PEPR EXPLORATOIRES
PROJET CIBLE
2022

PROGRAMME ENSEMBLE

DOCUMENT PRÉSENTATION PROJET

TRANSVERSE

Acronyme	**TRANSVERSE**		
Titre du projet en français	*Défis transversaux de la collaboration numérique pour la science et la société (TRANSVERSE)*		
Titre du projet en anglais	*Transversal challenges of digital collaboration for science and society (TRANSVERSE)*		
Mots-clefs	computer-mediated collaboration; interactive environments; collaborative user experience; human-computer interaction; environmental impacts; methods to measure impacts; legal, ethical and philosophical issues		
Établissement porteur	Sorbonne Université (SU)		
Responsable du projet	**Prénom, Nom, Qualité**		
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Durée du projet	84 Mois		
Aide totale demandée	3 003 003 €	**Coût complet**	15 024 783 €

Liste des établissements du consortium :

Établissements d'enseignement supérieur et de recherche	***Secteur(s) d'activité***
Sorbonne Université	***Informatique***
Université Grenoble Alpes	***Sciences sociales, informatique***
Université Paris-Saclay	***Informatique***
Université Claude-Bernard-Lyon 1 (ULyon1)	***Informatique***
IMT	***Sciences sociales, informatique***
Université Toulouse 3	***Informatique***
Université Panthéon Sorbonne	***Sciences sociales***
ENAC	***Informatique***
Université de Rennes	***Sciences sociales, informatique***
Université Technologique de Troyes (UTT)	***Sciences sociales, informatique***
ENSAM	***Informatique***
Université de Rouen	***Sciences sociales***
Université Gustave Eiffel	***Sciences sociales***

Université de Strasbourg	*Sciences sociales*
Université de La Réunion	*Sciences sociales, informatique*
Université Technologique de Compiègne	*Sciences sociales*

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

Autres partenaires	***Secteur(s) d'activité***
CESI	*Sciences sociales, informatique*

Résumé du projet en français (Non Confidentiel – 4000 caractères maximum, espaces inclus)

Le présent projet propose d'aborder les défis transversaux de la collaboration numérique sur la science et la société. Plus particulièrement, il aborde des questions qui découlent des activités menées dans l'ensemble du PEPR eNSEMBLE mais qui nécessitent une perspective méta, principalement en ce qui concerne l'évaluation de l'impact des technologies de collaboration développées par eNSEMBLE aux niveaux individuel, sociétal et culturel. Plus précisément, le projet étudiera la manière dont ces technologies affectent la durabilité, quels sont les impacts au-delà de la technologie, et quelles sont les questions éthiques qui en découlent.

Les principaux défis scientifiques sont les suivants : 1) identifier ou développer des méthodologies pour évaluer l'impact des technologies collaboratives sur les individus, les groupes d'utilisateurs et la société ; 2) recommander des stratégies pour réduire l'empreinte carbone des technologies collaboratives, et 3) identifier les questions éthiques, philosophiques et juridiques soulevées par la collaboration médiée par la technologie.

Résumé du projet en anglais (Non Confidentiel – 4000 caractères maximum, espaces inclus)

The present project proposes to address transversal challenges of digital collaboration on science and society. More particularly, it addresses issues that arise from activities pursued in the entire PEPR eNSEMBLE but require a meta perspective, primarily with respect to assessing the impact of the collaborative technologies developed by eNSEMBLE at the individual, societal and cultural levels. More specifically, the project will study **how these technologies affect sustainability, impacts beyond technology and ethical issues**.

The key scientific challenges include 1) identifying or developing methodologies for assessing the impact of collaborative technology on individuals, groups of users, and society; 2) recommending strategies for reducing the carbon footprint of collaborative technologies, and 3) identifying the ethical, philosophical and legal issues raised by technology-mediated collaboration.

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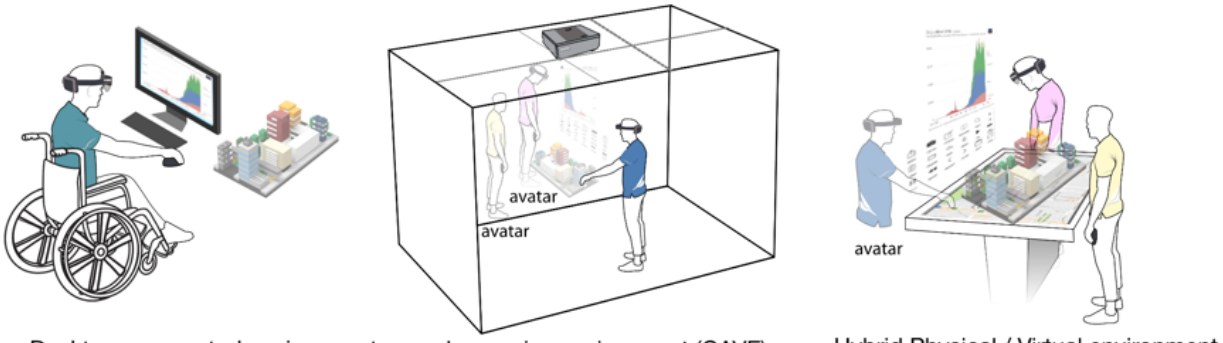
1. Context, objectives and previous achievements / Contexte, objectifs et réalisations antérieures

