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# DePERU: Decision-making Processes under Extreme Radical Uncertainties

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**Project title: Decision-making Processes under Extreme Radical Uncertainties**  
**Acronym: DePERU**  
**5 keywords: radical uncertainty, extreme uncertainty, decision-making, future studies, strategic foresight**  
**Duration: 8 years with 4 years GO/NO-GO evaluation**  
**Requested budget: 2 870 k€**  
**If co-financing has been obtained, indicate the total cost of the project: 3 190 k€ (additional funds yet to be obtained)**

**Principal Investigator**

Last name: Le Lec  
 First name: Fabrice  
 Position: Professeur des Universités (Full Professor)  
 Organisation (employer): Université de Lille  
 Research Unit: Lille Economics and Management, UMR CNRS 9221  
 E-mail: fabrice.lelec@univ-lille.fr

**Co-Principal Investigator**

Last name: Makki  
 First name: Sami  
 Position: Maître de Conférences (Associate Professor)  
 Organisation (employer): Sciences Po Lille  
 Research Unit: CERAPS, UMR 8026  
 E-mail: sami.makki@sciencepo-lille.eu

**Thematic hub(s) and ERC panels (it is possible to tick more than one box).**

Hub "Precision Health"  principal  secondary  
 Hub "Science for a changing planet"  principal  secondary  
 Hub "Human-friendly digital world"  principal  secondary  
 Hub "Changing Cultures, Societies and Practices" X principal  secondary

ERC Panel(s):

**----- Primary Panels:**

SH1\_7 Behavioural economics; experimental economics; neuro-economics  
 SH1\_8; SH1\_8 Microeconomic theory; game theory; decision theory; SH1\_10  
 Management; marketing; organizational behaviour; operations management;

SH1\_11 Technological change, innovation, research & development SH2  
 Institutions, Values, Environment and Space Political science, law, sustainability  
 science, geography, regional studies and planning; SH2\_1 Political systems,  
 governance; SH2\_2 Democratisation and social movements; SH2\_3 Conflict  
 resolution, war, peace building; SH2\_5 International relations, global and  
 transnational governance; SH4 The Human Mind and Its Complexity Cognitive  
 science, psychology, linguistics, philosophy of mind; SH4\_7 Reasoning,  
 decision-making; intelligence

**-----Secondary panels:**

PE6\_7 Artificial intelligence, intelligent systems, natural language processing SH2\_7  
 Environmental and climate change, societal impact and policy; SH2\_8 Big data in  
 political and legal studies SH3\_13 Digital social research; SH3\_14 Social studies of  
 science and technology

## Abstract

Major global transitions are expected to take place in the coming years, in geopolitical, ecological, technological and social dimensions. The drastic nature of these changes and their simultaneous occurrence will generate **radical forms of uncertainty**, perhaps to an unprecedented level in human history. As a result, it is increasingly difficult not only to assess the likelihood of possible scenarios for the future of humankind, but also to merely circumvent the set of possible scenarios. The fact that the human mind may not be able to conceive all the possible outcomes of a given situation is the defining characteristic of radical uncertainty. As the contemporary sources of uncertainty are multiple and may lead to extreme consequences, we conjecture that the current situation is one of extreme radical uncertainties.

This raises the critical question of how humans deal with such a situation. The key issue of the project is to find whether such forms of uncertainties impact our collective and individual decision-making processes and in what way. So far, the study of decision-making under uncertainty has tended to focus on less radical forms of uncertainty, namely risk and ambiguity, where all consequences can be conceived of. Important findings in this field, whether theoretical or empirical, may thus not apply to radical uncertainty. We aim at contributing to fill this gap through the investigation of the following research questions: **How does radical uncertainty influence decisions**, and more specifically how does it inform three particular components of decision-making processes: **deliberation, choice, and legitimation** (work-packages 2, 3 and 4)? Does radical uncertainty lead decision-makers, be they individuals, groups or organizations, to rely on decision-making processes that mark a radical break from processes currently examined?

This research program requires new methods and approaches, in particular a genuinely cross-disciplinary perspective. The elusive nature of radical uncertainty first calls for a robust **conceptualisation** (work-package 1) to map the various ways actors and stakeholders apprehend it, respond to it or even train for it. Second, the very opacity of radical uncertainty makes it hard to study its influence on decision-making in the lab, by definition, a controlled environment that can hardly accommodate high levels of unexpectedness in experimentation. The need to study external, “real world” environment decisions is then inherent to the study of decision under radical uncertainty.

The core idea of the project is to **document the current forms of radical uncertainty** to produce scenarios that can be used as material for empirical research on how actors make decision conducted through a mix of methods (experiments, surveys, observation). In particular, this project of documenting contemporary radical uncertainties will target a wide variety of crisis management and all-hazards preparedness professionals from the public, non-profit and commercial sectors. The project will engage with the community of interconnected experts to better understand their interactions with decision-makers who are challenged by unknown complex geopolitical, technological, and environmental events.

