PEPR EXPLORATOIRES
PROJET CIBLE
2022

PROGRAMME ENSEMBLE

DOCUMENT PRESENTATION PROJET

COllectives for kNowledGe pRoduction mAnagement That Scale

Acronyme	**CONGRATS**		
Titre du projet en français	*Gestion des communautés à différentes échelles*		
Titre du projet en anglais	*COllectives for kNowledGe pRoduction mAnagement That Scales*		
Mots-clefs	large-scale collaboration; online collaboration; creative collaboration; transversal collaboration, intra-organizational collaboration, communities of practice, value creation through communities, evolution of communities		
Établissement porteur	Université Grenoble Alpes		
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Durée du projet	84 mois		
Aide totale demandée	5,16 M€	**Coût complet**	12,09 M€

Liste des établissements du consortium :

Établissements d'enseignement supérieur et de recherche	***Secteur(s) d'activité***
Univ. Grenoble Alpes	*Sciences sociales, informatique*
Université Paris-Saclay	*Informatique*
Université Claude-Bernard-Lyon 1 (ULyon1)	*Informatique*
IMT	*Sciences sociales, informatique*
Sorbonne Université	*Informatique*
Université Toulouse 3	*Informatique*
Université de Lille	*Informatique*
Université de la Réunion	*Sciences sociales*
ENAC	*Informatique*
Univ. Technologique de Compiègne (UTC)	*Sciences sociales*
Univ. Technologique de Troyes (UTT)	*Sciences sociales, informatique*
ENSAM	*Informatique*
Université de Rouen	*Sciences sociales*

Organismes de recherche	***Secteur(s) d'activité***
CNRS	*Sciences sociales, informatique*
INRIA	*Informatique*

Autres partenaires	***Secteur(s) d'activité***	
N/A		

Résumé du projet en français (Non Confidentiel)

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COllectives for kNowledGe pRoduction mAnagement That Scale

Ce projet ciblé porte sur la collaboration des communautés ouvertes et à large échelle à l'aide de plateformes numériques, afin de créer des connaissances et de la valeur. Il vise à fournir aux acteurs (personnes --participants et gestionnaires des projets-- équipes, communautés et collectifs) des outils pour comprendre leur communauté (informations sur eux-mêmes et les autres) et la collaboration au sein de celle-ci (activités engagées, dynamiques de collaboration, réalisations). Il vise également à concevoir des outils pour comprendre comment fonctionnent les projets et agir pour les améliorer, sur la base des informations reçues et des objectifs des acteurs et du projet. Pour cela, il se concentre sur l'étude de la coévolution de la conception des plateformes et des collectifs qui les exploitent, en dépassant ainsi les travaux existants qui ont soit analysé les interactions sociales, soit abordé les défis techniques liés à la conception des plateformes.

Project's Abstract (Non-Confidential)

This targeted project studies the open and large-scale community collaboration using digital platforms to create knowledge and value. It aims to provide actors (individuals --participants and project managers-- teams, communities, and collectives) with tools to understand their community (information about themselves and others) and collaboration within it (activities engaged in, dynamics of collaboration, achievements). It also aims to design tools to understand how projects work and to act to improve them, based on the information received and the objectives of the actors and the project. To do this, it focuses on the study of the co-evolution of the design of platforms and the collectives that operate them, thus going beyond existing works that have either analyzed social interactions or addressed the technical challenges related to the design of platforms.

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1. Context, objectives and previous achievements

1.1. Context, objectives and innovative features of the project

Context

A key element of success for organizations is their capacity to dynamically create, identify, select, and coordinate the knowledge required for each task (Teece et al. 1997) through efficient teaming and team work (Wuchty et al. 2007). Today, especially in the era of COVID-19, team work has become increasingly virtual: people collaborate on digital infrastructures without meeting face-to-face (Masson & Parmentier, 2020).

The ability to bring together up to thousands to achieve complex goals opens up significant opportunities from exchanging and creating knowledge, deliberating or making decisions. Consequently, organizations have installed various approaches to improve their virtual team working efforts for knowledge production (that we define as places where people self-select on the task they want to participate in). They aim to tap into the distributed creativity, wisdom, and workforce of their employees and/or external internet users (Afuah & Tucci 2012), as well as to replicate the benefits and methods of the free / open source movement (Edison et al. 2020) via the building of “online communities”.

An online community is defined as a “set of members structured around common interests and interacting on a regular basis within a digital exchange space where they share, create, and meet” (Masson & Parmentier, in press). There are many types of online communities that can be defined according to their goals (communities of practice, epistemic communities, communities of innovation, communities of action and communities of crisis) and members (brand, customer and user communities). Among them, the epistemic communities (Hess 2007; Cohendet et al. 2001), and the communities of practices, built and active on digital platforms, are central to generating new knowledge (Mahr & Lievens 2012), when communities of innovation are central to generating new ideas.

However, we are now aware of the risks of spillover: misinformation, loss of skills, dehumanization of collaboration, and lack of privacy and control over personal data.

The PEPR’s call addressed in this PC is to analyze and propose solutions to allow for sustained online interacting group collaboration: how to reach the shared goals in terms of production in a safe, empowering environment. Put it another way, that means understanding how groups interact online, what are the socio-technical tools they need to regulate both platforms and collectives, and providing such tools.

We acknowledge that these groups, goals, and structures are various:

- These forms of collaboration afford **both opportunistic and structured forms of association**, engagement, work, in online platforms or in more traditional organizations, but with a voluntary-based orientation… These communities can be internal (integrated into a firm), external (driven by individuals outside a firm) or mixed (the community is deployed both inside and outside the firm).

- They **are dynamic**: groups appear, come together, split, and evolve over time, as do the goals of their members. Some groups or projects structure themselves to create an identity and see themselves as "communities", i.e. self-aware groups of people, more or less open (Bowles & Gintis, 2002).
- The underlying technological infrastructure shapes these social structures. Some socio-technical structures reinforce the control power of some participants over others, whereas some are more horizontal, aiming at developing collaborative spaces (power with), and **the research on which infrastructure is best suited to which task is still in its infancy** (see Carlsen et al. 2020 on that matter).
- Finally, **some projects** regroup a small group of participants, when others **scale-up**, up to regrouping thousands of people, even if these large-scale collectives are generally scaffold collaboration, with sets of groups working towards goals that put together enable the achievement of larger ones.

To do so, we must recognize the co-constitutive entanglement of technology with tasks, structures and forms of organizing (Faraj & Pachidi, 2021), something which was stressed by the Nobel awarded scholar E. Ostrom in her study of (digital) commons.

Objectives and Project's innovative character

While today's computing capabilities enable the collection and processing of virtual team work data on an unprecedented scale, measuring its viability, effectiveness, and efficiency remains complex. The viability of teams is reflected by an inherent understanding of working together towards a common goal. Such an understanding involves a **multi-dimensional nature** (e.g., teaming vs. coordination) that spans **multiple levels of analysis** (e.g., individual vs. team) in a **dynamically changing context**. It must account for diverging and potentially conflicting perspectives and emotions of multiple stakeholders (e.g., team members). Such subjective experiences drive satisfaction of having co-created knowledge (Voorberg et al. 2015; Bovaird & Loeffler 2012) and ensure participation in the long run (Troll et al. 2019; also the position of the Wikimedia Foundation). Cohesion represents a bond that makes team members want to stay and work together (Salas, Grossman, Hughes, & Coultas, 2015). Even the beneficiaries of the produced outcomes benefit from the long-term sustainability of such platforms that welcome individuals to join and reach their personal goals (Halfacker et al. 2011).

The reactive nature of virtual teamwork analysis needs to be overcome in order to make the collaboration process of those different individuals on digital platforms more informative, viable, and understandable. Extending the *Institutional Analysis and Development Framework* (Hess & Ostrom 2007) by theoretical and conceptual perspectives on virtual teams (Gilson et al., 2015; Marlow et al. 2017; Morrison-Smith & Ruiz, 2020) and team viability (Bell & Marentette 2011; Cao et al. 2021), PC4 will explore the following research questions (RQ):

- RQ1: How can we measure the multi-dimensional nature of the viability, effectiveness, and efficiency of virtual teams and online communities? (Efficiency refers to the process of knowledge production, when effectiveness refers to the delivery of the expected outcome, and viability of the community remains actives and attractive for (new) participants over time;

- RQ2: How and why do input factors such as team member characteristics influence the viability, effectiveness, and efficiency of online collaboration?
- RQ3: How and why do coordination processes during knowledge creation influence the viability, effectiveness, and efficiency of online collaboration over time?
- RQ4: How can we develop better tools to feedback the users on their efficiency/effectiveness, but also to create more efficient platform infrastructures?

