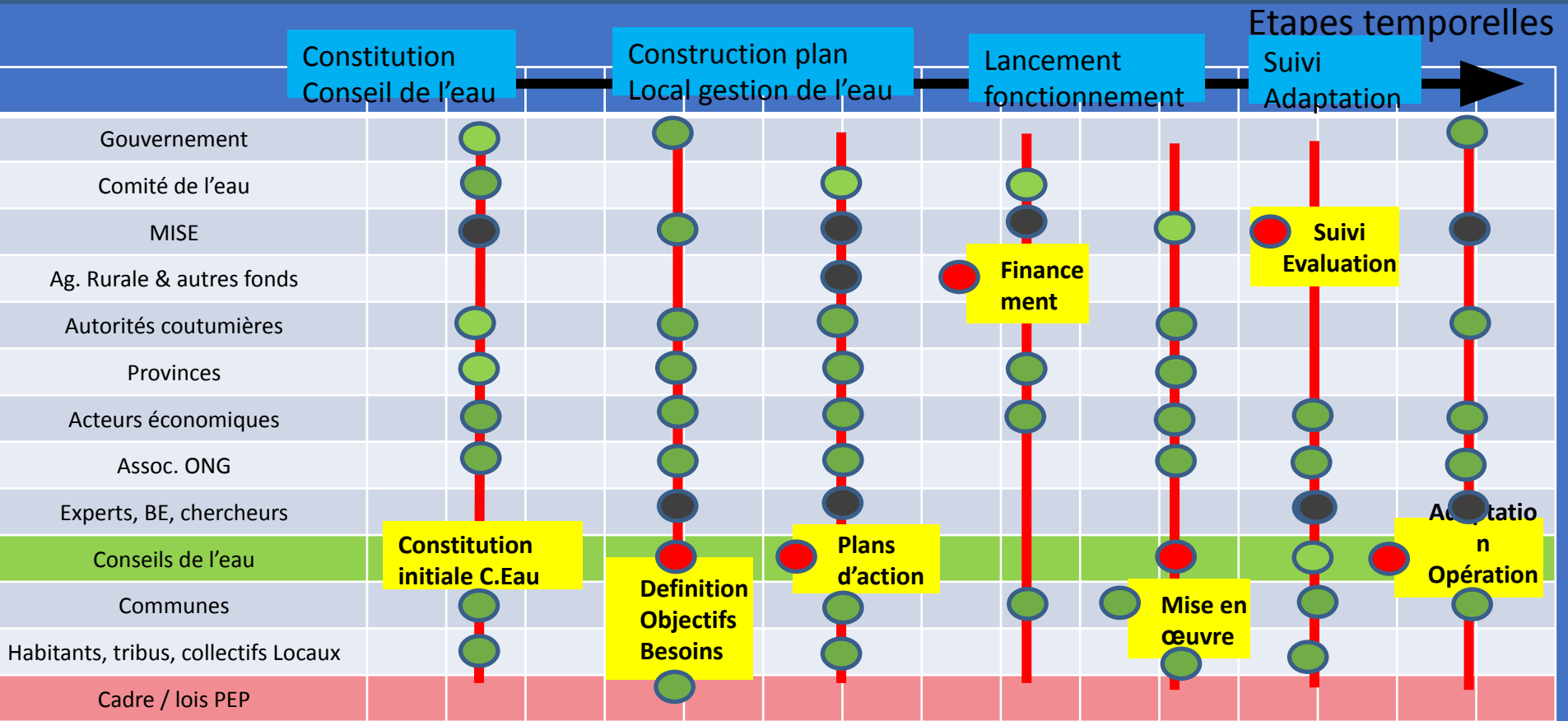
Tunisia (PACTE AFD CIRAD) Dual modeling of process & governance structure

Préparation			Diagnostic			Planification			Mise en œuvre		
Levée des besoins	Plan de travail	Validation des outils	Reconnaissance	Élaboration d'un état des lieux	Justification du projet	Définir le périmètre	Préparer le budget	Mettre en œuvre	Établir les relations	Contrôle des progrès	Mettre à jour