1.1 Context, objectives and innovative features of the project / Contexte, objectifs et caractère innovant du projet

The situations in which several participants communicate and collaborate at the same time, remotely or face-to-face, are many and varied: project review, hybrid teaching, telesurgery, crisis management, family reunion in a pandemic situation, etc. Such collaboration among participants engaged in various forms of activity and work takes place in a *collaboration space*. The unprecedented, extensive and sometimes unexpected use of collaboration spaces during the COVID-19 pandemic is the result of three decades of research on computer-mediated collaboration. For example, keeping a Zoom or Skype video call continuously open to maintain a sense of shared presence mimics the research prototype of Portholes[1], a media space created back in 1992.

An example of a heterogenous collaboration space with four participants, two being co-located.



Desktop augmented environment | Immersive environment (CAVE) | Hybrid Physical / Virtual environment

We are however at a turning point due to **a change of scale** and **a change of in algorithmic power** (*e.g.,* following the recent breakthroughs in Artificial Intelligence (AI) systems). In terms of scale, recent technological developments in sensing technologies, displays (large, immersive, mobile, wearable), networking and visualizations tools have led to increasingly heterogeneous physical and digital collaboration spaces where participants with different interaction devices and modalities must be able to collaborate efficiently. What was once confined to industrial and academic laboratories is now becoming increasingly available to a wider audience. Second, in terms of algorithmic power, the recent breakthroughs in AI research have led to the integration of AI algorithms into numerous digital interfaces that interact directly with users and with their data, including conversational agents, generative AI, as well as data-based user profiling and influence.

This rapid growth of digital collaboration technologies, combined with new AI technologies, raises serious concerns about the absence of precise evaluations of their impact on science and society. This impact can take various forms, not only environmental impacts but also impact on scientific

[1] Harrison, S. (Ed.). (2009). Media space 20+ years of mediated life. Springer Science & Business Media.

activity itself, with the potential for ethical, juridical and philosophical problems. Importantly, lack of taxonomies and standardized methods for evaluating these various impacts.

1.2 Main previous achievements / Principales réalisations antérieures

The four pilot institutions of PEPR Ensemble (University Paris-Saclay, University Grenoble Alpes, CNRS, Inria), together with the pilot of this fifth specific project within the PEPR (i.e., Sorbonne University) are major actors in research fields related to digital tools for collaboration such as Human-Computer Interaction, Distributed Systems or Artificial intelligence. In particular, UGA and UPSaclay are historical and pioneering centers of Human-Computer Interaction in France and in Europe. They also provide skills through their LabEX, EquipEX+ CONTINUUM, AI institutes and scientific clusters essential for the eNSEMBLE project.

The pilot institutions complementarity is strong: Inria, SU and the INS2I institute of CNRS are recognized for their scientific excellence in computer and digital sciences. Their strategies involve strong partnerships with French players in the field (telephony/communication, cloud, software publishers and digital services) and already collaborate closely through numerous joint research teams and national initiatives. Moreover, SU and the CNRS have strong traditions of interdisciplinary research, hosting not only engineers and computer scientists, but also researchers in social and human sciences, including philosophy and ethics. Overall, these five institutions support and promote interdisciplinarity which is at the center of human collaboration with digital tools.

The project will benefit from the previous experience and contributions of the different research groups of the consortium in the different required fields: Human-Computer Interaction, ergonomics and psychology, philosophy, ethics, law and sociology.

Human-Computer Interaction: The project will build upon the experience of its partners on the design and development of novel interaction techniques, modalities and devices for collaborative heterogeneous spaces, as well as the design and evaluation methodologies such as participatory design. These contributions, which have been published in top-tier research venues, ensure the availability of a wide variety of interaction techniques of interest for collaborative purposes, and whose combination and interconnection can be explored within the project.

Ergonomics and Psychology: The project will build upon the partners' research on the design and assessment of emerging technologies as well as on collaborative work and learning either in face-to-face situations or through innovative computer-mediated systems. The human-factors and ergonomics researchers in the partner teams build on a long-standing experience of interdisciplinary projects involving human and social sciences, design sciences, and human-machine interactions in emerging technologies for collaboration.

Philosophy and Ethics: The project will build upon the partners' recent contributions to the current debates on ethics and AI, the ethics of human-machine interaction, as well as how these technologies might affect the way humans and societies acquire new knowledge and perceive themselves, from the perspectives of epistemology, philosophy of science, and philosophy of mind. The European group of experts on AI proposed to generalize the rules of bio-ethics to AI and artificial

systems in general, with the addition of one specific rule: transparency, i.e., making these systems understandable and transparent for humans about the underlying mechanisms and intentions of the designers. These are important dimensions to take into account when assessing the potential societal impacts of human-machine collaboration.