The project’s methodology seeks to combine the **quantitative rigor of methods in experimental approaches and the richness of more qualitative approaches** by resorting to data collection through research interviews, archives consultations and field missions. The research findings will be published in specialized and academic journals.

These contributions will generate social impacts and give rise to applications through their integration into university teaching and renewed academic curricula, expertise provided to public and private organizations, and dissemination to the general public to better inform the public debate about the major transitions our democratic societies will have to face. These applications (work-package 5) will lay the foundations for the creation, in the next 4-year stage of the project, of the **Lille Interdisciplinary Institute on Radical Uncertainty (LIIRU)** where confidence-building initiatives, aiming at stimulating a sustainable cross-disciplinary dialogue, will bridge the gap between academia and decision-makers to better anticipate how decision-making processes deal with extreme radical uncertainties.

*In memory of Pascal Alphonse*

## I/ Description of the project

Our project seeks to study **decisions and behaviours under radical uncertainty**, *i.e.* when the agents cannot fully grasp the set of possible scenarios. To do that, we will rely on a methodology which has a cross-disciplinary approach at its centre: The core characteristic of radical uncertainty - the unconceivable nature of some scenarios will be reproduced in practice **by confronting decision-makers with highly heterogeneous, unfamiliar cognitive perspectives, that only a cross-disciplinary approaches can bring about**. A scenario that is not conceivable for a given type of agent may not be (fully) inconceivable for some other types of individuals (ex. experts in an external field, scientists, authors, etc.). To overcome the elusiveness of radical uncertainty understood as the inability to design some almost unconceivable consequences to emulate radical uncertainty, we will rely on the heterogeneity of the world representations provided by different types of expertise and knowledge. Therefore, the project will be two-fold, first it will **document almost impossible and radical scenarios, based on this cross-disciplinary approach**, and then it will **use these scenarios, in various empirical approaches, to observe behaviours under RU**.

### 1. State of the art

[...]

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**Academic partners:**

**Specific Deliverables:**

- [...]

- Publication of a Handbook on “Radical Uncertainty”,

**WP 2: Deliberation under RU**

**WP leaders:** Justine Faure (IRHiS), Sami Makki (CERAPS)

The general objective of this work package is to understand **how each of the steps related to preparation of the decision (gathering information, elaborating scenarios and consequences, evaluating the information, reasoning, and argumentation) are affected by the fact that the decision environment is marked by RU**. In a few summarizing questions, the issues are: How does the presence of RU influence deliberation, and how do the extreme and radical stakes come into play in deliberation? On the contrary, does this context lead to more caution (as in the precautionary principle) or sometimes even to non-decision? Can we call for the creation of a "continuum" between these forms of knowledge (experts, academics), which are sometimes so different and divergent, to create spaces for inclusive debate in deliberative processes? What is the role of civil society stakeholders and how should they interact with the academic world?

This work-package will particularly focus on **the levels of groups, organizations and institutions** as they provide a natural field of observation since deliberation is often public or at least observable. This WP will focus on knowledge and expertise in situations of RU, and on the emerging deliberative processes that place data at the centre of assessments and representations of **strategic environments** undergoing change within and beyond the state. The multiple temporalities of these analyses also provide a particularly rich context to study the deliberation processes in detail. These environments play a key role in the creation of hybrid systems in which a variety of actors interact in complex ways (competition, cooperation, coordination, integration or nexus, etc.), which emerged in response to complex emergencies in the 1990s (Fassin, Pandolfi 2010) and threats in the 2000s.

With regard to deliberation, we will analyse a wide variety of crisis situations in which, at the collective level, there is a mix of formal and informal processes of reflection, exchange of expertise and skills, and institutionalization of a programmatic approaches (formulation of a need, identification of a political and strategic goal, setting up of a programmatic budget), and at the individual level, psycho-economic mechanisms (learning, memory, prediction, anticipation, etc.). The aim is to examine the role of advice and expertise in the way possible futures are imagined through exploratory work, strategic foresight and scenario-based planning. What is the role of scientific knowledge and expertise

(especially from NGOs and think tanks) in developing strategies and supporting decision-making? At the individual level, the aim is to explore how knowledge acquired in advance, through direct experience or from others, plays a role in the process of predicting and anticipating the expected consequences of the choices that will be made by agents (political decision-makers, business leaders, military officers and diplomats, or humanitarian leaders). Moreover, beyond the accumulation of knowledge and know-how, can artificial intelligence help humans in the deliberation process? The use of simulation and wargaming is becoming increasingly systematic and is part of a wide range of initiatives (MoD's Red Team, government agency planners) aimed at thinking forward to anticipate crises in the hope of "imagining beyond the imaginary" (IFRI, 2023). At a time when the growing role of technology is reducing the "decision loop" (OODA in the military), what place should be given to democratic assessment by Members of Parliament or independent bodies? Are lessons learned from past failures and successes sufficient to prepare for crisis management and emergency/all hazards and train professionals to deal with extreme radical uncertainties? Demands for transparency from informed (or deliberately misinformed) civil societies challenge institutions and greater accountability is expected in times of RU.