INRAE

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 / Relational / Equity (Ferrand, Le Bars, 2004)
- Toward endo-evaluative participation

OUTCOMES	
ADAPTIVE NRM INSTITUTIONS & ORGANISATIONS	
NORMATIVE / DECISIONAL	Rules, norms and decisions taken by the stakeholders (Indiv collec / formal and informal / at the central, regional or local levels): sanctioning, conflict resolution mechanism , monitoring, etc.
COGNITIVE	<ul style="list-style-type: none"> * Knowledge about the SES and perception of the problem * Goal / Expectations * Commitments * Organizational identification * Innovative ideas / new decisions / agreements
OPERATIONAL	<ul style="list-style-type: none"> * Behavior / Practices / Actions. * Capacity to act. * Discourse vs. actual behavior and time between the 2.
RELATIONAL	<ul style="list-style-type: none"> * Relations among stakeholders / org", gpps (trust/conflict) * Relational / social learning (about oneself and others) * Authority / Power * Frequency of the interactions * Multi scale
SOCIAL JUSTICE	

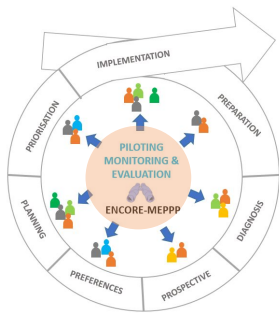
Methodology

**Co-constructed
Mixed-methods
Applied
Engaged**



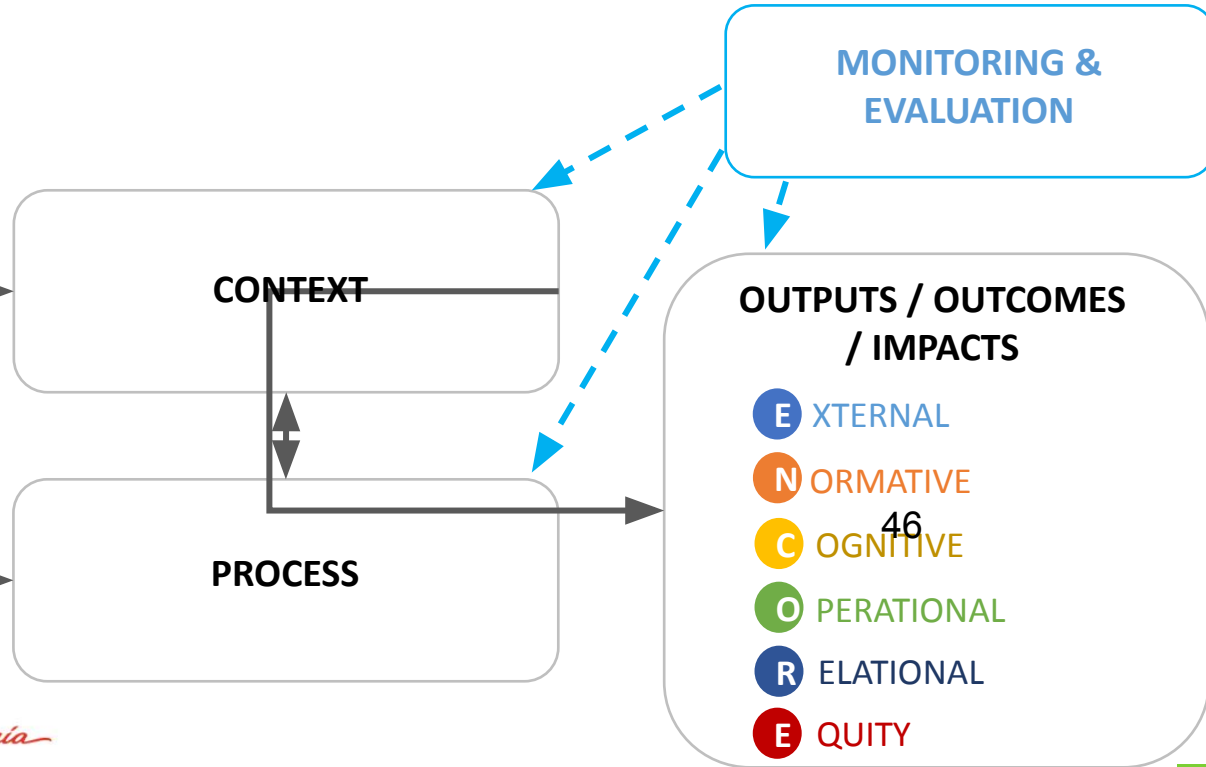



- Document review
- Interviews
- Questionnaires
- Participant observation
- Attendance lists
- Pictures & videos



The ENCORE-MEPPP tool

for monitoring & evaluation & steering

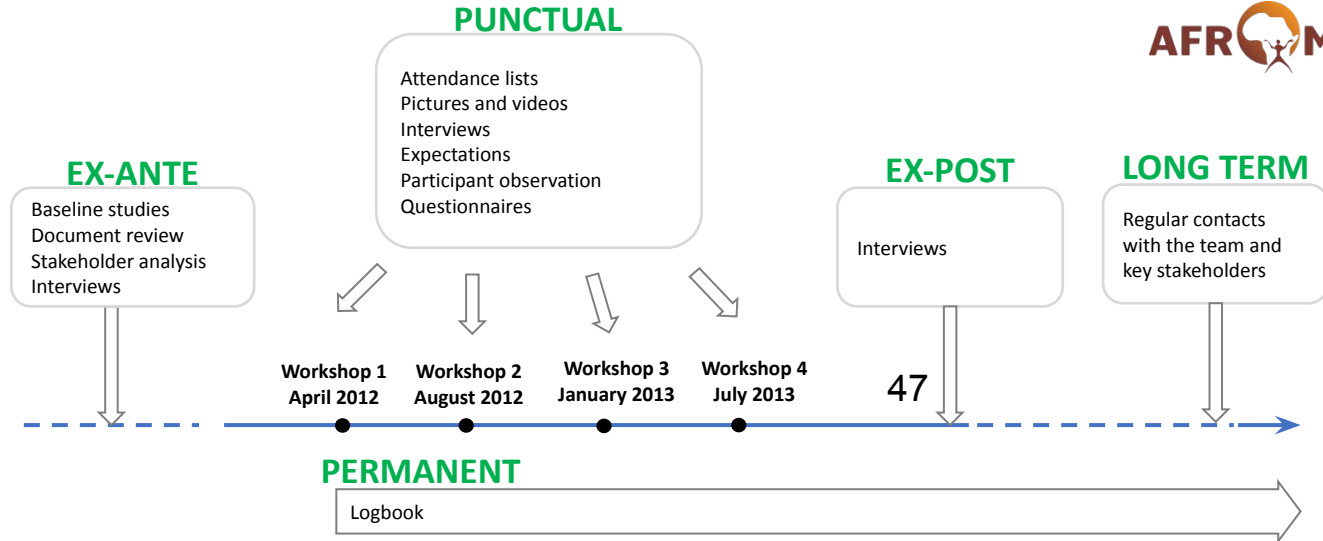
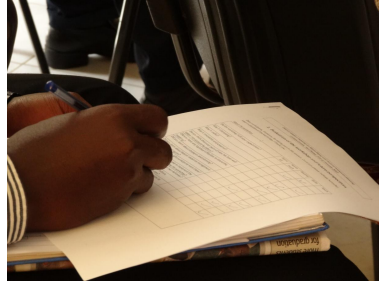
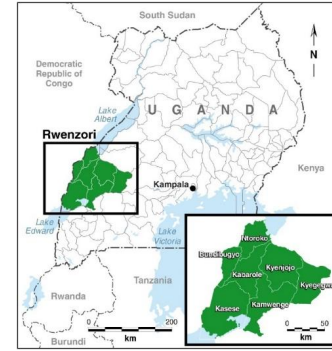