PC 4 proposes to provide people, teams, community, and collectives with:

1. **tools to understand:** the right information about themselves, the actors, the activities they engaged in, right in the sense correct but also adapted to their position and to the goal they are pursuing. We miss an understanding of team formation, coordination, and their interactivity that can guide virtual teams to achieve the necessary viability to effectively and efficiently produce knowledge (Gilson et al. 2015; Morrison-Smith & Ruiz 2020), especially when members participate voluntarily;
2. **tools to act**, on the basis of the information received, and of their goal, but also having in mind the others' and the project's overarching goals. This means that we will enable the reorganization of collectives and the live reconfiguration of platforms to suit these needs.

PC aims to go beyond the mere description of some projects, or the provision of generic tools, to propose mechanisms that instantiate generic tools according to the specific needs, the specific form of collaboration undertaken. This represents a unique challenge: on one hand engineers develop tools in reaction to organizational challenges, but these changes lead to new forms of organization, while platforms evolve in reaction to user and organizational needs. The fine balance social scientists observe may shift with weeks or months in reaction to internal changes in platforms, collective organization or external forces. **We will focus on studying the co-evolution of platform design and of the collectives that leverage them, while existing works either analyzed social interactions or addressed technical challenges related to platform design.**

1.2. Main previous achievements

Collaborative systems and community management: UGA team members have recognized expertise in collaboration management (Prof. Sabine Carton from UGA is co-chairing the Research Group on Collaborative Spaces; Prof. Guy Parmentier has published various contributions on online community collaboration) and has developed a dedicated online platform named Genagame to simulate online collaboration and collect experimental data through digital serious games (within the interdisciplinary InterCCom project led by Prof. Anne Bartel-Radic). CERAG/UGA has been investigating (virtual) collaboration within the European University Alliance UNITE!, to study why and how communities emerge in this large network, and how knowledge is shared, trust and cohesion are established, and a shared identity is built. Further investigation of the case will be based on novel methodologies such as concept mapping (partnership with UQAM, Canada). IMT Teams (DECIDE and LEGO) have recognized expertise in online collaborative space mining and management (Prof. Bothorel has published various contributions on community detection and mining, and Prof. Nicolas Jullien is recognized for his analyses of how online epistemic communities, such as Wikipedia, work). Sorbonne University's LIP6 Complex Networks team is one of the leading teams in graph mining studies worldwide. UCBL Sical team has recognized expertise in the field of computer supported collaboration and collaborative learning.

Information and knowledge management: the project consortium gathers teams that have long experience in research in the field of information systems management (Prof. Alain Cucchi from Univ. de la Réunion is the director of CEMOI (Centre d'Economie et de Management de l'Océan Indien) and OBSUN (observatory of digital usages) and an expert of "technostress") and knowledge management (the IKI-SEA center of excellence, University of Bangkok, is a close international partner of CERAG, UGA; its director, Prof. Vincent Ribière, was awarded the lifetime academic achievement award of the International Institute of Applied Knowledge Management).

Human Computer Interaction and engineering of collaborative systems: The consortium has strong expertise in the design, development and study of collaborative systems. UCBL and ENAC have developed a variety of recognized participatory design approaches while the DECIDE Team is one of the leading teams in Europe in Multi-Critera Decision Analysis and will provide the Decision Deck platform and tools to the Congrats. Inria's COAST, UCBL Sical and ULille Spirals teams have internationally recognized expertise in the engineering of reliable and resilient collaborative distributed systems. While UPSaclay exsitu and Inria ILDA and Univ Toulouse 3 Ellipse have proposed models, theories and toolkits to explain interaction with and through collaborative systems.

Please see relevant publications by CONGRATS members in bold letters in the reference list in the appendix.

2. Detailed project description

2.1. Project outline, scientific strategy

Today, community analytics are dedicated to researchers and platform operators. They require high levels of expertise, coding and data analysis capabilities, and are restricted to what platforms share publicly. We will develop tools enabling community stakeholders: moderators, regulators, but also simple users, to analyze community dynamics, the evolution of groups over time, of their objects of interests, and of the rules regulating their interactions. Our goal is to provide this information in real time in order to enable direct interventions and adaptations of community members.

Given the size of communities and considering the constraints of real-time visualization, there is a need for new classes of algorithms that can mine graphs and networks at high-speed, with progressive enhancements to accommodate interactive exploration of evolving data-sets. These visualizations should also display relevant metrics, describing key features of communities. Building upon the expertise of management scholars, they should also account for the semantics of activities, and surface meaningful patterns of cooperation revealed by organization and human sciences. The visualization tools should support reflexive images and awareness of communities, as well as the management of multiple identities as individuals will obviously simultaneously be (or already are) members of several kinds of collective entities.

Building upon various traditions of action-research, we will study how interventions influence organizations, and how tools supporting organization should evolve in reaction. Understanding these feedback loops, and the complex systems in which they take place is key to developing descriptive and predictive theories of digital organizations, and thus to equip them with innovative collaborative

tools. This PC will offer a unique opportunity to develop an integrative approach bringing together CSCW researchers, engineers, designers, social and organization scholars, to design socio-technical interventions across the whole spectrum from technical to social.

2.2. Scientific and technical description of the project

We have organized the PC through four work packages. The first work package (WP 4.1) is about project management, and aims at connecting the different teams and work-packages/tasks in order to ensure collaboration and cross-fertilization, within both this PC and the whole eNSEMBLE project. The second work package (WP 4.2) includes research aiming at theorizing online community collaboration: what is a good collaboration, in terms of production, but also of the health of the community and of its participants, and how can it be measured? Of course, these measures make sense only if they provide useful information to the various participants in such projects. The goal of work Package 4.3 would be to provide actionable tools for communities, adapted to its various members, in terms of roles, but also of understandability and of accessibility. Work Package 4.4 is dedicated to case studies and use cases, and to the transfer of the knowledge created previously to communities. We will do so by collaborating with a selection of existing online communities, representing the various types mentioned before (epistemic, of practice, of innovation, etc.) in order to better tune the tools designed to their needs.

If the rapid presentation of the work packages may give the impression of a linear work, from the theory to practice, we understand it more as a spiral model development, strongly guided by users' needs.

WP 4.1: Developing CONGRATS and Diffusing its Results

WP leaders: A. Bartel-Radic, N. Jullien, A. Tabard

Goals: This WP aims at organizing the tasks of interest for the whole PC and at enforcing the exchanges between the tasks within the PC, with the other eNSEMBLE activities and teams, and with the different potential beneficiaries of our work. In particular, it handles the publication of all the research on an open science basis, the implementation of the algorithms and of the data in publishable open source packages, but also the relationships with our case studies (platforms and participants). It will also manage two open calls for this PC: call for research proposals in line with the design of better tools for open online collaboration, and call for study and implementation in other platforms/projects/case studies than those already targeted and managed by WP 4. In particular, that means: (1) the monitoring and articulation of the phases of the program (task 4.1.1); (2) the monitoring and coordination of technical aspects (task 4.1.2); and (3) the diffusion of our results within the scientific community and beyond (task 4.1.3).

Task 4.1.1 - PC global management

Task 4.1.1 regroups all the activities aiming at creating connections between the **various research activities** through collective activities (seminar, gathering), and beyond the PC toward the whole project, and the communities: dissemination of the results of the program (scientific, technological, pedagogical, economic and societal). It will also take care of the reaching (management and development of collaboration with other research projects at French - ANR and European - Horizon levels, technology transfer toward the French and European industry, see also the open call). This

corresponds to the elements presented in Subsection 3.3 Management framework / Pilotage, and is described there.
Deliverables: the deliverables for this task are details in subsection 3.3

Task 4.1.2 - support the collaborative studies of collaboration
Gathering, labeling, and maintaining open data & software resulting from the PC work packages for the scientific community.
Deliverables: the deliverables for this task are detailed in subsection 3.3, we will insist on:

- Data management plan according to ANR's recommendations and template;
- Use of the data analysis infrastructure at IMT and / or INRIA which have the facilities to do so;
- Reusable datasets for being used in WP2-WP6 and first version of the algorithms; internal use only;
- Open sourced and maintained datasets and software packages with the algorithms.

Task 4.1.3 - Dissemination
This task will be dedicated to bottom-up initiatives that can contribute to the PC's global goal to develop an integrative approach to design socio-technical interventions and tools to manage online communities that scale.

Beyond the classic scientific dissemination actions in terms of academic publication, open-source packages (see subsection 3.3), this PC has a strong goal to share the results of our work with the communities. Task 4.1.3 will organize the discussion with the communities' project managers to understand their needs, access to their data, and evaluate possibilities to test project's developed algorithms/solutions with the projects (years 4 to 7, phase 2).

Deliverables: the deliverables for this task are details in subsection 3.3

WP 4.2. Theorize online community collaboration

WP leaders: Anne Bartel-Radic & Nicolas Jullien
The objective of WP2 is to advance theory on online community collaboration. This WP mainly relies on simulation and experimentation methodologies, in addition to literature reviews, surveys and qualitative methods. The work in this work package will be led in close collaboration with the other WPs of the project, in particular WP4 which focuses on case studies of specific digital communities. WP4.2. is structured in three tasks: 4.2.1. on the outcomes of open community collaboration (efficiency and effectiveness in terms of knowledge production and sharing), 4.2.2. on community health and the socio-emotional processes of collaboration (inclusiveness, trust and cohesion, affect and conflict, technostress, well-being and psychological safety), and 4.2.3. on methods and tools to analyze open community collaboration.