Law and Sociology: The project will build upon the partners' expertise in digital law, and in particular in questions such as whether and how societies should introduce new regulations to ensure that human-machine collaboration interfaces are beneficial for humans and the society. In particular, we want to investigate and extract propositions to tackle issues of deception, influence, privacy, and potential alterations of human autonomy (both in terms of authenticity and agency). From a sociological point of view, the project will build upon the partners' expertise in identifying and characterizing how digital technologies may affect how humans perceive themselves and perceive society.

The project will benefit from the previous experience and contributions of the different research Groups of the consortium along the set of projects they have respectively realized, including: EU Project HORIZON PILLAR-Robots (2022-2026); EU Project HORIZON CAVAA (2022-2026); EU Network of Excellence HumanAI; French-Austrian Project ELSA (2022-2026); National project ANR CAUSAL (2019-2023); National project ANR Equipex+ CONTINUUM (2020-2028); French Academy of Moral and Political Sciences TesAco project "Technologies Emergentes et Sagesse Collective" (2019-2023), To name just a few.

2. Detailed project description / Description détaillée du projet

2.1 Project outline, scientific strategy / description du projet, stratégie scientifique

The present project proposes to address transversal challenges of digital collaboration on science and society. More particularly, it addresses issues that arise from activities pursued in the entire PEPR eNSEMBLE but require a meta perspective, primarily with respect to assessing the impact of the collaborative technologies developed by eNSEMBLE at the individual, societal and cultural levels. More specifically, the project will study **how these technologies affect ethics, sustainability and impacts beyond technology**.

The key scientific challenges include 1) identifying or developing methodologies for assessing the impact of collaborative technology on individuals, groups of users, and society; 2) recommending strategies for reducing the carbon footprint of collaborative technologies, and 3) identifying the ethical and legal issues raised by technology-mediated collaboration.

2.2 Scientific and technical description of the project / Présentation scientifique et technique du projet

The project includes three different work packages addressing three main objectives that will be pursued in parallel.

WP1 – Methodologies for understanding the impact of technology-mediated collaboration on users and society
WP leaders: Wendy E. Mackay, Mehdi Khamassi

Different research disciplines use different research methods with correspondingly different underlying goals and assumptions. In order to encourage an active dialogue among partners trained in the natural sciences, social sciences and the humanities, we need to develop a common framework that characterises the similarities and differences across methods, as well as strategies for assessing risk. Targeted Project 5 TRANSVERSE extends the scope beyond measuring specific collaborative technologies developed in the four other Targeted Projects of the PEPR eNSEMBLE to **create a taxonomy of research methods and a general framework for assessing collaborative technologies**. We will borrow from existing disciplines, such as the evaluation of the positive, neutral or negative impact of inter-related populations upon each other in evolutionary biology or the analysis and understanding of addictive behavior from psychology and behavioral economics. We will examine methods for studying social dynamics, cultural frameworks, beliefs and views on technologies, and measure changes in collective imagination, as expressed through literature, the press, cinema, graphic narratives and other cultural productions.

The first challenge is to describe, compare and extend the research methods used in the other four targeted projects of eNSEMBLE. We will create a taxonomy that identifies both effective existing methods as well as gaps that require new methodologies. For example, the development of technological collaboration identified in Targeted Projects 1, 3 and 4 produces new forms of social spaces for work, sociability and leisure, with correspondingly new patterns of the spatial distribution of social interactions. We will consider both qualitative and quantitative methods for examining collaborative technology's impact on human relationships with other humans and intelligent agents, and assess the diverse factors and conditions that affect how people collaborate and undertake collective action. We will also consider methods that address behavior change at different time scales, from immediate impact on individuals to long-term impact on people and society.

The second key challenge is to create a roadmap that helps partners, as well as students and practitioners, to identify appropriate research methods for assessing and effectively deploying collaborative technologies. This transversal project will facilitate communication across all the partners, and will encourage t**he development of cross-disciplinary research methods specifically adapted to the unique challenges of evaluating the impact of collaborative technologies on users and society**.

WP2 – Address the positive and negative ecological effects of technology-mediated collaboration
WP leaders: Lionel Obadia, Wendy E. Mackay

Collaborative technologies that support remote work, conferences, education and forms of care offer an effective tool for reducing unnecessary mobility and the corresponding green-house gas (GHG)

emissions. Indeed, the transportation sector accounts for about 16% of GHG emissions, compared to 2-4% for the IT sector. However, the footprint of the IT sector is growing, and includes, besides GHG, pollution related to rare-earth extraction, e-waste, and geo-political tensions related to control over raw materials and component manufacturing. Although the project cannot address all these issues, TRANSVERSE will ensure that they are considered within the context of the other Targeted Projects of the PEPR eNSEMBLE.