- [2006] Ferrand, N., & Daniell, K. A. **Comment évaluer la contribution de la modélisation participative au développement durable ? Séminaire DDT**. Lille, France.
- [2015] Hassenforder, E., Pittock, J., Barreteau, O., Daniell, K.A., Ferrand, N., **"MEPPP Framework: A framework for monitoring and evaluating 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](#)

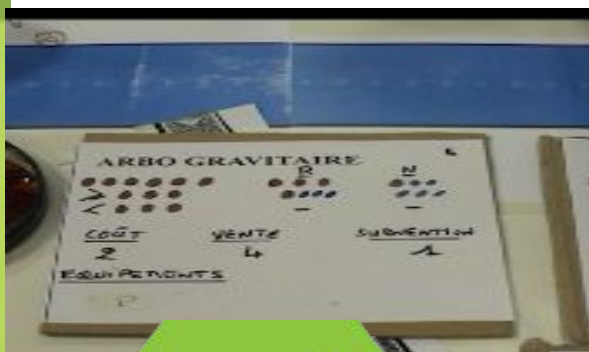
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Example of using ENCORE-MEPPP in the Rwenzori, Uganda

2012-2015



COOPLAAGE





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



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The Crea-WAG tool

Participatory modeling toward transition tools

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



Functional mapping



Design by playing !

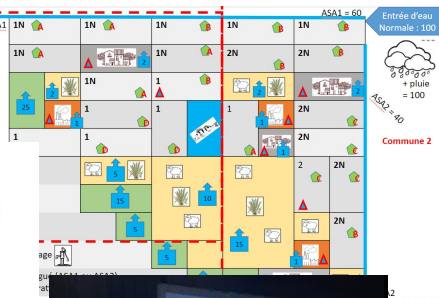
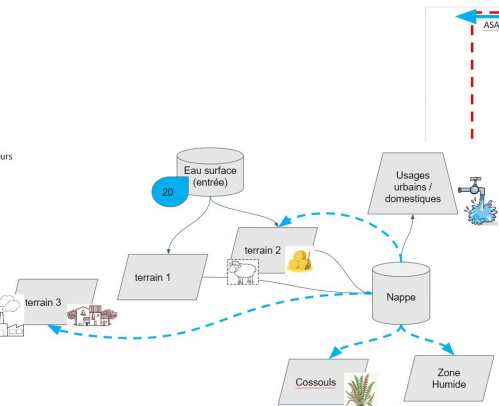
- At this stage, it is possible (and good) to try the game
 - start placing post-its on the game-board
 - try to circulate resources, even if the calibration is not done

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

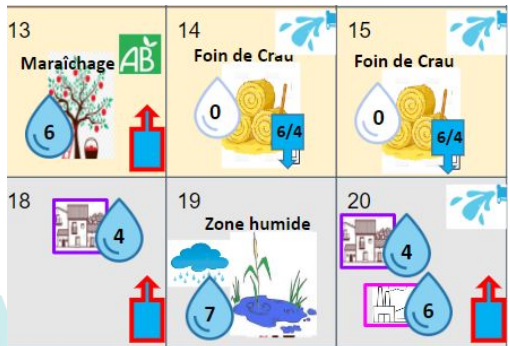
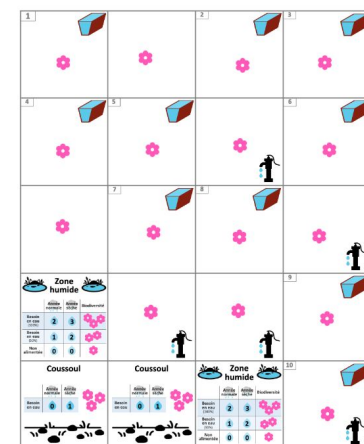




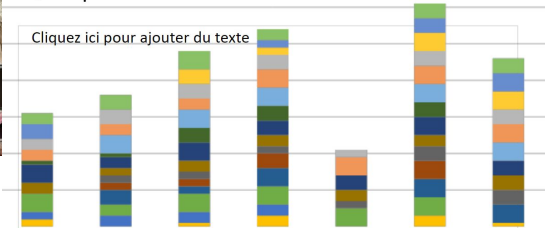
Crea-WAG in the Crau Watershed management



