CoOPILOT: Designing an Integrated Platform for Participation & Transition Engineering

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Introduction

The development of the CoOPLAGE tools presented in this book has been concentrated on the physical and material version, for robustness, transparency and cost reasons. However the designers (with a background in artificial intelligence) have always been interested as well on developing a digital support for the same participatory processes, with a goal of social extension and better capitalization and management of the data, plus potentially an added value for supporting the users and institutions through Artificial Intelligence solutions.
In terms of public policy support and transitions, the ultimate goal is to value the large experience of the CoOPLAGE tools and case studies, to transfer it in a generic platform open for all stakeholders, which would give them the capacity to design, pilot, participate, evaluate some integrated participatory processes. It should propose solutions beyond the existing large set of participation platforms (PeoplePowered, 2023 ; Participedia, 2023), with a focus on the global CoOPLAGE decision cycle (cf. part yyy), the role of participatory modeling (cf. part xxx), the process of “participatory engineering of participation” and a support to its implementation. As such, it is intended as a coherent “companion” to process managers and participants, which should strengthen the actual mobilization of participation in democratic decision making, and foster trust between citizens and institutions.
Over a period of 4 years, the CoOPILOT digital platform has been developed to integrate at this stage a coherent users and process management, the e-PrePar tool for participation engineering, the e-CoOPLAN tool for participatory planning, e-ENCORE for monitoring and evaluation, SMAG for governance self-diagnosis and the attached supportive tools for debate, user assistance and management of the data.
In this chapter we describe the initial rationales, the target implementation context, the reference use scenario which shaped the design, the structural choices, the architecture and finally we discuss ongoing adaptations.

Engineering Participatory Processes for Socio-Environmental Transitions

The contemporary social and environmental challenges require multiple transitions. They cannot be achieved without a coherent and protracted engagement of all stakeholders. Engineering participatory processes, as a global decision cycle including all actors, is a complex task requiring multiple skills, integration of many decisions steps and tools (cf. part 2.1), and a protracted management of participants, tasks and products. In this chapter, we address “engineering participation” as the design and management process of a global participatory procedure, including the protocol, methods, tools and their regulation while

implementing them. We specifically consider which digital solutions can be designed and extended. Three questions structure this design :

1. What are the essential steps and needs of stakeholders and institutions in socio-environmental transitions toward sustainability ?
2. What are the specific steps and tasks required for a participatory process supporting such transition processes?
3. When supporting it by digital means (online, mobile) what are the added requirements?

The first question addresses transition as a set of possible changes, actions, deliberations in the target territory, whereas the latter addresses the “process for supporting the process”. For the transition steps and needs, various approaches exist in the literature (Koning & al, 2021 ; Hyysalo & al, 2019; Fet, Keitsch, 2023). In the Transition Support System developed in Wageningen (Dijkshoorn-Dekker, 2018), five steps are considered: urgency, scenario analysis, in-depth analysis, insight into future directions and impact evaluation, with a possible repetition. Mainly focused on prospective methodologies, it emphasizes sequences of visioning and backcasting. In (Halbe, Pahl-Wostl, 2019), the four steps are: problem and actors analysis, participatory modeling with causal loop diagrams, analysis of learning objects, subjects, contexts and factors, and integrated governance system analysis. In this case, the role of participatory modeling and system analysis is stronger.
Based on several case studies introduced in this book, and driven by water management issues, we have established a different analysis and protocol in the CoOPLAGE framework (part x.x). Its origin lays in a more systematic and constructive decision loop, which, transcribed in terms of transition steps and needs, includes:

1. Procedural design: establishing the conditions, plans and rules of this transition process;
2. Diagnosis, baseline: building and sharing situation analysis for all dimensions (environmental or social - cf part y.y) and scales;
3. (Prospective thinking: considering scenarii)
4. Setting the transition or transformative goals, for the same dimensions,
5. Setting a monitoring, evaluation and adaptive management plan for this transition process (based on the transformative goals)
6. Building alternative transition action plans composed of sub-actions, coherent and efficient
7. Selecting one action plan and committing stakeholders to it
8. Designing an implementation plan and operationalizing it
9. Adaptive steering of the plan.