WP researchers will engage with the community of networked experts to better understand their interactions with decision-makers faced with unknown complex geopolitical, technological and environmental events. Comparative analysis will allow us to identify the main trends and formulate some more operational lines of thought. As a source of comparison, a major field research will be for example conducted in key US national security institutions (White House, DoD, State Department, Congress, US industry) during the uncertain election and post-election periods (autumn 2024 and spring 2025). This research mission will take place in Washington DC and Tampa, Florida (major US military headquarters) to assess ongoing adaptation and mitigation strategies. This field mission is part of an HDR project on "Geostrategic Civil-Military Adaptations to Extreme Radical Challenges in Democratic Environments" to be defended before the end of Phase 1. As part of this project, transatlantic partnerships will be developed, building on the existing institutional relationships with US partners. Thematically, WP2 will examine the rise of global disorder and emerging strategic challenges for European countries and NATO allies through a comprehensive analysis of European and American strategic sectors' adaptations to extreme/global radical uncertainties and the growing nexus between environmental emergencies, techno-digital revolutions and security challenges. A European Common Security and Defence Policy (CSDP) is slowly taking shape. But the transatlantic alliance, with its reactivated networks of experts from the past, offers an alternative military capability following the invasion of Ukraine [Poletti 2023]. With continuing hybrid threats, complex contingency operations, and risks of high-intensity warfare in Europe and the Asia-Pacific region, nuclear challenges will be considered through existing democratic oversight mechanisms [Pelopidas, 2022].

The analysis of foresight initiatives in Europe will help to understand how European democracies anticipate unplanned major complex contingencies with comprehensive civil-military strategies, with "rampant communitarization" of European defence creating new deliberative processes. Each step in the decision-making process (information gathering, scenario and consequence building, information evaluation, reasoning and argumentation) will be observed and analysed.

#### **Academic and institutional partners**

- Institut des Mondes Africains EHESS, Paris
- National Network of regional Sciences Po (le « réseau des IEP de région »)
- Johns Hopkins University's SAIS Europe, Bologna
- Université Libre de Bruxelles (USE) et Université d'Artois (LGI2A)

#### **Non-academic partners:**


- ACADEM (Defense Academy, Ecole militaire Paris),
- Campus Cyber de Lille
- Séries Mania Institute

#### **Specific Deliverables**

- € Conducting a unique qualitative and quantitative study of the career paths of young graduates in decision-making positions. This network of 450 graduates from Sciences Po Lille's Strategic studies (SIGR) program (currently advisers and decision-makers in the public and private sectors in France and abroad) will also promote the DePERU project within governmental age) &A•ĀOĀ•!ç^Ā, [ ~|âĀ•ĉ â^Ā@Ā\*!æã æ•Ā!^|æĀ }•Ā, ã@â^&ãĀ }-makers, their experiences of decision-making and their perceptions of challenges posed by ERU. Semi-directive interviews (year 3) could lead to a publication accompanying the organization of a series of roundtables.
- € Organizing 4 workshops to foster existing civil and military partnerships with practitioners locally, nationally, and internationally. Chatham House rules will be applied to promote trust.
- € Organizing Model Congress simulations as well as serious game platforms to initiate collaborative exercises between researchers, students and practitioners.
- € Facilitating of debates within Academia to form the basis for the development of the Lille Interdisciplinary School of European and International Affairs (LISEIA), contributing to emerging European strategic initiatives and existing academic networks.
- € Involving the creative sectors through cultural and scientific events with game and video creators (SerieMania Institute) and journalists as well as literary creation regarding anticipation and foresight.
- € Publishing a Handbook on Civil-military expertise and foresight initiatives to anticipate and prepare for Extreme Radical Uncertainties.
- € Promoting and disseminating research activities with 1 podcast to promote program outputs on a regular basis (1 per semester). Another podcast ("Facing US radical Uncertainties") would be created during the mission to the United States (the American elections and the transition period).

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**K D`YUXYfg:** Fabrice Le Lec (LEM), Arthur Prével (SCALab)

After the gathering of information from the environment and their processing, the step of deliberation in the decision-making process (WP1) is followed by a choice made by the individual or by a group of people. 

uncertainty. But other possibilities include the MAIF foundation (on risks) and the Volkswagen foundation (on humanities and social science). These private funding may be perfectly relevant since the corresponding organizations they are likely to go through major, and partly radically uncertain, transitions and changes. Moreover, these foundations are equipped to fund large project of the type we aim with **the Lille Interdisciplinary Institute on Radical Uncertainty**.

- **Creation of the LIIRU** (Lille interdisciplinary institute of Radical Uncertainty)

In the long term (Phase 2), our goal is to establish the **Lille Interdisciplinary Institute of** [...]