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



Quelques résultats d'évaluation



WAG-ing the Inn (Switzerland)





> 180 cases



Example of using CoOPLAN in Drôme, France

3 months (Jan-March 2018)



PROCESS

Online collection of action proposals

132 proposals from 75 participants

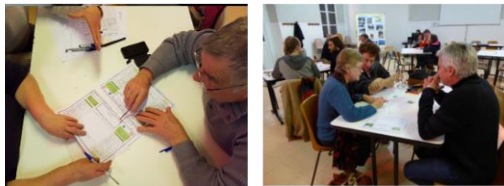


Habitants : proposez vos actions pour les rivières et le bassin versant de la Drôme !

+ expert
assessment

3 Comparative dialog workshops

184 proposals discussed, 41 participants



1 workshop for designing the plans

10 participants

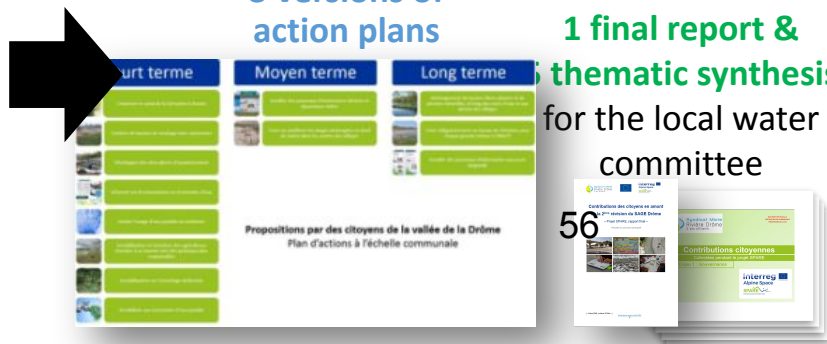


OUTPUTS

189 action
proposals

3 versions of
action plans

1 final report &
thematic synthesis
for the local water
committee



Interreg
Alpine Space

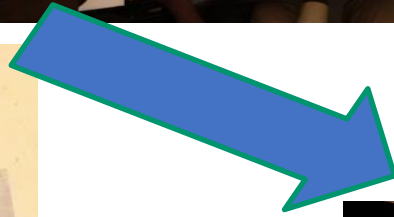
SPARE

Syndicat Mixte
Rivière Drôme
& ses affluents

CoOPLAN in Uganda

27 communities
strategies

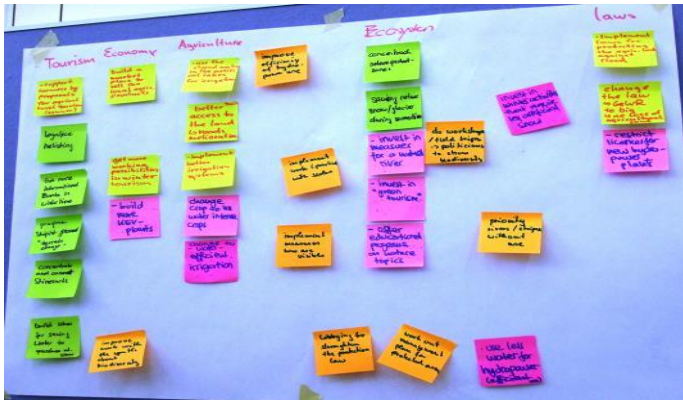
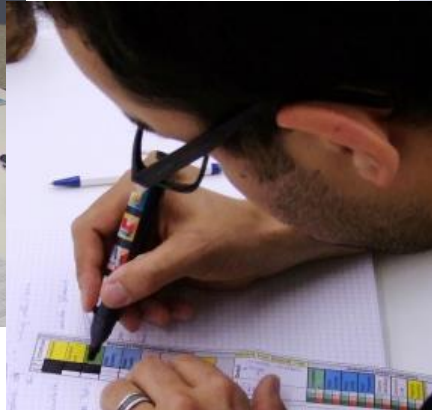
3 meso-level
strategies