This generic approach can be, in principle, structured and managed without any participation, by combined intervention of experts and decision makers, followed by a transfer and adoption phase toward other stakeholders. However, in the CoOPLAGE posture we address the same as an inclusive participatory design and management process, with a tentative engagement of all stakeholders at the various phases. This brings us to the second question: how to adapt these steps when enforcing participation? The general answer is simply to extend the group of stakeholders enacting the steps, which leads to specific adaptations like:

1. participatory design of the decision (hence participation) procedure & organization
2. participatory observation, participatory modeling
3. participatory future visioning
4. participatory normative & teleological framing

5. participatory monitoring and evaluation, participatory process steering
6. participatory planning
7. participatory selection or vote, large scale formal social commitment to the process
8. participatory implementation

These steps have to be made coherent and incremental.
In this chapter we'll discuss how this process can be supported by digital means, through online and mobile solutions.

The CoOPILOT origin and the design process of digital solutions

Since the origin of the CoOPLAGE tools (cf. part z.z), especially for Wat-A-Game, CoOPLAN and ENCORE, some simple and robust computer solutions have been developed to simplify and accelerate design and implementation. But they were not intended to replace the physical and material based version of the methods and tools. The accessibility, robustness and transparency criteria primed. For quick reference we can quote the following "add-ons" which have been used:

- For Wat-A-Game: normalized spreadsheet forms for structuring resources, actors and actions, and generating directly the action cards by publipostage; online version of the game itself under the Netlogo(r) multi-agent platform (WagLogo).
- For CoOPLAN: actions' processing database & action integration matrix with resources and impacts.
- For ENCORE: online forms registering events, participants and evaluations; post-processing.

However this took mainly the form of "bricolage" with ad-hoc solutions which were stabilized later. But they were not integrated or connected together.

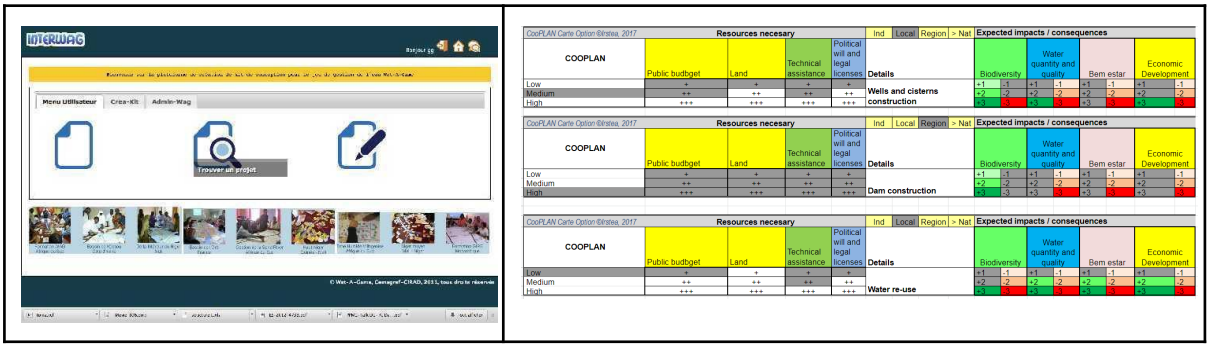


Figure ##: the Wat-A-Game ("InterWAG") and CoOPLAN digital support

A reference use scenario for CoOPILOT

The original scenario was originally established for the European project SPARE (Ferrand & al, 2017), for river ecosystem services management, and has been used as a reference for the assessment and design of the CoOPILOT platform. It has been adapted to transition processes.

In this challenging period, a regional authority LA decides to start a transition plan (TrP). A ***process manager PM*** *is designated. She identifies and gathers* ***a small pilot group PG*** *of 8 persons, made of diverse representatives who can help her animating the process. Including an expert, the PG recommends that* ***an ex-ante evaluation*** *is made on* ***a population sample*** *to ensure future comparative evaluation.*

Using social media, they communicate widely to ***the population*** *to inform them about the launch.* ***Volunteers*** *are already invited to register for future works, meetings, etc. Through a dedicated web & mobile app, everyone is invited to propose participatory actions (****Participatory actions proposals PAP****) to the LA: how they can contribute to the decision, i.e. how* ***citizens*** *should be associated, which rules.*