The key challenge is to address issues of efficiency and longevity in the design of collaborative tools. This entails both principles of ecodesign and societal changes. We will **develop methods and measures to achieve reliable life-cycle assessments of collaboration tools from networking to end-user devices**. This knowledge will enable us to minimize the footprint of the technologies developed. While analysis and optimization are necessary, broader changes within society are necessary as well, requiring questioning how socio-technological imaginaries are built. We will produce analyses of changes in collective imagination about collaboration and sustainability, as expressed through literature, the press, cinema, graphic narratives and other cultural productions, and how they relate to possibilities of social or ideological change.

WP3 – Address legal, ethical and philosophical issues
WP leaders: Mehdi Khamassi, Lionel Obadia

Collaboration technologies raise important ethical issues, particularly with respect to technological control, citizen's liberty, digital democracy, free will, governance of and by digital technologies, and the control of work13 or ordinary activities. This echoes the question of the legal framework organizing privacy, data protection, interoperability, security, and IA responsibilities, but also more classical questions such as the property of the collective intellectual productions especially in light of the EU member States of Directive 2019/790 on copyright and related rights in the Digital Single Market. Finally, philosophical debates and reflections posed by the Humanities explore how far humans can be helped, assisted, facilitated in their tasks and activities, while remaining "human".

Key challenges include identifying the ethical responsibilities in human-machine collaboration, and clarifying legal issues related to the impact of both collaborative and intelligent systems on individuals and society. Finally, it is crucial to address regulatory concerns related to privacy, copyrights, and interoperability.

2.3 Planning, KPI and milestones / Déroulement, indicateurs et jalons

Global organization and planning

TRANSVERSE is structured along three research-oriented Work Packages. The themes are considered to be equally important and all deserve to be launched together. Every year, each them will identify and fund Research Actions that correspond to one or more Ph.D. projects, and associate several Ph.D. students or post-doctoral fellows who treat the topic from different points of view to obtain richer and broader outcomes. Most of these Research Actions will be based on multidisciplinary approaches, associating disciplines such as Computer Science, Sociology,

Psychology, Law, Philosophy, Ethics and Design. This multidisciplinary aspect will be part of the criteria for evaluating the overall quality of the research.
The Project will be organized into successive calls for Research Actions. In the first years, the Research Actions should correspond to 3-4 Ph.D.s. Subsequent annual actions will be managed through internal scientific calls issued at the PEPR level and selected by a Scientific Committee. Ph.D. students will be recruited only up to year 4, so as to ensure completion before the end of PEPR Ensemble. During Years 5 to 7, a concretization phase will be established, with a three-fold goal:

- To select and consolidate a subset of the most promising use cases and interaction models proposed during the maturation phase;
- To develop concrete demonstrators based on the selected use cases and interaction models;
- To develop an integrative platform. It is a set of modules that guarantee interoperability within and between interaction models. The objective is that these modules will be used among the members of the program and outside of it.

We propose three milestones that will ensure that early work can feed into subsequent actions:

Milestones 1 (year 4):
- Framework and methods for analyzing the impacts of digital collaboration;
- 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; and
- Identification of TRANSVERSE Communities and the formalization of collaboration.

Milestone 2 (year 5):
- Report on how the TRANSVERSE guidelines and frameworks are applied in the design, implementation and evaluation of the eNSEMBLE tools and use cases.

Milestones 3: (year 7)
- Report on communities already analyzed, to implement/test the tools developed; and
- Publication of analyses of other projects/communities.

Key Indicators

TRANSVERSE will follow the general KPIs defined in the National Program FRANCE 2030 (see Appendix 1).

Risk Management and mitigation

Risk Type	Risk	Corrective measure
Human Resources	PhD recruitment: not enough candidates for all positions	Flexibility in the number of Ph.D.s 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	Development and Deployment of measurement tools and processes (or other technical risk)	Adopt community standards to facilitate the deployment and coherence of measures.
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 Ph.D. and post-docs workplan.

3. Project organisation and management / Organisation et pilotage du projet

3.1 Project manager / Responsable du projet

Mehdi Khamassi is a research director employed by the Centre National de la Recherche Scientifique (CNRS), and working at the Institute of Intelligent Systems and Robotics (ISIR), on the campus of Sorbonne Université, Paris, France. He serves as co-director of studies for the CogMaster program at Ecole Normale Supérieure (PSL) / EHESS / University of Paris Cité. His main topics of research include decision-making and reinforcement learning in robots and humans, the role of social and non-social rewards in learning, and ethical questions raised by machine autonomous decision-making. His main methods are computational modeling, design of new neuroscience experiments to test model predictions, analysis of experimental data, design of AI algorithms for robots, and behavioral experimentation with humans, non-human animals and robots.