## 2. Timetable

The project is split into two 4-year stages, the **first stage (2024-2028) will be dedicated to the advancement of our cross-disciplinary research paradigm (24 tasks and deliverables)**, seeking to establish the definition and boundaries of RU, establish the empirical methodologies and theoretical framework to approach human behaviours in such circumstances, and to start building the network of partnerships and funding's required to advance this research. The **second stage (2028-2032) will be centre on the creation of the Lille Interdisciplinary Institute on Radical Uncertainty**, with all the relevant dimensions (scientific, financial and social). The Institute will solidify the progresses and advances in the study of radical uncertainties, as well as tis applications.



**Appendix 1 :**

**1) Researchers and teacher-researchers involved in the project:**

The project gathers **46 researchers** (researchers and researchers-teachers) from **12 different research units**, divided in 5 work-packages, with 11 WP-leaders among which two Principal and CoPrincipal Investigators.

Last name	First name	Organization	Research Unit	PI/CO-PI/WP-leader/Other	Early-stage R.	Hiring date	Share of FTE	FTE in WP
<i>Alphonse†</i>	<i>Pascal</i>	<i>ULille</i>	<i>LUMEN</i>					
Alessandri	Jérôme	ULille	SCALAB	other	No		20	WP3: 100%
Basu	Debabrota	Inria	CRISTAL	other	Yes	2020/09	5	WP1: 30%; WP3: 70%
Benbouriche	Massil	ULille	PSITEC	WP-leader	No		30	WP5: 100%
Benistant	Julien	ULille	LEM	other	Yes	2023/09	20	WP3: 100%
Berger	Loïc	CNRS	LEM	other	Yes	2019/09	10	WP3: 100%
Bernard	Elsa	ULille	CRDP	other	No		20	WP2: 100%
Besson	Dominique	ULille	LUMEN	other	No		20	WP4: 100%
Billette de Villemeur	Etienne	ULille	LEM	other	No		20	WP1: 100%
Boof-Vermesse	Isabelle	ULille	CECILLE	other	No		20	WP1: 100%
Bracq	Stéphane	Sciences Po Lille	CERAPS	other	No		20	WP2 : 100%
Charabidze	Damien	ULille	CHJ	WP-leader	Yes	2018/09	35	WP5: 100%
Chusseau	Nathalie	ULille	LEM	other	No		25	WP1: 30%; WP5: 70%
Crainich	David	CNRS	LEM	other	No		20	WP3: 100%
Delevoye	Yvonne	ULille	SCALAB	other	No		20	WP3: 100%
Demals	Thierry	ULille	CLERSE	other	No		20	WP1 : 100%

Demil	Benoît	ULille	LUMEN	other	No		20	WP1: 30%; WP4: 70%
Epper	Thomas	CNRS	LEM	other	Yes		10	WP3: 100%
Everaere	Patricia	ULille	CRISTAL	other	No		20	WP1: 30%; WP3: 70%
Fajeau	Maxime	ULille	LEM	other	Yes	2021/09	20	WP1: 100%
Farvaque	Etienne	ULille	LEM	other	No		20	WP1, 100%
Faure	Justine	ULille	IRHiS	WP-leader	No		35	WP2: 100%
Garrouste	Clémentine	ULille	LEM	other	No		10	WP1: 100%
Geynet-Dussauze	Chloé	Sciences Po Lille	CRDP	other	Yes	2022/09	20	WP2 : 100%
Haute	Tristan	ULille	CERAPS	WP-leader	Yes	2021/09	10	WP4, 100%
Hellier	Joel	UNantes&ULille	LEM	other	No		20	WP1: 30%; WP5: 70%
Herbert	Maud	ULille	LUMEN	WP-leader	No		30	WP5: 100%
Hyard	Alexandra	ULille	CLERSE	WP-leader	No		30	WP1: 100%
Jozefowicz	Jérémie	ULille	SCALAB	other	No		20	WP3: 100%
Kalénine	Solène	Ulille/CNRS	SCALAB	other	No		20	WP3: 100%
Le Fur	Tanguy	ULille	LEM	other	Yes		20	WP1: 100%
Le Lec	Fabrice	ULille	LEM	PI	No		50	WP1, 30%; WP3:70%
Madelain	Laurent	ULille	SCALAB	other	No		20	WP3: 100%
Majolino	Claudio	ULille	STL	WP-leader	No		35	WP1: 100%
Makki	Sami	Sciences Po Lille	CERAPS	CO-PU	No		50	WP2: 90%; WP4:10%
Massin	Sophie	ULille	LEM	other	No		20	WP1: 100%
Morge	Maxime	ULille	CRISTAL	other	No		20	WP3: 100%
Morival	Yohann	ULille	CERAPS	other	No		20	WP2: 100%
Peyrat	Etienne	Sciences Po Lille	IRHiS	other	No		20	WP2 : 100%
Pietrandrea	Paola	Ulille	STL	other	Yes		20	WP1: 100%