A ***citizen assembly*** *is gathered with the volunteers. They can access* ***methodological training*** *using an online training course* ***(MOOC)****. After exchanging with* ***experts in participation****, they discuss the PAP and decide the* ***plan and rules for participation****. They also decide how the process can be* ***monitored*** *and should be evaluated. The LA and* ***the local politicians*** *also contribute and provide their vision. The draft* ***participation proposal*** *is made fully public and* ***comments*** *are welcome. A* ***final participation program (PrePar plan)*** *and* ***a charter*** *are published and signed by* ***the main representatives****. The process can start.*

Through a ***mailbox delivery*** *and by* ***internet****, every* ***household*** *(and* ***tourists*** *in their residence) receives an* ***Observation and Knowledge Kit (OKK)****: a set of simple and robust cards with transition awareness, a* ***socio-environmental monitoring form*** *(with* ***participatory mapping****), and* ***preference survey****. An* ***open mobile App*** *includes the same. An* ***OKK challenge*** *is organized, with symbolic awards. People (and schools) can* **travel the surroundings***,* ***collect questions and data*** *and* ***share them*** *through the LA. All these data are used by LA with experts to produce a* ***participatory diagnosis****, including situation and* ***revealed preferences****.* ***OKK public sessions*** *are gathered where people can meet to discuss their observations.* ***Distributive justice dialogue*** *is also facilitated (with* ***Just-A-Grid protocol****): people can express what they consider to be fair in terms of resource and effort sharing.*

Smaller groups (and ***classes*** *again) are invited, with a* ***facilitator****, to* ***build models*** *of the territory, and the possible transition pathways, including ecosystems, economy, exchanges. Using an adapted version of the* ***Wat-A-Game toolkit****, they obtain all together a general local model where different* ***options*** *and* ***scenarios*** *can be tested through* ***role playing game sessions*** *(participatory simulation). The model calibration is improved by experts. Several* ***copies*** *are* ***produced*** *and* ***distributed*** *to stakeholders for future uses.*

With this model, groups can reassess and challenge their ***OKK diagnosis****.*

LA aggregates all results and proposes a ***draft synthesis*** *which is* ***published and shared****. After* ***feedback*** *a final version of the diagnosis is* ***officialized****.*

All sessions and stages have been ***monitored and evaluated****.*

In this phase every household receives a new kit: the ***Option Proposal for Transition (OPT)*** ***part of the COOPLAN set****. Everyone can propose action for, around, about the transition in the territory. They can send it* ***on paper*** *or share by* ***internet*** *or an* ***app****. For each OPT they have to think about who, what, how and why. All OPTs are* ***published*** *on the LA site, under categories. A* ***Market Place*** *phase is started where people can meet to* ***comment*** *and* ***improve*** *the OPTs.*

With this set of updated OPTs, volunteer groups are invited to weave complementary OPTs in ***Transition Integrated Management Strategies (TIMS)*** *using the COOPLAN methods. They assess* ***feasibility*** *and* ***efficiency****, and a* ***dialogue*** *with experts is organized to criticize and assess the TIMS. All TIMS are published and shared and comments are invited from everyone. A* ***large public dialogue*** *is organized to* ***make summary*** *of all comments.*

All sessions and stages have been monitored and evaluated.

Everyone is invited to an ***official distributive vote*** *about the 5 final TIMS (****physical*** *and* ***electronic vote****) with an allocative judgment. They have 5 points to allocate to all RIMS. At the end of this process, the winning RIMS is designated and made public. It will be implemented."*

This scenario provides an overview of the target use. Most elements exist as already implemented methods. They need to be either digitized or integrated.

Shaping the CoOPILOT goal and posture

CoOPILOT is an online service which aims at supporting participatory process managers, policy makers and all participants in co-designing, piloting, using and evaluating their participatory decision processes, for their various needs and stages attached to socio-environmental transitions, in an integrated and coherent manner.
It should overcome the current limitations of the other platforms dedicated to participation which often gather separated action support for debate, budget, propositions, without a real procedural engineering nor an underlined model of social transformation and decision. CoOPILOT should foster the coherence of the process and the stakeholders' engagement, as well as develop trust between parties by transferring the bases of CoOPLAGE to a digital support. The specific relationship to be established between process managers and participants, especially through the PrePar instantiation (co-construction of the procedure), together with the monitoring and evaluation approach (reflexive steering), is a key asset.