Wendy E. Mackay is a Research Director, Classe Exceptionnelle (DR0), equivalent to a tenured full professor. She directs the ex)situ research group in Human-Computer Interaction at Inria, Paris-Saclay, and the Université Paris-Saclay (formerly Université Paris-Sud). She teaches in the HCID and HCI international Masters degree programs at the university. She served for over three years as Vice President of Research for the Computer Science Department at the University of Paris-Sud, after which she spent two years as a Visiting Professor at Stanford University in the Computer Science Department. She received her Ph.D. from MIT and has served as Chair of ACM/SIGCHI, co-editor–in-chief of the journal IJHCS, was general chair of our flagship conference CHI'13, and received the ACM/SIGCHI Lifetime Achievement Award for Service. She is also a recipient of a European Research Council Advanced Grant. Her current research interests include co-adaptive instruments, tangible computing and multi-disciplinary, participatory design methods.

Lionel Obadia is PhD in Sociology and Professor of Social and Cultural Anthropology at the University of Lyon 2, at the Rhône-Alpes Historical Research Laboratory (LARHRA). He is an associate member at ISIR, Sorbonne University, Paris. He specializes in the study of beliefs, religion, modernity and globalization. Part of his scientific activity has been devoted to the epistemological and methodological examination of religious science issues. He has published a dozen books, including La Marchandisation de Dieu, 2013, Anthropologie des religions, 2007, translated into Greek and Portuguese, republished in 2012, La Religion, 2004, translated into Korean, La

Sorcellerie, 2004, Le bouddhisme en Occident, 2007, translated into Italian and others in English such as the volume The Economics of Religion edited with Donald Wood, Emerald, 2011. He has published over a hundred articles in scientific journals and book chapters in French, English, Spanish, Chinese and German. He is now working on an anthropology of high-tech, AI and robotics.

3.2 Organization of the partnership / Organisation du partenariat

The consortium is composed of 19 partners (representing 42 teams), among which 2 national research institutions (CNRS, INRIA), 16 High Education and Research Institutions (listed below), 1 engineering school (CESI). 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: computer scientists (human-computer interaction (HCI), software engineering), sociologists, social and management scientists, philosophers, lawyers, designers, ergonomists, and data scientists, for a total effort of more than 65.10 man.year.

The project will be managed by the three coordinators (M. Khamassi, W. Mackay, L. Obadia). Each of them will contribute to the coordination of two WPs, so that each WP is coordinated by a pair. In addition, the three coordinators will collaborate on the management of the different workpackages, deal with administrative aspects and ensure the link with the rest of the PEPR projects.

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 the project**	**Invest. in project (in m.y)**
ACCRA	Design	U. Strasbourg	1,75
CEMOI	Management	U. La Réunion	0,70
Centre Internet et Société	Sociology / economics / ICT	CNRS	1,40
CERAG (ICO)	Management	UGA	0,70
CERAG (CRES)	Management and marketing	UGA	1,75
CERES	Digital humanities	Sorbonne U.	1,40
COSTECH	HCI, ergo, psycho, philo	UTC	0,70
CREM	Economics, management	U. Rennes	0,70
CRIStAL (Loki)	HCI	Inria	0,70
CRIStAL (SPIRALS)	Software eng. cloud	Inria	0,14
DANTE	Law	U. Paris Saclay	1,05
DySoLab	Sociology of Digital,	U. Rouen	0,56

	Computational social sciences		
GRIPIC (Media)	Networks	Sorbonne U.	0,35
I3 (INTERACT)	Ergo Psycho & Design	IMT+CNRS	6,65
IODE	Law	U. Rennes	0,70
IPAL	AI, HCI, Cognition	CNRS	4,20
IPHIG	Philosophy	UGA	0,70
IRIT (Elipse)	HCI	U. Toulouse 3	0,70
IRJS (DReDIS)	Digital law	U. Panthéon Sorb	0,70
ISIR (AMAC)	Cogni. sci., machine learning, ethics, neuro., robot.	Sorbonne+CNRS	1,75
ISIR (IME)	HCI, AI, robotics	CNRS	1,40
ISIR (Agathe)	Robotics, HCI	Sorbonne+CNRS	1,40
Laboratoire d'Informatique interactive	HCI	ENAC	1,40
Lab-STICC (Commedia)	Ethics, human and environmental impacts	CNRS	0,70
LaPEA	Ergo, psycho, virtual reality	U. Gustave Eiffel	1,75
LARHRA	Sociology, Anthropology, History	CNRS	0,70
LINEACT	Ergo, psycho, HCI	CESI	5,25
LEGO (ETIC)	management and economics of digital platforms	IMT	1,05
LIG (Metah)	CSCL	UGA	1,05
LIG (IIHM)	HCI	UGA	2,10
LIP6 (SMA)	AI, intelligent systems	Sorbonne U	0,35
LIRIS (SICAL)	HCI & CSCL	U. Lyon 1	0,70
LISN (CPU)	Ergo, psycho, HCI	U. Paris-Saclay+CNRS	3,15
LISN (Ex Situ)	HCI	U. Paris-Saclay+ CNRS+Inria	1,40
LISPEN (Aix)	Collaborative methods and tools	ENSAM	0,70
LISPEN (Chalon)	RV, HCI, Perception	ENSAM	0,70
LIST3N (Tech-CICO)	HCI, CSCW, info-com, ergo psycho, management, sociology	UTT	2,10
LITEM	management, economics, technostress, IS governance, knowledge flows in communities of practice/epistemics	IMT	2,80