Preux	Philippe	ULille	CRISAL	other	No		5	WP1: 30%; WP3: 70%
Prével	Arthur	ULille	SCALAB	WP-leader	Yes	2022/09	35	WP3: 100%
Rahman	Shahid	ULille	STL	other	No		10	WP1: 100%
Sangar	Eric	ULille	CERAPS	other	Yes		20	WP2 : 100%
Sénéchal	Juliette	ULille	CRDP	other	No	2019/09	5	WP1: 100%
Toti	Jean-François	ULille	LUMEN	WP-leader	No		30	WP4: 100%
Toulouse	Nil	ULille	LUMEN	other	No		20	WP1: 30%; WP4: 70%

**2) Curriculum Vitae:**

**Principal investigator:**

**Fabrice LE LEC**

Full Professor in Economics, LEM UMR CNRS 9221, Université de Lille  
SH2, Cité Scientifique - 59650 Villeneuve d'Ascq - [fabrice.lelec@univ-lille.fr](mailto:fabrice.lelec@univ-lille.fr)  
<https://orcid.org/0000-0002-1869-5520> - <http://www.lelec.fr>

**Education**

**2019: HDR in economics** at the University of Strasbourg, "Essais en économie expérimentale et comportementale", Supervision by Prof. M. Lefebvre (U. Strasbourg)

**2007: PhD in economics**, "Essays in Behavioural Game Theory", Aix-Marseille University, Supervision by Prof. A. Leroux (U. Aix-Marseille)

**2003: Master in Economic Philosophy**, Aix-Marseille University

**Professional Experience**

Since **09/20: Full Professor** in Economics

**07/17– 8/20: Researcher in Economics** at the Anthro-Lab (Catholic U. of Lille)

Head of the Anthro-Lab research group (2019-2020)

**09/13–07/17: Associate Professor (MCF)** in economics at the Paris-1 University, Centre d'Economie de la Sorbonne, group "Economics & Psychology"

**07/09–09/13: Associate Prof.** in economics at the Catholic U. of Lille

**05/08–09/09: Post-doc researcher** in economics and psychology at the Max Planck Institute, ABC Group, Berlin

**05/07–05/09: Pre-doc & Post-doc researcher** in economics at the CREED, Universiteit van Amsterdam

**10/03–10/07: Doctoral candidate** ("allocataire-moniteur", ATER) in economics, at Aix-Marseille U.

**Publications and Conferences/Seminars**

21 articles (16 international, 17 peer-reviewed), 1 book, 50 presentations in seminars and conferences.

Most relevant publications:

- Punishing the weakest-link -- Voluntary sanctions and efficient coordination in the minimum effort game, with Ondrej Rydval & Astrid Matthey, *Theory and Decision*, 2023

- Protocol for creating new warnings on cigarette packs and evaluating their efficacy in a randomised experimental setting, with C. Ben Lakhdar, A. Deplancke, S. Massin, A. Piermatteo & N. Vaillant, 2020, *British Medical Journal: Open*, doi: 10.1136/bmjopen-2019-03616

- On choice attitude - Some experimental evidence of choice aversion, avec Benoît Tarrow, 2020, *Journal of the European Economic Association*, 18:5, p.2108{2134.

-Dictating the Risk: Comment, with Michal Krawczyk, 2016, *American Economic Review*, 106 (3), 836-839.

-Making decision in uncertain times - What cognitive scientists can say or learn from financial crises, with Magda Osman et Bjoern Meder, 2013, *Trends in Cognitive Science*, 17(6), p. 257-260.

- 'Give me a chance!'. An experiment in social decision under risk, with Michal Krawczyk, 2010, *Experimental Economics*, 13, p. 500-511.

**Editorial activities, Responsibilities and Grants**

Reviewer for numerous economic (*American Economic Review*, *European Economic Review*, *Experimental Economics*, *Games and economic behavior*, *Journal of Economic Behavior and Organization*, *Journal of Public Economics*, *Management Science*, *Review of Economic Studies*) & psychology (*Frontiers in Psychology*, *International Review of Social Psychology*, *Journal of Economic Psychology*) journals. Reviewer for funding institutions: IResP, ANR. Co-editor of a special issue of the *Revue Economique*.

Director of the Anthro-Lab (2019-2020), co-head of the LEM doctoral program (since 2022) Leader of the **Pr-Cycl** project submission (120 k€, 2020, MAIF foundation, Anthro-Lab), coleader of the IBEBACC project (ISite UNLE, 2021, 96 k€), recipient as supervisor of a regional Doctoral Grant (2022), numerous small grants.

**Co-Principal investigator:**

**Sami MAKKI**

Associate Professor in Political Science (international relations), Sciences Po Lille

9 rue Angellier 59000 Lille - [sami.makki@sciencespo-lille.eu](mailto:sami.makki@sciencespo-lille.eu) - <https://orcid.org/0009-0007-3832-3154>

**Education**

**2023-2026: HDR candidate (International relations)** “Civil-Military Adaptations to Extreme Radical Challenges in Democratic Environments”. Supervision by Prof. J. Grajales (Univ. Paris I).