Position vs. other digital participation platforms

The position of the designed solution is addressed in regards to its main functions, and to the underlined models of decision process and actors.
When considering the existing platforms and tools, as referenced in the compendiums (PeoplePowered platform, 2023 : 49 platforms referenced) or (Participedia, 2023 : 28 methods with software), the general features proposed include (categories and terminology are extracted and adapted from the classification of PeoplePowered analytics, ibid.): assessment of ideas, collaborative budgeting, collaborative drafting, commenting, conversation, debates, events, forums, guided tours, idea submission, mapping, meetings, messaging, moderation, network / graph mapping, notifications, petition, polls, preference and prioritization, project timeline tracking, proposal splitting and merging, question authorities, recommendation engine, register volunteers, sentiment analysis, sign-up forms, SMS tools, surveys, translation, transparent survey results, verified participation, photo and video management, voting. Considering this large set and the platform expansion, we compared our design with the 3 platforms Decidim (Barandiaran, 2018), Assembl (2023, focused on conversations) and CitizenLab (2023), selected for the diversity of their features. The two first were widely inspired and initially funded under the European program "CAPS", Community Awareness Platform for Sustainability (CHIC, 2018), which triggered their emergence on the basis of communities' needs. As such the initial main features were: structuring and supporting the participants' groups, structuring the problem space, supporting debate and deliberation, voting and dissemination. Our aggregated analysis over the digital participation tools (RMCPART, 2020), led to a slightly more detailed classification : administration of the participatory process, structuring and organizing participation, sharing documents and supporting debate, diagnosis and data collection, collecting citizens' proposals, choosing and voting, funding an action. CoOPILOT aims at all but the latter.

Regarding the conceptual models, the actor's and integration models (how elements are related) of these platforms are not obvious. Their capacity to cope with the complexity of social processes and the induced action plans, i.e. interlinking issues and proposals with a situation model, although discussed (Barandarian, 2018), is not established in the available material. It seems to be left to the deliberation of participants. The main and classical processing of interdependencies is through the use of semantic classification and machine learning applied to the flows of participant's contributions. The minimal matching model is

based on similarity index (of interest, position), but not reconnected to a normative model of a target socio-environmental situation, as required for supporting the transition of territories. Meanwhile, in the CoOPLAGE approach, introduced in this book and grounding the CoOPILOT design, the integral approach of participatory decision making is supported by :

- a procedural model of a recommended decision cycle (cf. chap. YYY), used in PrePar,
- an actor, action and plan model (Ferrand & al, 2013), used in WAG and CoOPLAN,
- a situation model, transcribed in a Wat-A-Game implementation.
- a normative model constructed prior to the monitoring and evaluation process, used in ENCORE.

Consequently, the distinctive features of CoOPILOT, in comparison with the other digital participation platforms, are :

- An explicit procedural framework, to be followed as an iterative workflow,
- A focus on the design and steering of the participatory process,
- A coupling of the tools for the various decision steps,
- An explicit actor's, actions' and integrated plan's model,
- A strong coupling with an internal Online Course.

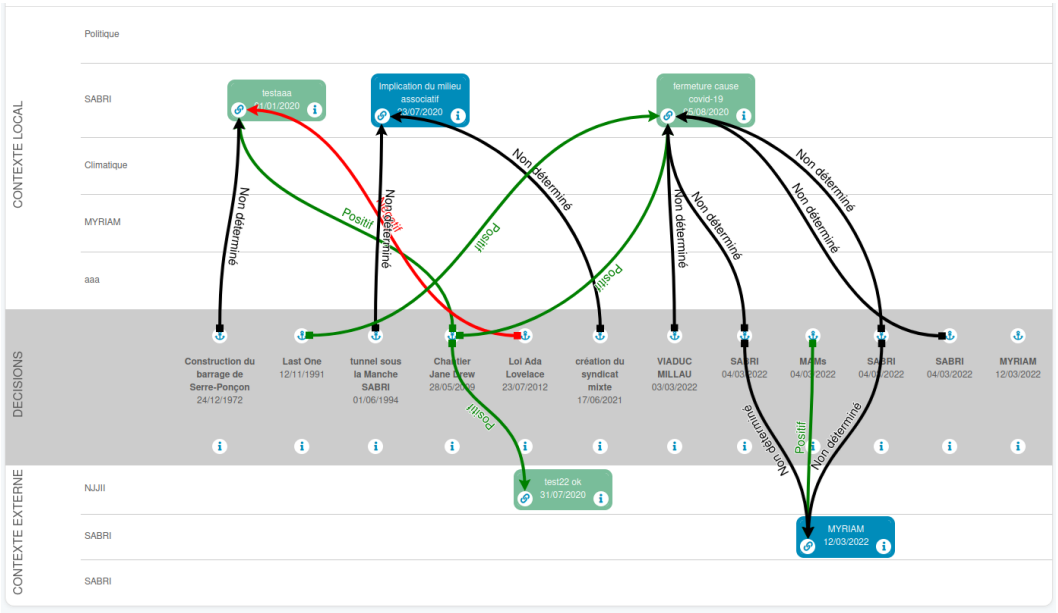
Transcribing the field' validated CoOPLAGE methods, it could benefit from their empirical adaptations. But the digital version could lead to other relevance and usability issues discussed in the next session.