Task 4.2.1. Efficiency and effectiveness of open community collaboration
As said, outcomes of online projects can be evaluated in different ways. Scholars (and project owners) usually refer to them in terms of the quality of knowledge (Arazy & Kopak 2011) or of creativity (Rhyn & Blohm 2017). However, existing research focuses on piecemeal effects in isolated studies and was not able to measure and grasp these overarching and potentially conflicting relationships. Thus, our project's first goal is to propose a new measurement approach for the

outcomes of digital collaboration that is applicable to different kinds of pieces of knowledge production (e.g. aggregating existing and creation of new knowledge). This task will develop a conceptual framework consisting of variables to understand effectiveness and efficiency of virtual collaboration in knowledge production.

This task will:

- theorize 1) the different input-process-output elements to look at in the evaluation of the efficacy of an online community, and on the relations between the inputs, the process and the output 2) how to improve the engagement of the participants, from and then beyond the existing literature
- test several sets of hypotheses developed from this previous research thanks to online experiments (data analysis of online projects, but also experimentation, mainly in the form of serious games, relying on the GenaGame platform, developed on purpose at UGA.

Task deliverables:

- Description of the project's various inputs/process/outputs and of their link,
- Development of measures of such elements,
- Theoretical and conceptual framework consisting of variables to describe effectiveness and efficiency of digital collaboration in knowledge production which is used in other WPs
- Experimental protocols and simulations for better understanding and managing knowledge sharing and knowledge hiding behaviors, as well as team creativity, and their antecedents and consequences
- Validated measurement framework for the effectiveness / efficiency of virtual organization in knowledge production (M42)

Identified labs

- IMT (LEGO, Litem), UGA (CERAG, LIG), Université de la Réunion (CEMOI)
- Nb: international partners external to the project will also collaborate through joint PhD supervision or participation in case studies: (IKI-SEA, Bangkok University)

Task 4.2.2 Community health, affect and cohesiveness

Besides the focus on online community collaboration outcomes, other important and quite neglected aspects refer to the participants' experience and engagement (Troll et al. 2019). A key factor for participation in open community collaboration, knowledge sharing and team learning is team psychological safety, first described by Edmondson (1999) as "a shared belief that the team is safe for interpersonal risk taking" (Edmondson et al., 2007). Research has also shown that the willingness to share knowledge is strongly influenced by factors such as organizational climate and management involvement (Jeon, Kim, & Koh, 2011). Finally, although digital technologies have strongly enabled collaboration, they also generate negative consequences. The increased use of digital management tools (video-conferences, screen sharing) and methods (agile, peer/mob programming) can exclude neuro-divergent individuals, people with temporary or permanent physical disabilities, as well as people excluded from accessing such tools.

This task will thus focus on:

- the influence of cultural and linguistic diversity in international digital collaborations and their consequences (in particular in terms of shared identity and cohesion of virtual teams);

- the digital accessibility of collaborative practices (see also 4.3.2). technostress factors in digital communities, and their consequences on knowledge sharing.

Task deliverables:

- Theoretical and conceptual framework consisting of variables to describe community health and cohesiveness in knowledge production which is used in all other WPs,
- Methodological framework for measuring emotions and affect in online community collaboration
- Proposed measures of such elements, in particular through experimental protocols and online simulations

Identified labs

- IMT (LEGO), UGA (CERAG, LIG), U. Rouen (SY)
- Nb: partners external to the project will also collaborate through joint PhD supervision or participation in case studies: (Kedge BS, Marseille; IKI-SEA, Bangkok University)

Task 4.2.3 Methods and tools to analyze/describe collaboration within and across communities

From theoretical and conceptual frameworks defined in Tasks 4.2.1 and 4.2.2, we need to design and develop the tools that will be able to 1) provide an overview of collaboration, understand how teams and their members interact within and across teams, and achieve the collective goals and 2) provide, in real time, the relevant monitoring metrics describing key features of group collaboration in order to enable direct interventions and adaptations of community members through visualization tools (WP 4.3).

Understanding teams in their whole diversity (their objects of interest, the rules, protocols, the division of work, the internal organization, the interaction between groups, and the dynamics of all these dimensions) requires dedicated methods. Graph mining techniques (data mining applied to complex networks) provide organizational insights into the functioning of teams through the analysis of social interactions or relationships. To track and understand teams' objects of interest and how members exchange both informational and organizational messages, and understand which goal teams achieve require Natural language processing (NLP) techniques, and encode semantics through attributes in the graphs we will study. These techniques applied to graphs modeling member flows between teams over time will allow to understand the recomposition of teams/projects and cross-team collaboration.

As real time monitoring is required to enable direct interventions and adaptations of community members, the link stream formalism may be an option to follow in order to discover unusual links between pairs of actors and to detect changes in interaction behavior both temporally and structurally, i.e. changes in frequency and/or interlocutors. Promising ideas to do so include signal processing on graphs (Bautista & Latapy 2022), or frequency-factorization technique (Chang et al. 2021) to which could be integrated additional information such as text or attributes on nodes (Viard et al. 2023).

This task will require engineering manpower, provided by Task 4.1.2, to set up the analysis framework and implement state-of-the-art well-known methods (descriptive statistics reflecting team/member activity, e.g. team size; descriptive metrics of interaction graphs by period, e.g. cohesion, centralities, etc.) but also manage the datasets, collect academic datasets in order to design methods and code, and finally manage and publish software libraries.

Task deliverables:

- metrics and methods to evaluate and measure the projects' input/process/outputs;
- tracking software libraries;
- protocoles / standards (ex: xApi, activitypub…)

Identified labs

- IMT (Labsticc, LEGO), UGA (Pacte)

WP 4.3: Community-centric management tools

WP leaders: Nicolas Jullien, Aurélien Tabard

This WP will focus on providing actionable tools for communities. While the metrics developed in WP 4.2 are useful to understand the dynamics of communities from a scientific stand-point, their abundance and complexity will make them challenging to understand for lay users of digital platforms.

Empowering stakeholders in understanding, discussing, and shaping collaborative platforms is necessary to maintain social cohesiveness and long-lasting communities. Such community-centric management tools are currently lacking, or geared towards centrally controlled platforms rather than distributed and participatory ones. In this WP we will conceptualize, develop and empirically test participatory design methods that enable communities to define how their platforms should behave. Beyond live visual analysis of communities, we will develop a unique set of tools that can support the management of communities by stakeholders themselves enabling them to re-organize communities and groups, re-attribute roles and re-structure hierarchies, handle toxic behaviors, and other interventions related to specific case studies.

Task 4.3.1 - Design methods for community centric information tools

Over the past two decades digital design methods have stabilized around a set of broad principles now called UX Design. While these methods have demonstrated their usefulness in making digital technologies more accessible, they often center on individual experiences. They leverage either qualitative user-research or large-scale behavioral analytics. These methods are generally top-down: teams of engineers, designers, and product managers defining what is best with input from stakeholders.

As demonstrated by the wealth of issues around social platforms, while traditional design methods work well for individual applications they miss complex issues related to social interactions at scale. New design methods are needed to create tools that do not alienate parts of communities, and account from the get-go of risks, ethics, privacy and other design threats. We will develop a new class of community-centric design methods that scale classical user-centered design to large user groups, and take into account issues of scale. This involves the integration of multiple points of view in the decisions. We will explore two broad approaches, one building upon participatory design tradition, the other building on multi-stakeholder decision management. One particular challenge is to account for community diversity, and foster inclusion in design decision processes.

To do so we will engage with the communities studied in WP 4.4, looking for the most important factors from WP 4.2 that influence the viability, effectiveness, and efficiency of projects and participants. Using workshops and other collaborative activities, we will refine these metrics and work

on their presentation and understandability so that platform users can understand them without statistical training and extensive explanations.

Task deliverables:

- Participatory Design at scale method handbook, with presentations of design activities and critical discussions;
- Actionable models to assess users' priorities regarding the input/process/output variables to monitors;
- MCDA tools and libraries;
- Theoretical contributions on participatory design at scale drawing on systemic approaches**.**

Identified labs

- IMT (Labsticc, LEGO), Univ Lyon 1 (LIRIS), ENAC (LII)

Task 4.3.2 - Coordinating people and communities with visual coordination tools

Existing analytical tools for collaborative platforms are either geared towards platform administrators, creators, or researchers. Platform participants have very little insights on the platform overall activity, and even less so on how their activity or the one of the communities to which they belong and with whom they interact fits within larger patterns. This is a cause of concern as individual experiences rarely reflect global platform activity. Involving communities in the governance of the platforms on which they collaborate requires clear and actionable information.