LS2N (PACCE)	Psycho, ergo, CS, HCI	CNRS	3,50
LS2N (IPI)	CS, Quality of Experience	CNRS	2,10
Sci. Normes Decision	Philosophy	Sorbonne U	0,70
STIH	Computational linguistics	Sorbonne U	1,75
		TOTAL	**65.10**

3.3 Management framework / Pilotage

Consortium management

The TRANVERSE management committee will be composed of the three project leaders and one representative from each partner organization. It will show a strong interdisciplinarity and complementarity. Its three leaders respectively represent cognitive sciences, human-computer interaction and sociology and have all been involved in many previous and current interdisciplinary projects. It is interesting to mention that the management committee largely covers the regions in France (Aix, Grenoble, Lille, Lyon, Nantes, Paris, Rennes, Rouen, Strasbourg, Toulouse, Troyes, …) 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.

In addition to 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 TRANSVERSE

At least two international open symposiums will also be organized during the program to internationalize the community. This may take the form of a summer 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 the 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, TRANSVERSE will start with an internal kick-off seminar (M1) and organize annual seminars (M13, M25, M37, …) in addition to two annual face-to-face workshops. Because TRANSVERSE addresses transversal challenges that are relevant for the whole PEPR eNSEMBLE consortium, we will make particular efforts to organize events where people from the five different Targeted Projects of the PEPR participate. In particular, we will organize a yearly seminar on ethical issues, environmental impacts and other potential impacts of digital collaboration on the society, to familiarize newly recruited Ph.D. students of the whole PEPR with these issues. This will help them start taking these issues into account in their thinking early in their career. Finally, 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 20%-time project administrative manager, employed by the PEPR eNSEMBLE as a whole, will be attached to TRANSVERSE. 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 Targeted Projects 2, 3 and 4, facilitating the harmonization and the coordination at the PEPR level.

Micro-project management. TRANSVERSE will dedicate 475K€ to fund micro-projects, a flexible way to enable different partners to coordinate their action on a specific scientific goal, with tangible outcomes, when this goal addresses transversal challenges of the PEPR eNSEMBLE and measures some of the impacts of digital collaboration. Thus, part of TRANSVERSE management efforts will be dedicated to managing the application, selection, funding, monitoring and reporting processes of micro-projects. Examples of micro-projects include visit of one partner to another partner's institutions to work on specific methods or impacts; recruiting an engineer to establish a new method or new standards to measure impacts; organizing a workshop dedicated to methods or to specific ethical, philosophical, juridical, or environmental issues raised by digital collaboration.

Management of other activities. Like the other projects of the PEPR, we will also organize regular campaigns for Ph.D. funding, organize workshops to gather the PEPR community on specific topics or questions, and contribute to establishing a common scientific culture for the Ph.D. students hired within PEPR eNSEMBLE.

Harmonization at PEPR level

TRANSVERSE'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 revisions to the roadmap of the Targeted Projects. 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.

TRANSVERSE 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 Ph.D. & post-doc candidates selection committees.

TRANSVERSE will rely on the following transversal actions of the PEPR eNSEMBLE detailed in the Governance project:

- 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);
- Valorisation and transfer to build concrete collaborations with non-academic partners;
- Education and training to train a generation of Ph.D. students and post-doctoral researchers to address the long-term challenges of collaboration with digital tools; and
- 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: ACM CSCW, ACM CHI, ACM 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 / Stratégie des établissements

All partners of TRANSVERSE are actively involved in the study of digital collaboration and its impact on science and society. Nineteen universities or institutions are implied in project TRANSVERSE. How it fits in the strategies of some of the most representative partners is detailed below.

CNRS: CNRS has been involved in various aspects of AI and HCI (human-computer interaction) research. In the field of AI, CNRS researchers have contributed to the development of machine learning algorithms, natural language processing, and computer vision, among other areas. They have applied these AI techniques to various domains such as robotics, healthcare, and transportation. Regarding the association of AI and HCI, CNRS researchers have explored how AI can enhance the user experience and usability of computer systems. They have also studied the ethical implications of AI in HCI, such as privacy concerns and algorithmic bias.

INRIA: “sustainable artificial intelligence” is one of the research priorities identified by Inria in its strategic research plan (Contract of Objectives and Performance). Inria already invested resources in ambitious projects related to Targeted Project 3 on collaboration with intelligent systems, such as the PEPR IA, the Défi project Ys.AI with Interdigital, or several Horizon European projects. Interaction with AI-driven entities is addressed by several Inria teams, and by platforms such as the immerStar VR platform (part of the Equipex+ CONTINUUM), OpenViBE and BioPyc software.