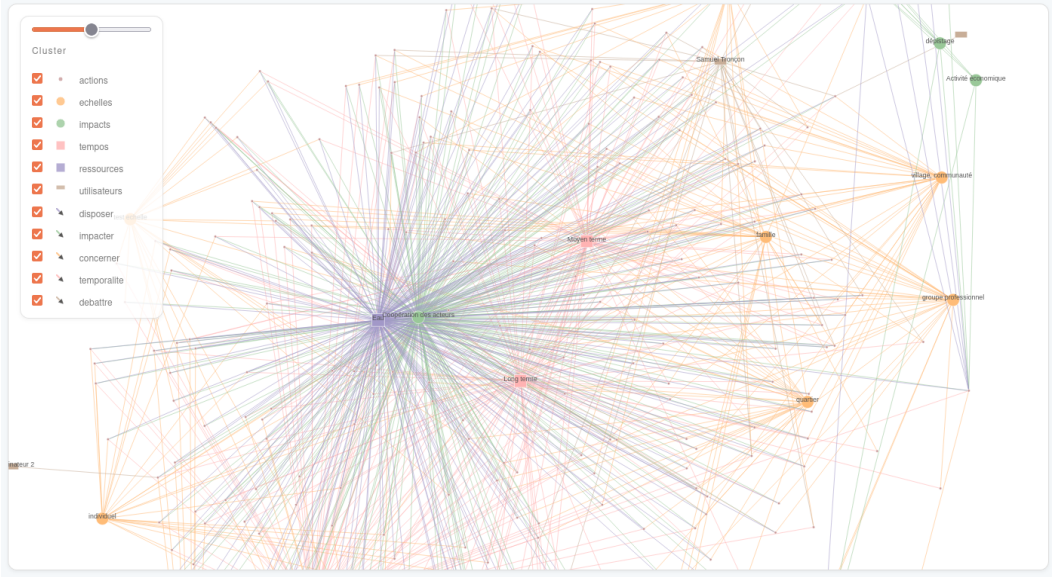
The CoOPILOT platform

The e-coopilot platform was initially designed as a digital implementation of the CoOPLAGE tools. In this respect, the main question that arises is twofold:

1. Is the implementation consistent with the model? This amounts to asking whether the conceptual specifications are respected.
2. Does the implementation make it possible to complete the initial model or to revise it, and therefore, to modify in return the Cooplage method in its "material" implementation ?

The implementation was carried out in several iterative steps. Based on an initial data structure matching the CoOPLAGE UML model, we designed the processes and interactions necessary to feed, query and navigate in the model. Then, we implement the "graphical" tools for collaborative work which notably allow a synoptic view of the work carried out by the participants (diagrams, drawings, plans, etc.).