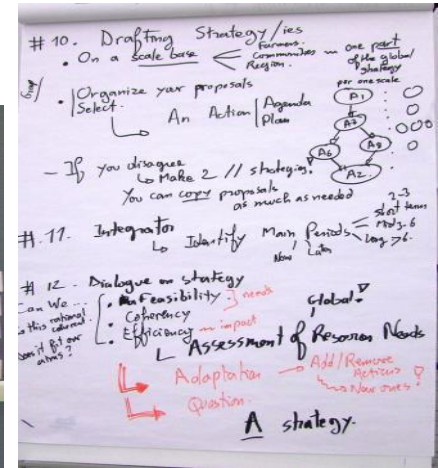
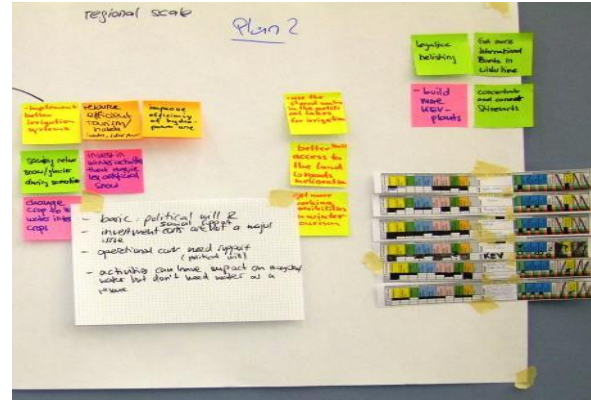
Proposed regional
INRM strategy



COOPLAN-ing the Inn



COOPLAN Integrating Strategies



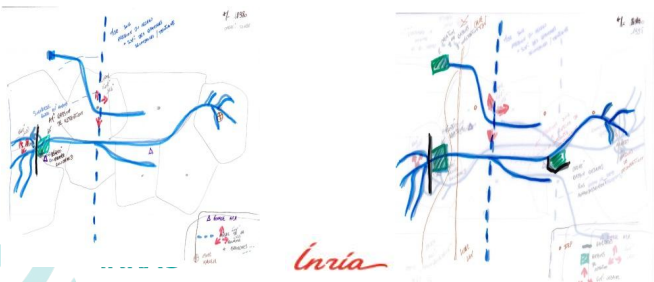
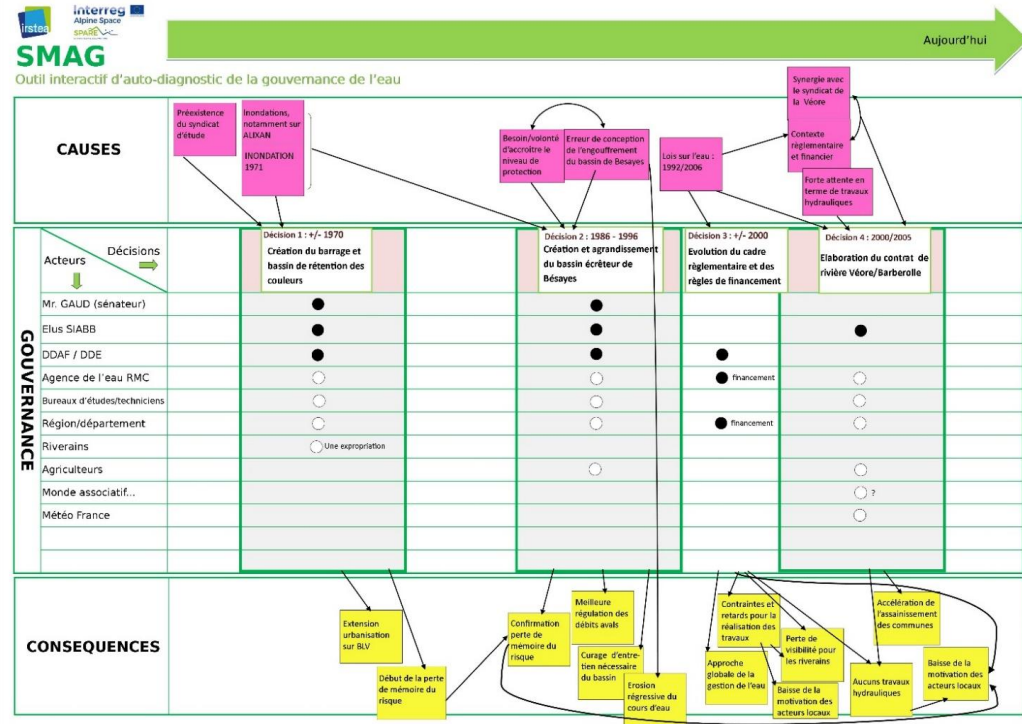
Part. modeling of past governance (SMAG)