Université Paris-Saclay: The University of Paris-Saclay is committed to developing a strategy in artificial intelligence (AI) and human-computer interaction (HCI) aimed at strengthening research, training and economic development in these fields. In the field of AI, the University of Paris-Saclay is developing interdisciplinary research covering areas such as machine learning, computer vision, automatic natural language processing and robotics. Researchers at the university are also working on AI applications in areas such as health, the environment and energy. Université Paris-Saclay focuses on developing technologies that enable natural and intuitive interaction between humans and machines.

UGA strongly supports the development of interdisciplinary research projects involving digital collaboration and its impacts on society, 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. TRANSVERSE corresponds to several UGA teams’ research areas in computer sciences, human-machine interaction and social sciences. UGA hosts 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. Efforts will be focused on the co-evolution and the emergence of human 5.0, aiming to consider the reciprocal actions and interactions of human and technological environment by addressing the issues of augmented skills and knowledge, sensory systems and the contribution of the human in terms of intelligence, meaning and creativity for efficient complex systems. Digital

sovereignty also involves AI and responsible data which will rely on solid mechanisms of cooperation between humans and complex systems.

Sorbonne University: Interaction with intelligent systems is an important research field at SU with for instance the Institute of Intelligent Systems and Robotics (ISIR) or the institute of Artificial Intelligence (SCAI). SU is conducting multidisciplinary research on various themes in human-intelligent system interaction, including human-artificial intelligent agents interaction, human-centered approaches to machine learning, decision making, AI, robotics, and the ethics of AI and robotics, to name a few.

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.

Université Toulouse: Université Toulouse is involved in the association of AI (Artificial Intelligence) and HCI (Human-Computer Interaction) through its participation in ANITI (Artificial and Natural Intelligence Toulouse Institute). ANITI is a multidisciplinary research institute that brings together experts in machine learning, natural language processing, robotics, and human-computer interaction to advance research, innovation, and education in these fields. They are working to develop new AI technologies that are more transparent, trustworthy, and understandable to end-users.

Université Gustave Eiffel: Université Gustave Eiffel combines expertise in the fields of AI, HCI, and psycho ergonomics to understand how users interact with AI-based systems, how to optimize user experience and satisfaction, and how to improve system performance. The ultimate goal of their research is to create AI systems that are intuitive, easy to use, and provide value to users. Through collaboration with industry partners and other academic institutions, Université Gustave Eiffel is at the forefront of research in AI and HCI along with psycho ergonomics, and is contributing to the development of innovative technologies that improve human-computer interaction.

ENAC: ENAC, the French Civil Aviation University, has been involved in the association of AI (Artificial Intelligence) and HCI (Human-Computer Interaction) for avionics in several ways. ENAC has developed virtual reality training environments for pilots, which use HCI to enhance the training experience. ENAC is a member of the SESAR Joint Undertaking, which is a public-private partnership focused on modernizing European air traffic management. Through this collaboration, ENAC is involved in developing and testing new technologies for air traffic management that use AI and HCI.

We indicate below, for all partners of project TRANSVERSE identified to date, a rough and minimal evaluation of the resources available for the conduct of scientific projects on the impacts of digital collaboration for science and society. The estimate of the internal efforts from the partners of TRANSVERSE project is expected to reach more than **65.10 person-years** for the total duration of the project and is summarized in the table below. This global effort should naturally increase over the duration of the project. Please note that this estimation is only based on an average percentage

of team members and their research time devoted to the PEPR, as the project TRANSVERSE will be based on scientific-driven attribution of resources amongst proposals submitted to regular open calls. Also, as for the PEPR at large, the research activities of the project will be able to rely on the significant CONTINUUM network of Human-Computer Interaction platforms.