Building upon other tasks (4.2, 4.3.1) and the work of eNSEMBLE's PC 3's activities on algorithmic intelligibility, this task will investigate the use of visualization tools to support community driven platform knowledge and management. In doing so, we will tackle challenges related to digital literacy, inclusiveness whether through accessibility efforts or diversity and cultural inclusion. This task will study empirically, 1. the intelligibility of visualizations of communities, 2. the ability of actors to act upon the information provided in meaningful ways, and 3. study the forms of coordination they foster and the ones they inhibit. The empirical insights will be used on one hand to develop socio-technical theories of platform governance, and on the other hand be used to feed the design of the platforms studied in 4.3.

Task deliverables:

- Visualization design and software
- Empirical results on the impact of visualization tools on coordination

Identified labs

- Inria Saclay, Univ Toulouse 3 (IRIT), UGA (CERAG)

Task 4.3.3 - Infrastructuring platform participation

Creating the meaningful metrics envisioned in WP 4.2 and supporting the forms of participation envisioned in 4.4 will require profound changes to the way collaboration platforms are designed. Defining how people present themselves, the roles they can have, how they interact together through the platforms, what is tracked and what is not, has implications at various layers of the underlying technological stack.

Designing and deploying such socio-technical systems is a form of *infrastructuring*, it is not only about creating proper tools or social arrangements, but also the underlying technical layers that can enable the arrangements we envision. Rather than starting from design and development and then studying emerging behaviors, this task will build upon the lessons learnt in WP4.2 and WP4.4 to create technical prototypes demonstrating how alternative forms of social interaction could be mediated technologically. These technical interventions will relate to group formation, privacy and role management, accessibility, authorship, and interaction among users that can handle noise and toxicity, support building trust, information coherence and consistency, as well as broader platform management and governance interventions.

These interventions will be studied empirically, either experimentally in controlled settings, or through longitudinal field work in the context of the platforms studied in WP 4.4. The studies will assess the technical feasibility, the performance and scaling capabilities at a technical level, and the viability, relevance, and impact at an individual and social level, as people interact in high volumes and velocity, often in a distributed fashion. This will enable us to iteratively refine theories of infrastructuring and revise platform design guidelines

Task deliverables:

- Prototypes demonstrating technical concepts
- Empirical results from experimental and longitudinal field studies
- Design guidelines

Identified labs

- Inria Nancy, Univ Lyon 1 (LIRIS), UPS (LISN), Inria Lille

WP 4.4: Understanding socio-technical collaborative systems in action.

WP leaders: Anne Bartel-Radic, Aurélien Tabard

PEPR program's goal is to produce actionable research. In that perspective, this WP will:

- study different types of voluntary knowledge production platforms, in order to diversify the knowledge produced (aggregation of existing knowledge or production of new knowledge) and the conditions of participation (openly accessible or for organizations' employees only), to evaluate the models and analytic tools developed in WP4.2;
- to test the tools developed in 4.3, to make them actionable, and if possible implemented.

These studies will be conducted hand to hand with the projects/communities in order to grant a real transfer of the results of research to the communities' different stakeholders.

WP4 is structured following **objectives of the collaboration:**

- **Task 4.4.1** includes cases of platforms aiming at sharing and building verified information, such as Wikipedia (the Wikimedia Foundation), or OpenStreetMap,
- **Task 4.4.2** includes cases of platforms for public debate and deliberation,
- **Task 4.4.3** includes cases of digital epistemic communities.

The teams contributing to this WP have established partnerships with these different organizations, which guarantees fast access to the different fields. The objective of this WP is to compare the different cases (which dis-/similarities?), to identify specific problems from the field which will nourish

the more general frameworks in WP4.2., and to test and diffuse knowledge that has been generated in WPs 4.2. and 4.3. to these communities.

Task 4.4.1 - Sharing and building verified information

Volunteer online open projects aimed at curating and aggregating pieces of knowledge are a paragon example of online projects. These types of projects exist for voluntary, open goals, as for organizations (knowledge management). Despite important literature, their internal organization, and more specifically the best way for these organizations to team their participants in order to achieve efficiency remain to be studied, partly because of the difficulties for extracting, curating, and analyzing the vast amount of data they produce. We provide two examples of the types of communities that could be studied here.

The gathering of the existing knowledge within an organization. An example is Wikipedia, that has become, in 22 years of existence, the encyclopedia of reference. The tool it uses (Media Wiki) is also used by a lot of organizations such as NASA for knowledge management (co-production and sharing). Thanks to its 22 years of data stored it is also a unique project to study the history of such virtual organization, and to see if there are cultural specificities in the production of knowledge. The Wikimedia Foundation also allows for joint research projects on tools to improve the functioning of Wikipedia.

Open Data, Geographic information: Open Street Map. It is one of the most successful projects regarding the collective gathering of open-data. It raised several questions about data quality (availability, but also Thematic Accuracy, Temporal Accuracy, Logical consistency, Semantic accuracy, Usage/purpose/constraints, Variation in quality, Meta quality, and Resolution), and use of data by various projects and actors (Schott et al., 2021).

We expect that other examples of such an organization will be studied by PC4

Task deliverables:

- Report from empirical study on knowledge accumulation (epistemic) communities
- Design principles for fostering deliberation
- Recommendations for knowledge accumulation platforms

Identified labs

- IMT (LEGO), UGA (PACTE), U. Rouen (DySoLab)

Task 4.4.2 - Public debate and platforms for citizen deliberation

Online spaces have become important places of public debate. They connect and enable exchanges between publics that may not have interacted before, but can also lock exchanges in bubbles. These spaces can also be used for adversarial attacks seeking to shift opinions. This raises important questions on how to support deliberation processes, how to make them more inclusive, transparent, and accessible.

Various platforms have emerged to support diverse forms of deliberation from web forums and social networks, to more recent online platforms dedicated to deliberation. The structure of these platforms shapes the forms of deliberations and expression. This task will seek to understand the dynamics of online deliberation in relation to the underlying platform design, and the broader digital environment in which they evolve. This can involve computational social science analysis, visualization of

debates, or experiments to better understand specific factors (topics, participant profiles, argument structures, use of objects and representations, interaction patterns, etc.) Framing online activities within broader offline movements would be beneficial.

Task deliverables:

- Report from empirical study on participation and deliberation quality
- Design principles for fostering deliberation
- Recommendations for deliberation platforms

Identified labs:

- IMT (I3), UGA (Pacte), UTC (Costech)

Task 4.4.3 - Communities of Practice and of Innovation

Organizations have realized the value that communities of Practice (CoPs) can bring to increase experiential knowledge sharing among its members. The main benefit from communities of practice is knowledge sharing, and the promise of innovation steaming from it. CoP objectives are usually aligned with the organizational needs and strategies, and lead to increased innovative output and value creation (Wenger, McDermott et al. 2002). Nevertheless, due to the organic nature of CoPs, member engagement often remains a challenge, as is the organization's capacity to formalize (explicit) the exchanges of knowledge.

An example of a case to be studied: Schneider Electric has 300 internal communities of practice involving more than 45,000 employees, and the Michelin, Axa, Edf, Sncf, etc.'s inter-company employee community "Les collectifs" acts on company management in order to the ecological shift of their company.

Task deliverables:

- Reports on results
- Academic publications
- Recommendations to managers (management principles, roadmaps, checklists)

Identified labs:

- UGA (CERAG), IMT (LITEM), UP Saclay (LITEM), Univ. Réunion (CEMOI)
- Nb: partners external to the project that will also collaborate: KCO (Knowledged Community Observatory), an action research group on CoP that includes about fifteen companies; Bangkok University (IKI-SEA).

Task 4.4.4 - Other case studies

We aim at exploring other types of online communities thanks to propositions collected via the open-call. Examples of communities which may be studied are:

- *Open Platform Infrastructure.* Platforms inspired by open source models targeting a specific social or environmental problem have emerged. An example is Alaveteli, a digital platform infrastructure to make public freedom of information requests to public bodies, which we started analyzing (Gossart & Özman 2020). These Open Platform Infrastructures" (OPIs) are adapted by local developers to their local context. OPI's openness allows users to regain control over how they are implemented and tuned to their needs. However, coordination in

OPIs is complex and requires various spaces of discussion and exchange, both locally and globally. (Note that the collective production of software is studied in PC2).

- *Massively Multiplayer Online Role-Playing Game (MMORPG)* where teams of players often mobilize an entire ecosystem of collaboration tools at different scales (wiki throughout the game, documents shared between friends/guild., discussion servers, etc.). These practices are fairly idiosyncratic but with a lot of reflexivity in assemblies.
- *Crisis management teams*. These communities are highly dynamic, rely upon heterogeneous platforms, and must operate under strict time constraints. Crisis management is handled by PC 2; but they also need reliable information, which is to be provided, and check in almost real time, and decision systems, which could benefit from the studies and tools developed in PC4.
- *Climate change anticipation*. These communities are future oriented, involve stakeholders with highly varied expertise, and master heterogeneous forms of knowledge. Such collaborations extend over long time-spans, and are tied to other collaborative spaces (associations, local and national political spaces).

These elements are provided as illustrations and do not commit the PC.