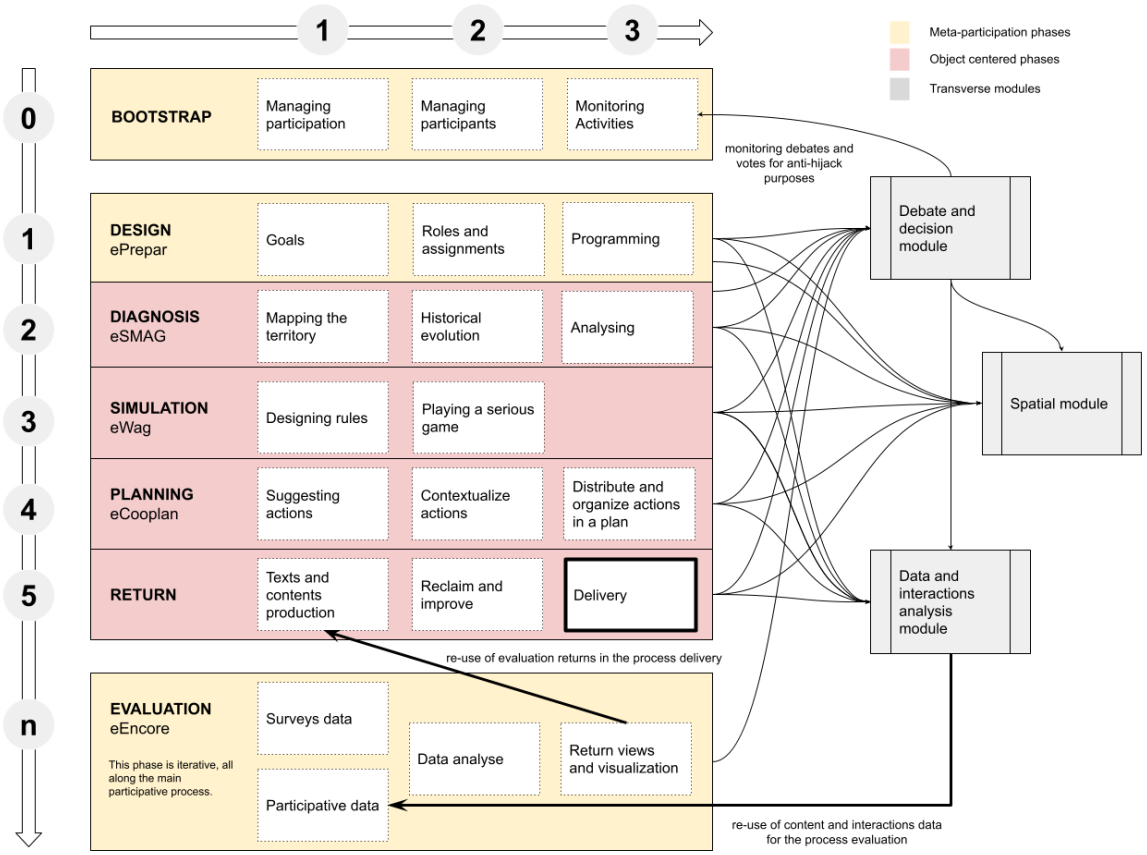




In a second stage, we added some components made necessary for the actual implementation. They fall into two categories. Some are purely technical, relating less to the conceptual model than to the relational model. More interestingly, others are quasi-conceptual elements absent from the initial logical model, which question whether they are real objects, i.e also relevant in the physical “version” of CoOPLAGE, or if they only belong to the digital “version” of the method. As such, this implementation of CoOPLAGE raises many particularly interesting questions. For example, the representation of the process has evolved throughout the modeling. The user’ status in the computer version enforces:

- complete traceability of the users’ actions in the model, which is impossible to achieve exhaustively in an empirical process, whereas it is “by design” in the digital model;
- the emergence of a "digital double" of the participant, specific to digital use, which will be defined both in relation to its categorical definition (age, gender, territory, social categories…) but also by the actions it carries out (proposals, debates, various

interactions…),and can be used later to support a personal assistant agent (Ferrand, 1997).



Similarly, the possible uses of the digital version raise many questions of consistency and variability to the initial model:
1/ Is the digital version a consistent implementation of the physical version?
2/ Does the digital version create new meaningful uses?
The physical version of CoOPLAGE was implemented face-to-face with groups of variable size, in coordination or not with other groups following the same protocol in different territories and at different times. The main difference with a process carried out on Internet lies in the fact that users can collaborate asynchronously and remotely. The first version of Coopilot was designed to be used as a digital medium in the same type of context: a face-to-face group in a one place, a facilitator who projects the main interface on a screen (for example a visualization of the actions proposed by participants) and users on individual computers that perform actions in the interfaces. Quickly, new needs appeared with the possibility of carrying out the same type of session but only remotely, therefore with people connected to the platform simultaneously, which supposes having real-time notifications of the actions of the participants. Finally, a third use, asynchronous and remote, which reveals new needs both in terms of interactions (notifications, tracking of changes, alerts), but also in terms of interfaces, because users must be able to progress at their own pace, and it is therefore necessary to allow both synchronizations (collective times for deliberation for example) and personalized routes (for users wishing to go further or more in depth).