Partner	Team	Staff	% involvement	Involved staff	%time involv.	Effort in m.y	Partner eff.
Sorbonne Univ	SU ISIR AGATHE	17	5,88%	1	5	0,35	
	SU ISIR AMAC	12	8,33%	1	5	0,35	
	SU STIH Ling. Comput.			3	25	1,75	
	SU CERES Huma. Num.			3	20	1,40	
	SU GRIPIC Medias			1	5	0,35	
	SU SND			1	10	0,70	
	SU LIP6 SMA			1	5	0,35	**5,25**
CNRS	CNRS ISIR AMAC	12	8,33%	1	20	1,40	
	CNRS ISIR IME	9	11,11%	1	20	1,40	
	CNRS ISIR AGATHE	17	11,76%	2	15	1,05	
	CNRS CIS	6	50,00%	3	20	1,40	
	CNRS LARHRA	90	1,11%	1	10	0,70	
	CNRS LISN CPU	6	50,00%	3	45	3,15	
	CNRS Lab-STICC COMMEDIA	9	22,22%	2	10	0,70	
	CNRS LS2N IPI	13	23,08%	3	30	2,10	
	CNRS L2SN PACCE	16	18,75%	3	50	3,50	
	CNRS I3 INTERACT	13	15,38%	2	20	1,40	
	CNRS CREM			1	15	1,05	
	CNRS IPAL	49	12,24%	6	60	4,20	**22,05**
Univ Gustave Eiffel	Eiffel LAPEA CREATE	26	7,69%	2	25	1,75	**1,75**
IMT	IMT LEGO ETIC			2	15	1,05	
	IMT LITEM			4	40	2,80	
	IMT I3 Interact	13	23,08%	3	75	5,25	**9,10**
INRIA	INRIA LISN EX SITU			2	15	1,05	
	INRIA CRIStAL LOKI			1	10	0,70	
	INRIA CRIStAL SPIRALS			1	2	0,14	**1,89**
Univ Toulouse 3	Toulouse IRIT ELIPSE			1	10	0,70	**0,70**
Univ Lyon 1	Lyon LIRIS SICAL	15	6,67%	1	10	0,70	**0,70**
Univ Grenoble Alpes	UGA CERAG CRES	22	13,64%	3	25	1,75	
	UGA IPHIG	11	9,09%	1	10	0,70	
	UGA CERAG ICO			2	10	0,70	
	UGA LIG METAH			3	15	1,05	
	UGA LIG IIHM	13	23,08%	3	30	2,10	**6,30**
Univ Paris-Saclay	UPS DANTE			2	15	1,05	
	UPS LISN Ex-Situ			1	5	0,35	**1,40**
Univ Rouen	ROUEN DYSOLAB			1	8	0,56	**0,56**
Univ Panthéon Sorbonne	UPS IRJS DREDIS			1	10	0,70	**0,70**
ENAC	ENAC Interactive Info	9	11,11%	1	20	1,40	**1,40**
ENSAM	ENSAM LISPEN Chalon			2	10	0,70	
	ENSAM LISPEN Aix			2	10	0,70	**1,40**
CESI	CESI LINEACT			3	75	5,25	**5,25**
Univ Strasbourg	US ACCRA			2	25	1,75	**1,75**
Univ Rennes	RENNES CREM			3	10	0,70	
	RENNES IODE			2	10	0,70	**1,40**
Univ Tech Troyes	UTT LIST3N Tech-CICO			2	30	2,10	**2,10**
Univ La Réunion	ULR CEMOI			2	10	0,70	**0,70**
Univ Tech Compiègne	UTC COSTECH			4	10	0,70	**0,70**
				90		man.year effort	
				Involved perm.			
						65,10	**65,10**

4. Expected outcomes of the project / Impact et retombées du projet

4.1 Expected outcomes

The project will contribute scientific research for and with societal initiatives that propose to render digital collaboration more viable, sustainable, and ethical, with minimized negative societal impacts, such as environmental impacts. One of the main outcomes of the project will be to establish efficient and standardized methods for evaluating and understanding the impact of technology-mediated collaboration on users and society. Addressing a series of research goals that go beyond the current

socio-technical foundations of online digital platforms, we will provide their providers and users with a better understanding of how successful collaboration works, why people involve themselves, and how they can be coordinated. 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 scientific publications, the project will strengthen 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, social 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 the impacts of digital collaboration. 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.

4.2 Dissemination strategy

From a scientific point of view, we will ensure the publication and dissemination of results in major journals and conferences in the relevant fields (e.g., by supporting the organization of workshops associated with the main conferences in the fields). We will follow ANR's Open Science policy by requiring all funded research projects within the program to publish their data and outputs on national platforms: HAL open archive for publications, TGIR Huma-Num's Nakala for data. All the produced code will be released and maintained under open-source licenses and referenced in the Software Heritage database, with the support of the program's research engineers who will be specifically trained in these practices.

To ensure the visibility of the community beyond its scientific results, we will establish connections with national (AFIHM, AFIA, AFXR, ARPEGE, ARCo, CNRS GDRs) and international (IEEE, ACM, EUSSET) societies, taking advantage of the fact that several Program Directors and members of the Executive Committee are strongly involved in them. We will also build upon the 4AI institutes (MIAI, PrAIrie, ANITI and 3IA Côte d'Azur) network and the DATAIA and SCAI institutes to disseminate our results in their research and industrial communities.

Regarding the general public, civil society and institutions, the Executive Committee will encourage the participation and presentation of the program's activities in annual national events such as Fête de la Science, or in outreach initiatives in high schools such as DECLICS and Comptoir des sciences. They will also work closely with local initiatives of pilot and partner institutions to bring the academic world closer to society, such as contributing to funding programs for artists' or designers' residencies in research laboratories (e.g. AIRlab at University of Lille). This will feed our research, but also produce artifacts adapted to communication towards the general public (interactive artworks, serious games, performances) that will be showcased e.g., during public sessions of the eNSEMBLE days.