France, Barberolle water governance

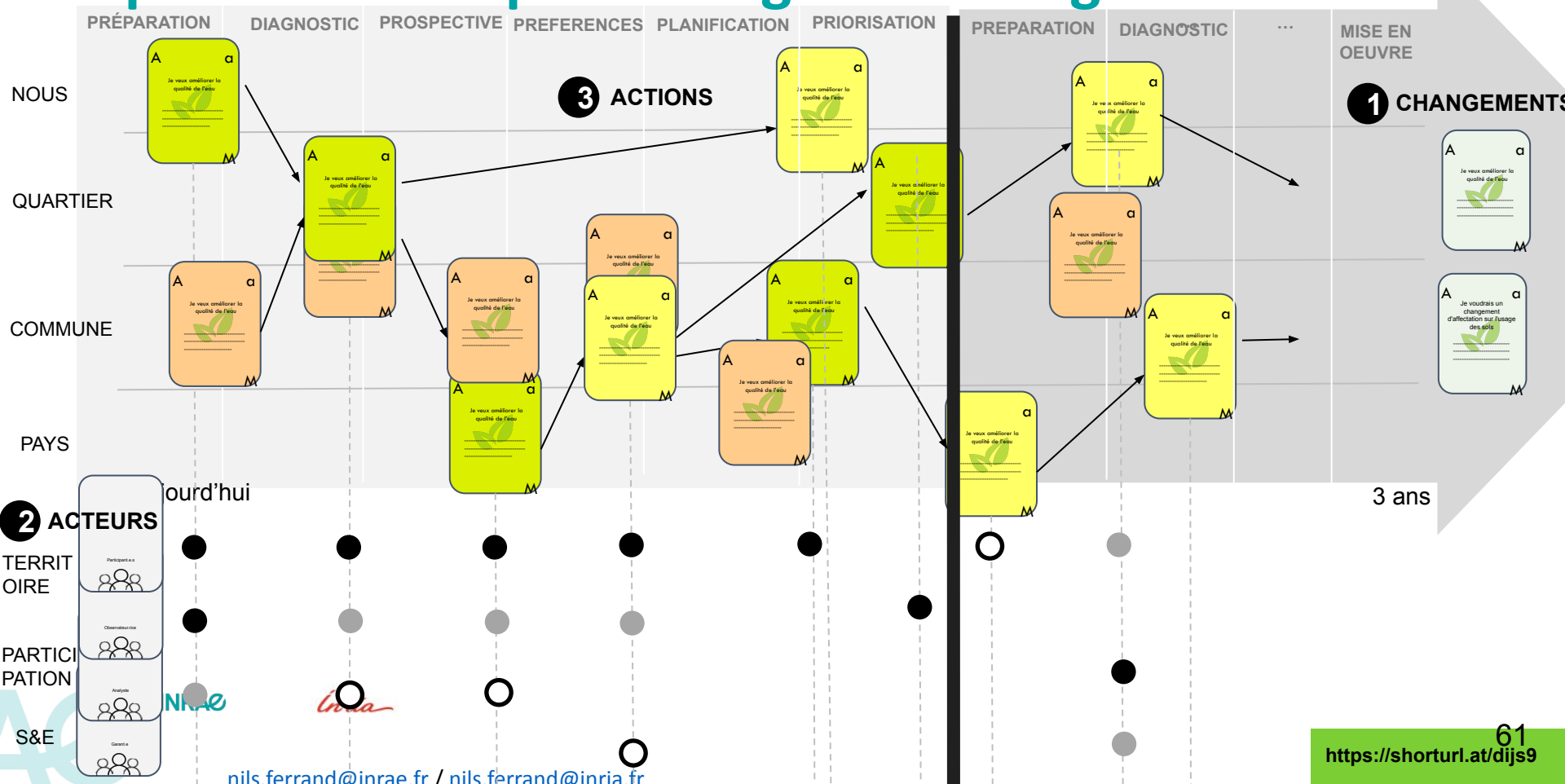


Crédit : Syrine Ben Slimane

Handwritten notes and diagrams related to the water governance study, including a map of the area and various annotations.



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

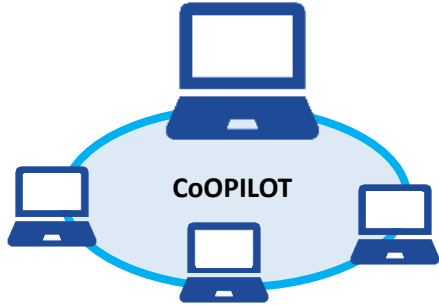


Coupling co-creation arena / stages

CoOPLAGE

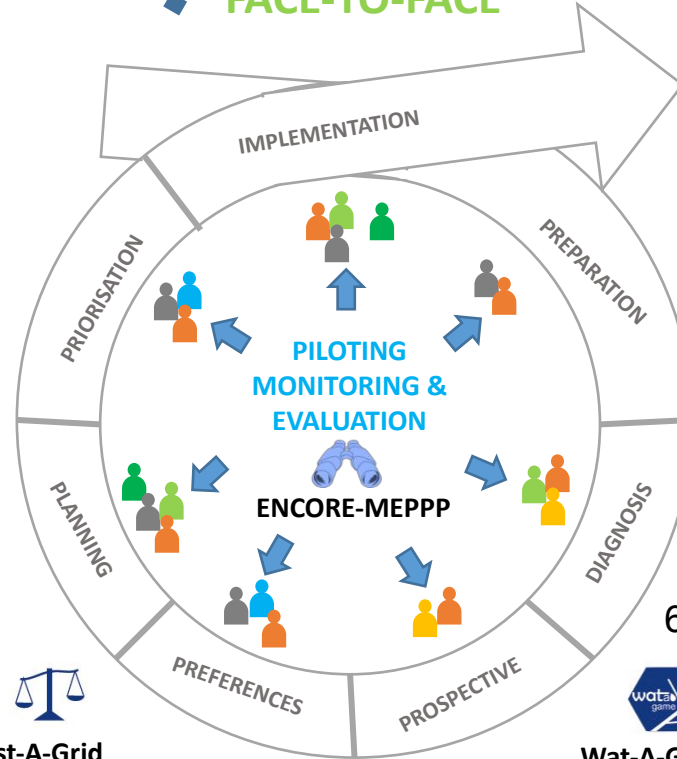
<http://cooplaage.watagame.info>

DIGITAL



Facilitating the process online

FACE-TO-FACE



PrePar

Engineering the participatory process, engaging stakeholders, regulating



ROCK

Discussing and anticipating observation and data needs



SMAG

Analyzing past governance

62



Wat-A-Game

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



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

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“Navigating” ethics & processes

Ethics of Participation

Inclusion, respect,
deliberation, transparency,
accountability

Non evidence
based
Relativism
Manipulation
FakeNews

No consideration
upon possible
impacts

*Méta-
participation*

*Unmoderated
online
debates*

*Citizen
juries*

*Part.
budgeting*

*Citizen
sciences*

*Participatory
planning*

*Participatory
modeling*

*Participatory
research
un-applied*

Acceptology

Experiments

Consequentialist
ethics

Scientific ethics

Multi-impacts,
multi-objectives
Complexity

Agency, responsibility

Empirism,
falsifiability,
incrementality,
experimentalism

Exclusion - disrespect on
rules and participants
Procedural manipulation



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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 ?



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