**2008: PhD in political sociology (International relations)**, Ecole des hautes études en sciences sociales (EHESS), Paris. Highest honors. *The Metamorphosis of the American Power*.

**1998: Master in Social sciences**, Ecole des hautes études en sciences sociales, Paris. Honors

**1997: MA in Contemporary History**, La Sorbonne University. Highest honors. **BA in History** ('96)

**Professional Experience**

**Since 09/2015: Associate Professor** in Political Science at **Sciences Po Lille**.

Founder (2008) & **co-director** of the MA “Strategy, Intelligence, Risk Management” (SIGR).

Sciences Po Lille **Director for Research** (2019-2021). **Researcher**, member of research unit **CERAPS** (UMR 8026). **ANR projects** researcher: TRANSGUERRES (2014-17), DATAWAR (2019-23) & FORPEACE (2023-26)

- “Armed Forces and Society” IUS *Life Fellow*, ISA (US), RUSI, IISS (UK) *Member*.

- National **expert** & former member of the ANR Review Committee on “Cybersecurity and Global Security”.

- **Reviewer** (*Etudes internationales, Cultures et conflits, International Peacekeeping, FMSH, Septentrion*).

- Former editorial Board Member of *Humanitaire* (Paris), and *Sécurité et stratégie* (Paris)

**05/2015 – 09/2023: National scientific coordinator** of the official MoD programme for the preparation of French military Officers for the **National War College** (Ecole de Guerre) competitive entrance exam.

**10/2010 – 09/2015: Non-tenured Assistant Professor, Sciences Po Lille**

Associate Researcher, Center for European Research on Administration, Politics and Society (**CERAPS**)

**06/2007 – 09/2015: Associate Researcher**, Institute for African Studies (**IMAf**), **EHESS/Paris I**, Paris

**06/2007 – 10/2010: Academic Programme coordinator** on the Transformation of WarProject (ANR-funded post-doctoral researcher), Center for African Studies, **EHESS**, Paris.

**09/2001-6/2007: Doctoral Researcher**, Interdisciplinary Centre for Peace Research and Strategic Studies (CIRPES), EHESS, Paris.

**06/2000-9/2001: Policy Researcher, International Alert**, Policy and Advocacy Dept, London.

**International cooperation and fellowships**

**2023 (Fall): Visiting Professor, The Johns Hopkins University, School of Advanced International Studies (SAIS) Europe**, Bologna (Italy)

**2007-2008: Visiting Research Fellow Tel Aviv University**, « Arab-Israeli Conflict Resolution ».

**2006-2007: Visiting Researcher, Institute for Security Studies, European Union**, Paris.

**2003 & 2001: Fellowships Fondation Schuman & Sec. Gén. Défense Nationale** (PM's Office), Paris.

**Selected publications**

(18 book chapters, 19 articles (9 peer-reviewed), 6 policy papers, 50 international conferences)

- Co-editor, *Quantifying International Conflicts - Data On War or Data For War*, Palgrave, 2024.

- DATAWAR, « Right Numbers, Wrong Predictions? Why the Ukraine War Caught Europe by Surpris », *La vie des idées*, 2022.

- Makki S., Anderson, G., Beaumais, L., Lambert I., Ramel F., Sangar E., « Exploring Practices of Conflict Data Production, Analysis, Dissemination, and Practitioner Reception », Working Paper 2021/1, CERI, 2021.

- Makki S. & Bazenguissa-Ganga R. (dir.), *Sociétés en guerres. Ethnographies des mobilisations violentes*, Paris, éd. de la Maison des Sciences de l'Homme, 2012.

- *Militarisation de l'humanitaire, privatisation du militaire*, Paris, CIRPES-EHESS, 2004.

- *Processus d'externalisation dans les armées britanniques*, Paris, ministère de la Défense, 2003.

- WP-leaders

### WP1: Defining and documenting RU

**Alexandra Hyard**, PhD (EHESS, Paris), is Associate Professor in economics at the University of Lille (France) and attached to the CLERSE laboratory (UMR 8019). As a historian of economic thought, epistemology and philosophy, her research focuses on decision and choice theory in economics. She is also co-director (with Nicolas Gravel, Univ. Aix-Marseille) of a doctoral thesis on the limits of decision theory in economics (by R. Haddad). More generally, A. Hyard is the author of some twenty scientific articles, as well as several books and book chapters. Her work has received several awards ("Maurice Picard" thesis prize from the Chancellerie des Universités de Paris...). Internationally, she was Visiting Scholar at the Center for HOPE, Duke University (USA) in 2018, and has received invitations from various universities (Lausanne, Oxford, Québec...). Since 2022, she has been on the jury for the best book award for the History of Economic Society (USA) and on the Hagley Library (USA) steering committee. At national level, she has been president of the Association francophone Charles Gide pour l'histoire de la pensée économique (2020-2023) and co-director of the *Revue d'histoire de la pensée économique* since 2019. At the University of Lille, she has various responsibilities, including coordinating the Graduate Programme "Culture, Society and Practice in Change". In addition, she has directed or participated in a dozen research projects (European project, ANR...). Her research ID is <https://orcid.org/0000-0002-0548-3617>. Her recent work includes: DEMALS T., HYARD A., "Pareto's economics: from utility to ophelimity", *Vilfredo Pareto's Contributions to Modern Social Theory: A Centennial Appraisal*, C. Adair-Toteff (ed.), Abingdon, Routledge, 2023; HYARD A., "Arrow and the limits of democratic decision-making", *History of Political Economy*, submitted.