Task deliverables:

- Empirical results and academic publications
- Actionable managerial recommendations (management principles, roadmaps, checklists)

Teams: (open call) all teams

2.3. Planning, KPI and milestones

Global organization and planning

CONGRATS is structured along three research-oriented Work Packages. The themes are considered to be equally important and deserve all to be launched now. For each theme, each year, Research Actions that can correspond to one PhD or more, associating several PhDs or Post-docs so as to treat a topic from different points of view and obtain richer and broader outcomes will be financed. Most of these Research Actions will be based on multidisciplinary approaches, associating disciplines such as Computer Science, Sociology, Psychology, Management, Economics and Design. This multidisciplinary aspect will be part of the criteria we propose to evaluate the quality of research.

The Project will be organized in successive calls for Research Actions. In the first year, the Research Actions should correspond to 3-4 PhDs. The following yearly ones will be managed through internal scientific calls issued at the PEPR level and selected by a Scientific Committee. We envision three milestones so that early work can feed into subsequent actions.

Milestones 1 (year 4):

- Framework for analyzing the efficiency/effectiveness of online communities
- Results from in depth studies of communities (epistemic, of practice, creative, etc.)
- Tools to mine the communities' activity and to feedback the results to the users
- Communities of WP4 identified and collaboration formalized.

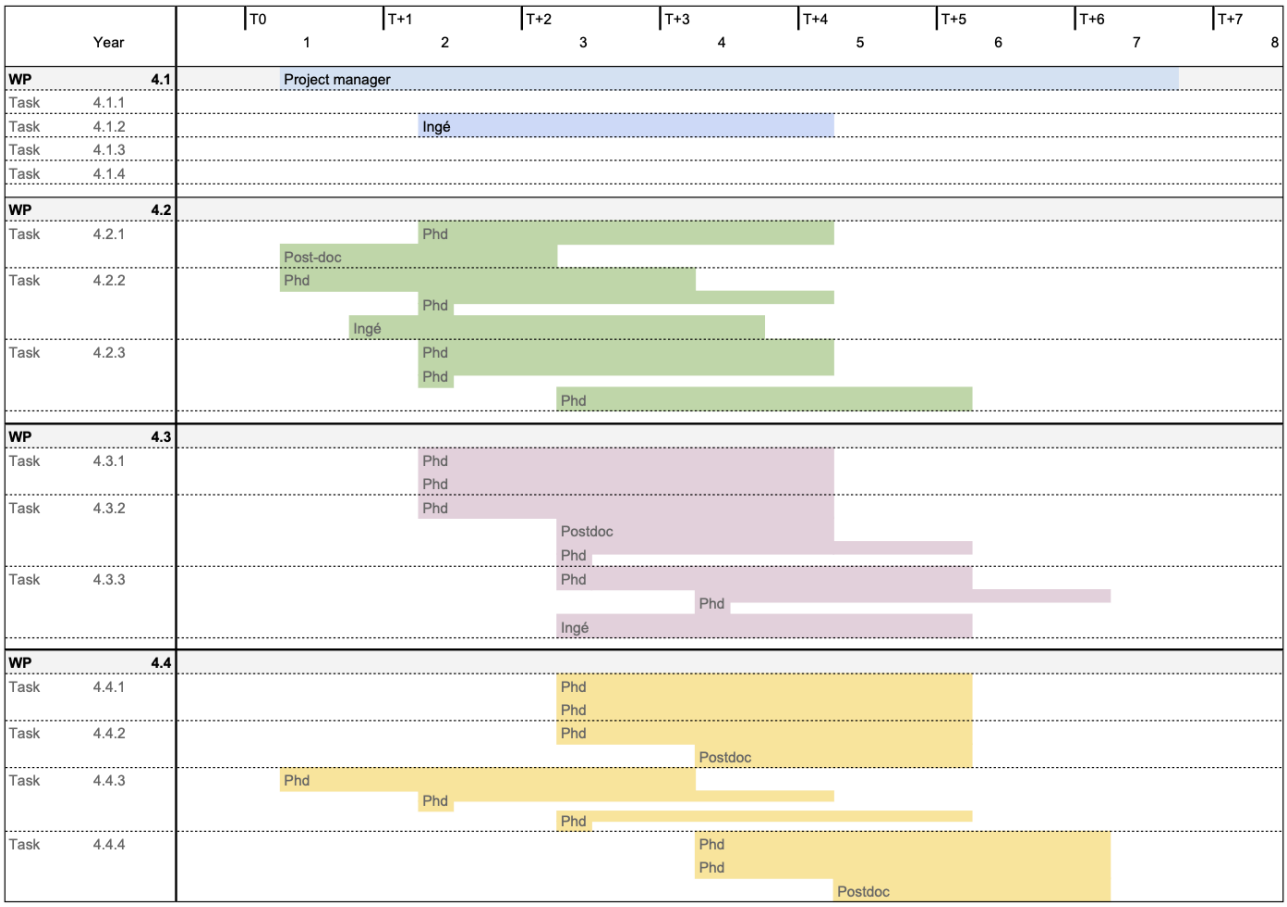
Milestones 2 (year 5):

- Prototypes created in WP3 are released
- Development libraries are released
- Design toolkits are published

Milestones 3: (year 7)

- Report on communities, already analyzed, to implement/test the tools developed
- Analyses of other projects/communities are published

Gantt Chart



Key Indicators

CONGRATS will follow the general KPIs of the eNSEMBLE program as defined in WP0.

Risk Management and mitigation

Risk Type	Risk	Corrective measure
Human Resources	PhD recruitment: we don't get enough candidates for all positions	Flexibility in the number of PhDs per year and possibility to postpone a topic
Coordination	Works of different partners are not connected or integrated	Organization of a yearly consortium seminar. Facilitation of interdisciplinary projects.
Project and data access	Difficulties to access real projects and to transfer our results	Contacts with certain communities are already existing; some projects have open access data so research is always possible
Technical risk	inefficient or over complex algorithmic development (community mining, decision aid process algorithms)	We have an incremental approach by increasing the complexity of the models step-by-step (more information taken into account). This is well adapted to PhD works because it is iterative and based on previous work handled by members of the consortium. It allows us to pursue the project with less complex models if necessary.
Technical risk	Development and Integration of Monitoring and Feedback tools. Integration into existing platforms which may result in additional implementation effort at the side of the case organizations.	Start with standalone prototypes that do not require deep integration and limited participation to a selected group of members whose data is readily available in the created data sets. Careful design of field experimental settings.
Methodological risk	Interdisciplinary nature of some of the research projects (difficulties in cooperation, recruitment, publication, etc.)	Organization of dedicated workshops. Elicitation of epistemological strategy associated with the PhD and post-docs workplan.

3. Project organization and management

3.1. Projects managers

Anne Bartel-Radic is full professor of management at Sciences Po Grenoble - UGA and member of CERAG laboratory (UGA). Her research in the field of international management concerns the collaboration of individuals, teams and organizations across national, cultural and linguistic borders. She has supervised seven PhD theses (three ongoing) and four DBA theses (three ongoing). From 2017 to 2022, she was the director of the research cluster of UGA in social sciences and member of the vice-presidency of research and innovation of UGA. Since 2022, she is the dean of research of Sciences Po Grenoble - UGA. Since 2018, she is leading the interdisciplinary InterCCom project that creates serious games for training and research on soft skills in (international) online collaboration, and which has developed a novel experimental methodology and dedicated online platform (called Genagame). Anne Bartel-Radic is part of the AC of the academic association Atlas-AFMI in international management and co-responsible for the PhD and DBA annual awards.

Nicolas Jullien is full professor in economics at the LUSSI department, IMT Atlantique, Brest Campus and member of LEGO laboratory (UBO-UBS-IMT Atlantique). He was one of the pioneers of the economic analysis of the free software phenomenon in the late 1990s, and defended his thesis on the economic impact of free software in 2001. His research is always placed in the framework of innovation management and the management of (virtual) organizations, and in what is now called "open innovation". He is interested in the interactions between market institutions and non-market and open collective production (such as free software or Wikipedia): how these industries are impacted in their organization by these collective productions, both on economic models and on the organization of work. Nicolas Jullien is scientific director of Marsouin, the Breton research network in social and humanity science on the digital society. He is a member of the editorial board of the journal Terminal.

Aurélien Tabard is assistant professor at Université Lyon 1 and is in delegation at Université Lille. His work investigates convivial informatics through the design and development of alternatives to existing computational platforms. This involves platforms that take into consideration digital limits and foster sufficiency, maintenance, autonomy, and durability. His research relies on participatory approaches, and investigates how can be designed participatory infrastructures that are resilient to breakdowns. He was an invited researcher at UCSD Design Lab (2017), and at the Centre for Digital Creativity at Aarhus University (2019). He has co-directed three large interdisciplinary projects (FUI, PIA, ERA-NET), with work published in leading HCI and Computer Science venues (CHI, CSCW, IMWUT, TOCHI). Four of his projects led to industry transfers, with innovations incorporated into products used by millions (for learning [1, 2], for culture [1, 2], for navigating cities).