	synchronous	asynchronous
face-to-face	a projected interface, participants on their terminals to a single work interface.	separate groups, which contribute at different times to different stages of the process.
distant	a control interface for facilitators, users connected to the same interface at the same process step	a management and monitoring interface for facilitators, a monitoring interface for users, everyone progresses at their own pace

The transition to digital therefore makes it possible to vary the modes of use, and therefore also the modes of animation of the process, which has influences on the initial model of Cooplage and raises many questions on the way of designing and animating the processes. An operational paradox was that while CoOPILOT was being developed, a very large scale face-to-face process had been organized in Tunisia (cf. part yyy) which also led to its own parallel procedural adaptations. his obviously has a significant influence on the type of interfaces to be developed according to the different methods, the complexity of development, and in particular on the proceduralization:
- the possibility or not to advance in the workflow step by step, by closing the steps already completed which remain only consultable, with an influence of the actual steering of the relational procedures,
- the management of various user profiles, depending on their motivation, the intensity and extension of participation, their digital skills and the accessibility of the tools (excess of participatory requests can mislead some users by complicating interfaces).
These questions, initiated by the design of the CoOPILOT tool, constitute also operational challenges that need to be addressed. They constitute real research questions at the crossroads between the science of participation and computer science. In particular, they require other tools and other technologies, in addition to interfaces, the web and data analysis, which may imply the development of automatic assistants to support participants and follow various protocols, adapted to the participation' goals and the expectations of the participants.

Open scientific and operational challenges

During the analysis of the needs for participation and transition engineering, several scientific or operational questions have emerged. The development of CoOPILOT left many of them open. We address some of them hereafter with a short insight on the related assumptions for future developments.

Conditions of adoption and integration by stakeholders ?	Pre-training (online access) & sensitization to participatory decision - Alignment with their actual decision cycle - Compliance with legal context - Accessibility & low access cost - Awareness of mutual use by the various groups

Constraints on integration and coupling of tools ?	Incremental use of information (no repetition) - User's visibility on the coupling - Transversal monitoring & evaluation - Unicity of the conceptual model (e.g. for actions in WAG & COOPLAN)
Test and validation in real policy conditions ?	Initial adoption cost toward process manager - Robustness - Responsiveness on time - Continuous support - Conditions of comparative evaluation vs. control situation (no tool)
Hybrid physical - digital solutions and processes	Mirroring the methodologies - Support to physical sessions & solutions (organization, guidelines, monitoring)
Triggering and sustaining commitments	Analyzing the individual contributions to generate relevant intentions - Share - Structure social commitments in networks
Coupling with external databases and A.I.	Searching for relevant data or sources by text analysis - Proposing contextualized assistance based on the collective process: Assistant Agent (Ferrand, 1997) - Structuring debates
Coupling with debating solutions	Reconnecting dynamically the content of the attached debate with the decision tools
Use and binding on participatory modeling	Formalizing the conceptual meta-model - Reconnecting CoOPLAN to a territorial model - Activating WAG models
Access and use of mobile solutions	Specific adaptation for mobility use - Contextualized / spatial approach - Citizen-to-citizen local matching and dialogue

Conclusions

While the CoOPLAGE tools have been extensively used and validated in field applications, CoOPILOT is still in a beta stage and should be tested in practice. It is however already a comprehensive platform including non classical functions for digital participation, like procedural design and steering, explicit models for actors and plans, enforced role of monitoring and evaluation. The CoOPLAGE community expects CoOPILOT to become a major instrument for large scale social dissemination of the good practices and impacts of the material tools. Therefore the user requirements and the interface will undergo an improvement process and a specific adaptation to the transition models..
Further development are focused on direct support to participants, including mobile use, and integration of A.I. techniques using the principles of assistant agents' communities (Ferrand, 1997).

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