**Claudio Majolino** (PhD, University of Rome "La Sapienza") is an Associate Professor in philosophy of language at University of Lille (2005, current) and member of research units such as UMR 8163 (University of Lille/CNRS) and Inbegriff (University of Geneva). His research focuses on the history of philosophy, phenomenology, ontology and metaphysics. He has been Research and Teaching Assistant at University of Amiens (2003-4) and Lille (2004-5), Lecturer at University of Paris I "La Sorbonne" (2002-3, 2003-4), Paris X "Nanterre" (2002-3) and Lyon III "Jean Moulin" (2004-5), Distinguished Visiting Professor at Seattle University (USA) (2008-10), Invited Visiting Professor at University of Ouagadougou (Burkina Faso) (2007) and The Chinese University of Hong Kong (China) (2017). He has also been the 2017 recipient of the Excellence Research Chair João Paisana at University of Lisbon (Portugal). Since 2013 he is also full professor and director of the curriculum of the "Summer School of Phenomenological Philosophy" at University of Ca' Foscari, Venice (Italy). He is currently in charge of the international master program LILIPHI at the department of philosophy of the University of Lille. He has been also PI of the ANR/FNR international research project "SÉMAINÔ. Archéologie différentielle du Signe Linguistique" (2016-19). In the last twenty years has widely published and edited books and articles in international peer-reviewed journals in French, Italian, English and German. His last authored book is *The Invention of Infinity. Essays on Husserl and the History of Philosophy* (Springer 2023).

### WP2: Deliberation under RU

**Justine Faure**, PhD (Sorbonne-Nouvelle, Paris) and HDR (Panthéon-Sorbonne, Paris), is Professor in Modern History at the University of Lille (France) and attached to the IRHiS Laboratory (UMR 8529). At the University of Lille, she has various responsibilities, including coordinating a master's program and one of her laboratory's scientific axes. Her research focuses on the history of the Cold War and the relations between the United States and the Soviet bloc, through the systematic use of archival sources from the United States, the Soviet Union and Eastern Europe. In particular, she is interested in the construction of expertise and circulation of knowledge in the humanities and social sciences between the USA and the Soviet bloc, thanks to an innovative analysis of East-West academic exchanges and, more generally, American programs aimed at overcoming the opacity of the Iron

Curtain. She is the author of over thirty scientific articles, two scientific monographs and several university textbooks, and has edited or co-edited four special issues of journals. She is a member of the scientific committees of two of France's leading history journals, *20&21. Revue d'histoire* and *Monde(s)*. Internationally, she was Fulbright Fellow and Visiting Scholar at Columbia University in 2010, and has received invitations from various universities (Prague, Pardubice, Fribourg, Geneva, Barcelona...).

**Sami Makki** (see main resume for Co-PI)

### WP3: Choice under RU

**Arthur Prével**, PhD (Univ. Lille), is Associate Professor in psychology at the University of Lille and attached to the SCALab laboratory (UMR 9193). His research focuses on the mechanisms of human learning and on the application of these mechanisms to develop procedures and strategies for behavior modification. In particular, he is interested in topics like human reinforcement learning, behavioral interventions in people with neurodevelopmental disorders, or in human-machine interaction. He published more than ten articles in scientific journals and participated as a speaker to multiple scientific conferences and workshops. Arthur Prével joined the University of Lille as Associate Professor in September 2022. Before that, he was a postdoctoral researcher in the Department of Experimental Psychology at Ghent University (from 2018 to 2021) and in the LIFE Department at the Royal Military Academy in Brussels (from 2021 to 2022). He is now a scientific collaborator at the Royal Military Academy with the team of Dr. Lo Bue. At the University of Lille, he supervises the Master thesis of seven students and he is involved in different scientific collaborations (e.g., the recently funded project TOP-VIP led by Dr. Solène Kalénine). He is the scientific referee for Open Science at the SCALab and he joined the network *correspondant-données* of the Lille Open Research DATA (LORD) project. Outside academia, Arthur Prével is involved as volunteer in the association *Pas à Pas*, dedicated to the treatment of children with developmental disorders, in which he shares in scientific expertise.