3.2. Organization of the partnership

The consortium is composed of 15 partners, among which two national research institutions (CNRS, INRIA), 13 High Education and Research Institutions (listed below). Altogether, these partners and their research laboratories ensure the participation of researchers across the different research fields required to successfully address the challenges of this project: social and management scientists,

ergonomists, data scientists, and computer scientists (human-computer interaction, software engineering), for a total effort of more than 64 man.year.

The project will be coordinated by the three coordinators (A. Bartel-Radic, N. Jullien, A. Tabard). The three coordinators will collaborate on WP1, deal with administrative aspects and ensure the link with the rest of the PEPR projects. All other three WP will be coordinated by two of managers:
WP2: A. Bartel-Radic & N. Jullien; WP3: N. Jullien & A. Tabard; WP4: A. Bartel-Radic & A. Tabard
The research teams that compose the project consortium cover a large spectrum of disciplines and approaches related to online collaboration. They show strong expertise in specific domains and clear complementarities between disciplines as exemplified in the following table:

Laboratory (team)	**Competencies**	**Managing institution for PC4**	**Invest. (in m.y)**
CEMOI	IS management	U. La Réunion	1,4
Centre Internet et Société	sociology / economics / ICT	CNRS	5,6
CERAG (ICO)	Management; 1 researcher is responsible for the management of PC4; Genagame platform	UGA	6,65
Costech	Information communication	UTC	2,45
CRISTAL (Spirals)	Software engineering. Cloud	U Lille	1,4
DySoLab	Sociology of Digital, Computational social sciences	U. de Rouen	3,15
Laboratoire d'Informatique interactive	IHM	ENAC	9,1
I3 (INTERACT)	Ergo Psycho & Design	IMT	8,05
IRIT (ELIPSE)	IHM	U Toulouse 3	4,55
Lab-STICC (DECIDE)	Data science (community mining) and decision sciences. Decision deck platform	IMT	3,5
LaBRi (Potioc)	HCI	Inria	0,7
LEGO (ETIC)	management and economics of digital platforms	IMT	2,1
LIG (Sigma)	computer sciences / Information Systems SIGMA team has long experience in interdisciplinary collaboration with social sciences	UGA	1,05
LIP6 (Complex Networks)	Data sciences	Sorbonne U	1,19
LIRIS (SICAL)	HCI & CSCW	UCBL	1,75
LISN (ILDA)	HCI/visualization	Inria	2,1
LISN (Ex Situ)	HCI	Inria	1,4
LISPEN (Aix)	Collaborative methods and tools	ENSAM	1,05
LIST3N (Tech-CICO)	HCI, CSCW, info-com, ergo psycho, management, sociology	UTT	3,85

LITEM	management, economics, technostress, IS governance, knowledge flows in communities of practice	IMT	1,05
LORIA (COAST)	Collaborative systems	Inria	1,05
Pacte	Social sciences	UGA	1,05

3.3. Management framework

Consortium management

CONGRATS management Committee is composed of the three project leaders and one representative from each partner organization. It shows a strong interdisciplinarity and complementarity. Its three leaders respectively represent Management, Economics and HCI/CSCW sciences and have all been involved in many previous and current interdisciplinary projects regarding online communities. It is interesting to mention that the management committee largely covers the regions in France (Grenoble, Lille, Lyon, Brest, Paris, Toulouse, La Réunion, Compiègne, Rouen…) so that the relays towards local research would be facilitated. The responsibilities of Work packages in the project have been allocated to pairs while trying to balance the fields of expertise, but beyond this formal allocation, there will be continuous exchanges within the Management Committee to keep benefits from the wide spectrum of its members.

While organizing a yearly seminar with the project consortium, there will be a broad diffusion of on-going work progress. The management committee will also handle the tuning of the emergent research themes. Regularly sharing these elements with the whole consortium will reinforce the community identity and strength. A special effort will be put on the association of human sciences and computer sciences to motivate interdisciplinary projects and proposals.

Extending the community and promoting CONGRATS

At least two international open symposiums will also be organized on the program duration to internationalize the community; this may take the form of a summary school, for young researchers. Two networking actions towards community actors and partners will also be handled - in complement of the generic action at the level of PEPR - along the period of the project.

Scientific management

The management committee will iteratively work on the definition of research priorities of the project to adapt them to intermediary achievements and to the main achievements observed in the community and the evolution and emergence of technology and societal issues along the program duration. Specific attention will be paid to the cooperation between Human Sciences and Computer Sciences. The actions will result in a continuous update of scientific programmes and priorities managed by the project.

More specifically, CONGRATS will start with an internal kick-off seminar (M1) and organize annual seminars (M12, M24, M36, …) in addition to two annual face-to-face workshops. Moreover, institutionalization of regular fortnightly meetings and project governance infrastructure will be implemented (M3).

Reporting: the management committee will provide yearly reports on publications, conferences, communication events or technical results produced through the project activities.

General project management

Coordination meetings: coordination meetings of the Management committee will be organized monthly for the current managers of the project. Face-to-face meetings will be planned twice a year for a better consolidation of the management team, jointly with research action meetings.

A 25%-time project administrative manager will be attached to CONGRATS.This person will assist the co-coordinators in the animation of the network and the exchanges between partners, the preparation, the follow-up and the update of the tools necessary to the management of the projects, the implementation of the internal and external communication actions, the organization of the annual meetings of the teams, the colloquiums and/or workshops, the preparation of the agendas and the reports, the collection of the indicators and the assistance in the drafting of the activity reports, the follow-up of the administrative documents, etc. Note that this person will also manage eNSEMBLE's PC 1, 2 and 3, facilitating the harmonization and the coordination at PEPR level.

Harmonization at PEPR level

CONGRATS's three leaders are part of the executive committee of the PEPR eNSEMBLE, and will thus participate in the reporting to the Steering Committee on the progress of the program and in proposing possible revision of the roadmap for each Targeted Project. They will also co-write the call for expressions of intent ("Appel à Manifestation d'Intérêt"; AMI) and the call for projects ("Appel à Projet"; AAP) for validation by the Steering Committee.

CONGRATS leaders will also contribute to the general processes of the PEPR: communication (e.g. feeding the websites with targeted communication elements), harmonization of scientific priorities with other targeted projects (as there could be some joint interests and good synergies to find along the PEPR duration), participation in PhD & post-doctoral candidates selection committees.

The Targeted project CONGRATS will rely on the following transversal actions of the PEPR eNSEMBLE detailed in the project of governance:

- Technology development to ensure the development of software bricks, integrative platforms and demonstrators as well as to support open specifications and standards.
- Communication and dissemination to ensure the animation of a French multidisciplinary community around the scientific and societal issues of mediated collaboration; to ensure the organization of events; to ensure the dissemination of the results of the program (scientific, technological, pedagogical, economic and societal).
- Valorization and transfer to build concrete collaborations with non-academic partners.
- Education and training to train a generation of PhD students and post-doctoral researchers to address the long-term challenges of the collaboration with digital tools
- International strategy to ensure the visibility of the program beyond France through the organization and participation in scientific and other events and the exchange of scholars.

The table below summarizes the types of data to be produced in the course of the project and the policies regarding their redistribution.

Types	Diffusion /Access / Sharing
Project's web pages	Public (for project outreach, starting M3) not a dedicated web site
Data from Survey & experimentation	Private (restricted to project members to preserve anonymity)
Databases & Software	Licensed under the Open Data Commons Open Database License (ODbL) on the Nakala platform by HumaNum; and software open-source licenses (see the French Government's recommendations),
Publications	All **scientific publication**s will be put on HAL (authors' version as per law). Targeted venues: CSCW, CHI, GROUP, and AIM conference; Academy of Management meeting; EGOS conference; European Citizen Science Association; International Conference on Information Systems; Management Information Systems Quarterly; Management Science; Organization Science, DSS.
Transfer to the platforms and their users	For **each platform, a specific report of the findings will be published**, and upon acceptance by the platform, a meeting with the users (Webinar) will be organized. All such **reports and presentation materials** will be published under a Creative Commons BY-SA license.

3.4. Institutional strategy

All partners of CONGRATS are actively involved in the study of online cooperation. For sake of simplification, we specify below how the CONGRATS project fits into the strategy of the main partner institutions (project leaders' attachments). The estimation of the internal efforts from the partners of CONGRATS project is expected to reach more than **64 man-years** on the total duration of the project (see the table in Subsection 3.2). This global effort should naturally be increased on the total duration of the project.

UGA strongly supports the development of interdisciplinary research projects involving HSS and TSS teams, since they ensure the production of knowledge, innovations and expertise that society can expect from scientific research, in order to respond to the challenges it is facing. The project CONGRATS corresponds to several UGA teams' research areas in computer sciences, human-machine interaction and social sciences. UGA has SILECS / Grid'5000, users' experimental labs and observational platforms.

IMT: The Institut Mines Telecom has defined its 2023-2027 strategy which has identified an overall thematic positioning that includes, among other things, the responsible industry of the future and digital sovereignty. For these two themes at least, efforts will be focused on the co-evolution and the emergence of human 5.0, aiming to consider the reciprocal actions and interactions of man and technological environment by addressing the issues of augmented skills and knowledge, and the contribution of the human in terms of intelligence, meaning and creativity for efficient complex systems. Digital sovereignty also involves learning and decision systems, which will rely on solid mechanisms of cooperation between humans and complex systems. This positioning and the related

actions at IMT group level are clearly indicating that CONGRATS is aligned with IMT's research and societal strategy.

Université Claude Bernard Lyon 1: The University has identified responsible innovation and technology as one of its key research priorities. This includes addressing the ethical, legal, and social implications of emerging technologies and ensuring that they serve the common good. Collaborative research efforts such as ENSEMBLE and this targeted project aligns with the University's vision of responsible innovation and technology, as it seeks to understand the complex interactions between humans and technology and their impact on society.

4. Expected outcomes of the project

The project participates in the science for and with societal initiatives that propose to render virtual team work and knowledge production more viable, effective, and efficient. The main outcome of the project is in the field of designing digital platforms that enact and shape virtual participation. Addressing a series of research goals that go beyond the current socio-technical foundations of these platforms, we provide their providers and users with a better understanding of how successful collaboration works, why people involve themselves, and how they can be coordinated. We will also provide the platforms with tools to do so. Our direct collaboration with existing platforms (those already selected and others reached thanks to the open call) ensures results of high robustness and generalizability. **All results (algorithms, but also monitoring and feedback tools) will be open sourced and the project will recruit research engineers to manage this.**

For the researchers, in addition to the scientific publications, it will strengthen the collaborations with international initiatives such as the Linux Foundation Chaoss project (https://chaoss.community/) to create metrics, metrics models, and software to better understand open source community health on a global scale, USA-NSF supported project The Work in the Age of Intelligent Machines Research Coordination Network, or European initiatives, such as the COST action P-Will on platform work and discrimination, or the French initiatives to develop digital commons such as the launch of a EU task force on that matter.

We also hope to develop examples of multidisciplinary research, which is accepted in reviews of reference in both computer and management sciences (such as STS, CSCW). We will create dedicated pages in our web site (or contribute to eNSEMBLE's website and online code repository) to host a presentation of the project and pointers towards the obtained results (it will not be a dedicated web site as its long-term sustainability is rarely granted, but rather a public platform).

The main direct impact of the project is of societal nature: We will provide digital platforms, and their stakeholders, with better tools to understand and monitor how the teams work. For each platform, we will feedback the stakeholders with a specific report and a specific implementation of the monitoring and management tools. Considering the impact of such platforms on the economy of knowledge, any improvement of their functioning has an important added value for society.

5. Justification of the requested means

The budget charged to PC4 is structured as follows. UGA will receive the corresponding budget, and redistribute it to the partners. IMT and UCBL will receive initial funds for co-managing and animating the project.

Types of expenses	without overhead	with 20% overhead	%total
Students & Personnel	3692 k€	4431 k€	86%
Animation	446 k€	535 k€	10%
Functioning	516 k€	619 k€	12%
Total requested funding for Animation & Governance	**4300 k€**	**5160 k€**	**100%**

The breakdown of each of these actions is as follows (with values rounded to 1k€):

Students & Personnel (3692k€, or 4431k€ including 20% overhead)		
17 PhDs (3 years)	2210k€	2652k€
4 Post-docs (2 years)	520k€	624k€
2 Senior Engineers (4 years each)	576k€	691k€
1 Junior Engineer / research assistant (3 years)	156k€	187k€
1 Project manager (25% worktime, 7 years)	75k€	90k€
11 Interns (2/3 of future PhDs, 6 months, 650€/month)	43k€	51k€
Animation (446k€, or 535k€ including 20% overhead)		
Travel expenses for project coordination (2 CONGRATS workshops/year + annual meeting, each with 15 people)	221k€	265k€
Scientific Travel costs, Engineers + staff (1 international conference / year)	48k€	58k€
Travel costs for PhDs and post-docs (missions)	105k€	126k€
Organization of workshops and annual meetings	30k€	36k€
Functioning (516k€, or 619k€ including 20% overhead)		
Field work and experiments	43k€	51k€
Subcontracting (research services: big data services, software development, transcription, etc.)	45k€	54k€
Other expenses for PhDs and post-doc (incl. laptops)	105k€	126k€
Laptops for staff (1 laptop per staff = project leaders and engineers)	12k€	14k€
Salary project leader	82k€	99k€
Teaching discharge project leader (96h/year)	30k€	36k€

Quoted references

NB: Publications by members of the CONGRATS consortium are in bold letters.

Arain, G. A., Bhatti, Z. A., Hameed, I., & Fang, Y. H. (2019). Top-down knowledge hiding and innovative work behavior (IWB): A three-way moderated-mediation analysis of self-efficacy and local/foreign status. *Journal of Knowledge Management, 24*(2), 127-149. https://doi.org/10.1108/jkm-11-2018-0687

Ayyagari, Grover, & Purvis. (2011). Technostress: Technological Antecedents and Implications. MIS Quarterly, 35(4), 831. https://doi.org/10.2307/41409963

Bannon, L., Bardzell, J. & Bødker, S. (2018) Reimagining participatory design. *Interactions* 26(1), 26-32.

Barcomb, A., Jullien, N., Meyer, P., & Olteanu, A. L. (2019). Integrating managerial preferences into the qualitative multi-criteria evaluation of team members. In *Multiple criteria decision making and aiding* (pp. 95-143). Springer, Cham.

Bartel-Radic, A., Taylor, D., Asshidi, H. (2023) Digital serious games for training and research on soft skills in international management, In: Marcon, C., Nivoix, S. (coord.), Firm Internationalization, Intangible Resources and Development, Routledge.

Bartel-Radic, A., Siritrakankij, S., Ribière, V. (2022) How do French, Thai and US-Americans manage conflict in global virtual teams? Insights from a lab quasi-experiment based on a digital serious game. 12e Conférence Atlas-AFMI, Nice, France, 2-4 Mai 2022.

Bautista, E., & Latapy, M. (2022). A Frequency-Structure Approach for Link Stream Analysis. *arXiv preprint arXiv:2212.03804*

Benzari A., Torrès O., Khedhaouria A., Cucchi A., (2022), "The impact of technostress on small business owners' burnout: The mediating role of strain", *International Journal of Entrepreneurship and Small Business*, In press

Betancourt, G. G., Segnine, A., Trabuco, C., Rezgui, A., & Jullien, N. (2016, August). Mining team characteristics to predict Wikipedia article quality. In *Proceedings of the 12th International Symposium on Open Collaboration* (pp. 1-9).

Bothorel, C., Brisson, L., Lyubareva, I. (in press, French and English versions). Plateformes en ligne et analyse des dynamiques communautaires. *Diversité des approches méthodologiques en sciences sociales*, ISTE.

Carton, S., Corbett-Etchevers, I., Farastier, A., & Fine-Falcy, S. (2021). Diversity of Perception of the Dynamics between Collective Identity and Innovation in Communities of Practice. *International Journal of Innovation Management*, 25(05), 2150057.

Cauwelier, P., Ribiere, V. M., & Bennet, A. (2019). The influence of team psychological safety on team knowledge creation: A study with French and American engineering teams. *Journal of Knowledge Management.*

Chang, Yen-Yu, et al. (2021) F-fade: Frequency factorization for anomaly detection in edge streams. *Proceedings of the 14th ACM International Conference on Web Search and Data Mining*.

Charbey, R., Bothorel, C., Brisson, L. (2020). Énumération de motifs dans un graphe d'évolution de communautés. *MARAMI 2020*, Oct 2020, Virtual Conference, France.

Charbey, R., Brisson, L. Bothorel, C., Ruffieux, P., Garlatti, S., Gilliot, J.-M., Mallégol, A. (2019). Roles in social interactions: graphlets in temporal networks applied to learning analytics. *COMPLEX NETWORKS 2019 : 8th International Conference on Complex Networks and their Applications*, Dec 2019, Lisbon, Portugal.

Chompunuch, S., Ribière, V., Chanal, V. (2019) Team Creativity: Systematic Literature Review, *ISPIM Innovation Conference*, 16-19 June 2019 – Florence, Italy

Connelly, C. E., Zweig, D., Webster, J., & Trougakos, J. P. (2012). Knowledge hiding in organizations. *Journal of Organizational Behavior, 33*(1), 64-88. https://doi.org/10.1002/job.737

Cucchi A. (2022), User's Technostress Appraisal: Do Organizational Practices Matter?, *27ème Conférence Internationale de l'Association Information et Management (AIM)*, Carry-le Rouet, France, 6-8 juin 2022

Cucchi, A., Fuhrer, C., (2011), Capital social et usage des technologies de l'information et de la communication (TIC) ; Une analyse par les réseaux sociaux, *Management & Avenir*, 45, 179-206

Cucchi A., Porphyre V., (2017), Le rôle du support à l'innovation dans la centralité des acteurs : le cas du réseau d'innovation QualiREG, *7ème Conférence Internationale d'Atlas-AFMI*, Antananarivo, Madagascar, 2-4 mai 2017

Cunningham, E., Greene, D. (2023). The Structure of Interdisciplinary Science: Uncovering and Explaining Roles in Citation Graphs. In: Cherifi, H., Mantegna, R.N., Rocha, L.M., Cherifi, C., Miccichè, S. (eds) Complex Networks and Their Applications XI. COMPLEX NETWORKS 2016 2022. *Studies in Computational Intelligence,* vol 1077. Springer, Cham. https://doi.org/10.1007/978-3-031-21127-0_30

Dao, V.-L., Bothorel, C., Lenca, P. (2017). Community structures evaluation in complex networks: A descriptive approach. NetSci-X 2017: *International School and Conference on Network Science*, Jan 2017, Tel Aviv, Israël. pp.11-19

De Benedittis, J., Movahedian, F., Farastier, A., Front, A., Dominguez-Péry, C. (2018). Proposition d'une méthode collaborative pour appréhender les pratiques et routines de capacité d'absorption de connaissances. *Systèmes d'Information et Management*, 3, 1–36.

De Vaujany, F-X., Fomin, V., Haefliger, S. & Lyytinen, K. (2018). Rules, Practices and Information Technology (IT): A Trifecta of Organizational Regulation. *Information Systems Research*, doi: 10.1287/isre.2017.0771

Fan, Xiaojun, et al. (2021) Does role conflict influence discontinuous usage intentions? Privacy concerns, social media fatigue and self-esteem. *Information Technology & People* 34.3, 1152-1174.

Jeon, Suhwan, Young-Gul Kim, and Joon Koh (2011). "An integrative model for knowledge sharing in communities-of-practice." *Journal of knowledge management* 15.2: 251-269.

Kang, S. W. (2016). Knowledge withholding: Psychological hindrance to the innovation diffusion within an organisation. *Knowledge Management Research and Practice, 14*(1), 144-149. https://doi.org/10.1057/kmrp.2014.24

Karhunen, P., Kankaanranta, A., Louhiala-Salminen, L., & Piekkari, R. (2018). Let's Talk about Language: A Review of Language-Sensitive Research in International Management. *Journal of Management Studies*, 55(6), 980–1013. https://doi.org/10.1111/joms.12354

Khedhaouria, A., & Cucchi, A. (2019). Technostress creators, personality traits, and job burnout: A fuzzy-set configurational analysis. *Journal of Business Research*, 101, 349–361. https://doi.org/10.1016/j.jbusres.2019.04.029

Kumar, R. (2004). Culture and emotions in intercultural negotiations: An overview. *The handbook of negotiation and culture*, 95-113.

Lallemand, C., & Gronier, G. (2015). *Méthodes de design UX: 30 méthodes fondamentales pour concevoir et évaluer les systèmes interactifs.* Editions Eyrolles.

Li, H. (Jessica), Yuan, Y. C., Bazarova, N. N., & Bell, B. S. (2018). Talk and Let Talk: The Effects of Language Proficiency on Speaking Up and Competence Perceptions in Multinational Teams. Group & Organization Management, 44(5), 953–989. https://doi.org/10.1177/1059601118756734

Masson, Z., Parmentier, G. (2020). Les nouvelles formes virtuelles d'actions et d'être ensemble. *Revue Française de Gestion*, 293(8)

Masson, Z., Parmentier, G. (in press). Drivers and mechanisms for online communities performance: A systematic literature review, *European Management Journal*

Norman, D. (1986). *User centered system design. New perspectives on human-computer interaction.*

Pan, W., & Zhang, Q. (2018). Withholding knowledge in teams: An interactionist perspective of personality, justice, and autonomy. *Social Behavior and Personality, 46*(12), 2009-2024. https://doi.org/10.2224/sbp.7390

Parmentier G., Gandia R. (2013). Managing sustainable innovation with a user community toolkit for innovation: the case of Trackmania – *Creativity and Innovation Management*, 22(2)

Parmentier G., Mangematin V. (2014). Orchestrating innovation with user communities in the creative industries, *Technological Forecasting and Social Change*

Picot-Clémente, R., Bothorel, C., & Jullien, N. (2015, August). Social interactions vs revisions, what is important for promotion in Wikipedia?. In *2015 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM)* (pp. 888-893). IEEE.

Ragu-Nathan, T. S., Tarafdar, M., Ragu-Nathan, B. S., & Qiang Tu. (2008). The Consequences of Technostress for End Users in Organizations: Conceptual Development and Empirical Validation. Information Systems Research, 19(4), 417–433. https://doi.org/10.1287/isre.1070.0165

Ribiere, V. M., & Zhang, Q. (2010, January). Expertise and mistakes, to share or not to share? A cross cultural study of in-group/out-group relationships on knowledge sharing. In *2010 43rd Hawaii International Conference on System Sciences* (pp. 1-10). IEEE.

Ribière, V. (2019). Driving innovation through communities, in: Tomorrow's KM: Innovation, best practice and the future of knowledge management, Ark Group Publishing, Chapter 8 (ISBN: 978-1-78358-374-4)

Rule, A., Drosos, I., Tabard, A., & Hollan, J. D. (2018). Aiding collaborative reuse of computational notebooks with annotated cell folding. *Proceedings of the ACM on Human-Computer Interaction*, *2*(CSCW), 1-12.

Rule, A., Tabard, A., & Hollan, J. D. (2018, April). Exploration and explanation in computational notebooks. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (pp. 1-12).

Rullani, F. & Haefliger, S. (2013) The periphery on stage: The intra-organizational dynamics in online communities of creation. *Research Policy*, 42(4) :941–953, 2013.

Salas, E., Grossman, R., Hughes, A. & Coultas, C. (2015). Measuring Team Cohesion: Observations from the Sciences, *Human Factors*, 57(3), 365-374. 10.1177/0018720815578267

Schott, M., Grinberger, A. Y., Lautenbach, S., & Zipf, A. (2021). The Impact of Community Happenings in OpenStreetMap—Establishing a Framework for Online Community Member Activity Analyses. *ISPRS International Journal of Geo-Information*, 10(3), 164.

Srivastava, S. C., Chandra, S., & Shirish, A. (2015). Technostress creators and job outcomes: Theorising the moderating influence of personality traits. *Information Systems Journal*, 25(4), 355–401. https://doi.org/10.1111/isj.12067

Stenius, M., Hankonen, N., Ravaja, N., & Haukkala, A. (2016). Why share expertise? A closer look at the quality of motivation to share or withhold knowledge. *Journal of Knowledge Management, 20*(2), 181-198. https://doi.org/10.1108/JKM-03-2015-0124

Tabard, A., Mackay, W. E., & Eastmond, E. (2008, November). From individual to collaborative: the evolution of prism, a hybrid laboratory notebook. In *Proceedings of the 2008 ACM conference on Computer supported cooperative work* (pp. 569-578).

Taylor, D. (2022) The Influence of Language Diversity on Virtual Team Processes: Overcoming Barriers and Leveraging Benefits. *Management International – MI*, 25(SI).

Taylor, D., Corbett-Etchevers, I., Bartel-Radic A. (2022) Building Team Cohesion: How Language Diversity Enables Virtual Teams. *European International Business Academy (EIBA)*, Oslo, Norway, 8-10 December 2022.

Tarafdar, M., Qiang Tu, Ragu-Nathan, T. S., & Ragu-Nathan, B. S. (2011). Crossing to the Dark Side: Examining Creators, Outcomes, and Inhibitors of Technostress. Communications of the ACM, 54(9), 113–120. https://doi.org/10.1145/1995376.1995403

Tarafdar, M., Tu, Q., & Ragu-Nathan, T. S. (2010). Impact of Technostress on End-User Satisfaction and Performance. Journal of Management Information Systems, 27(3), 303–334. https://doi.org/10.2753/MIS0742-1222270311

Viard, T., Soldano, H., Santini, G. (2023). Exploring and Mining Attributed Sequences of Interactions. In: Cherifi, H., Mantegna, R.N., Rocha, L.M., Cherifi, C., Micciche, S. (eds) Complex Networks and Their Applications XI. COMPLEX NETWORKS 2016 2022. Studies in Computational Intelligence, vol 1078. Springer, Cham.

Walter, C., Ribiere, V., & Galipeau, D. (2013). Evaluating the effect of rewards on the level of participation in communities of practice at UNDP. BU Academic Review, 12(1), 1-20.

Wang, Q., Clegg, J., Gajewska-De Mattos, H., & Buckley, P. (2020). The role of emotions in intercultural business communication: Language standardization in the context of international knowledge transfer. Journal of World Business, 55(6), 100973.

Yang, K., Ribière, V. Bartel-Radic, A. (2022). Understanding Knowledge Hiding Behaviors in the Workplace Using a Serious Game Data Collection Approach. *Online Journal of Applied Knowledge Management*, 10(3), 27-45.