**Fabrice Le Lec** (see main resume as PI)

### WP4: Legitimation under RU

#### Tristan Haute

MCF en science politique à l'Université de Lille et chercheur au CERAPS (UMR 8026)

ORCID : 0000-0002-2065-420X

IDHAL : haute-tristan

Mots-clés : vote, participation politique, relations professionnelles, syndicats, conditions de travail et d'emploi, attitudes politiques, méthodes quantitatives

Publication d'un ouvrage, de 19 articles dans des revues à comité de lecture, dont 2 en anglais, de 2 jeux de données, de 9 chapitres d'ouvrages et de nombreux articles de vulgarisation

Présentation de plus de 30 communications dans des événements nationaux ou internationaux

Coordination d'un projet ANR JCJC (2024-2027)

Organisation d'une école d'été récurrente

Principales publications :

- (avec Vincent Tiberj), *Extinction de vote ?*, Paris, Presses universitaires de France, 2022, 120 p.
- « Diversité et évolutions des attitudes des salariés à l'égard des syndicats en France », *Travail & Emploi*, 2021/1, n°164-165, p. 137-160.
- (avec Camille Kelbel, François Briatte et Giulia Sandri), « Down with Covid. Patterns of

Electoral Turnout in the 2020 French Local Elections », *Journal of Elections, Public Opinion and Parties*, 2021/1, n°31, p. 69-81.

- (avec Pierre Blavier et Étienne Penissat), « Du vote professionnel à la grève : les inégalités de participation en entreprise », *Revue française de science politique*, 2020/3-4, n°70, p. 443-467.

### Jean-François TOTI

Associate Professor of Marketing, IAE University School of Management- Lille University

Professional address: IAE Lille 104, Avenue du Peuple, 59800 Lille, France

2016 to present: Senior Lecturer in Marketing, IAE Lille, Université de Lille (LUMEN)

2015 October: PhD in Management Sciences, Marketing, Aix-Marseille University.

Thesis topic: "The role of ethics in the consumer decision-making process and ethical consumption".

His research focuses on ethical issues in marketing and consumer behaviour, and applies to a wide range of fields. It has been presented at over 30 national and international conferences, has been the subject of several book chapters and has been published in academic journals.

A selection of 3 scientific publications is shown below:

- Huaman-Ramirez, R., & Toti, J. F. (2023). How are e-retailer brands related to the manufacturer brands they offer? *International Journal of Market Research*, 65(1), 100-125. [HCERES B/ FNEGE 3/ CNRS 4].
- Steils, N., Martin A. & Toti, J.F. (2022), Managing the Transparency Paradox Of Social-Media Influencer Disclosures: How to Improve Authenticity and Engagement When Disclosing Influencer-Sponsor Relationships, *Journal of Advertising Research*, DOI:<https://doi.org/10.2501/JAR-2022-008>[HCERES A/ FNEGE 2/ CNRS 3]
- Toti, J.F., Diallo, M.F. and Huaman Ramirez, R. (2021). "Ethical sensitivity in consumers' decision-making: the mediating and moderating role of internal locus of control", *Journal of Business Research*, 131, 168-182 [HCERES A/ FNEGE 2/ CNRS 2].

He is also in charge of the 3-year Bachelor's degree in Marketing and Sales at IAE Lille. He leads the Marketing and Sustainable Development SIG within the French Marketing Association, and is the initiator and organizer of the Methods Summer School.

### WP5: Applications

**Massil Benbouriche** (PhD, HDR) is an Associate Professor in psychology and justice at the University of Lille (France). He holds a PhD in psychology (experimental social psychology), a PhD in criminology, and has experience as clinical psychologist with violent and sexual offenders. His research program focuses on social cognition in sexual violence and violent behaviors, with the overarching aim to reduce interpersonal violence. A first axis deals with experimental and applied research to examine the role of knowledge structures as well as situational, cognitive, and emotional factors in the expression and regulation of such behaviors. A second axis, framed within a translational perspective, deals with evidence-based practices to assess, and prevent sexual violence and violent behaviors, in both general population and offenders. Thanks to an interdisciplinary (i.e., psychology, criminology, cognitive sciences, behavioral neurosciences, and cultural studies) and international (i.e., France, Canada, and USA) academic background, most of the research undertaken is framed within a team science approach and involves collaborations with colleagues from different disciplines. Current developments of his research program deal with problems relating to social issues, risks, and crises (e.g., social reintegration of terrorist convicts, violent vs. non-violent extremism in the face of climate changes, or the migration crisis). He has served as a member of scientific committees for national and international scientific events in France and Canada and acted as an examiner of PhD dissertations in Belgium and Canada. He is a member of the Editorial Board for three journals and regularly acts as a reviewer for top-ranked journals. He also served as an expert reviewer for international funding committees: Fonds de Recherche du Québec – Société et culture (2020, 2021, 2022, 2023); Social Sciences and Humanities Research Council of Canada (2021); Canada Foundation for Innovation



(2019). His list of publications includes 47 peer-reviewed journals. His track record of acquiring external funding for his research from major funding agencies in France, the EU, and Canada, totaling 1.6 million Euro as principal investigator, co-principal investigator or collaborator.

**Damien CHARABIDZE**, Ph D., MCF HC – Current affiliation: UMR 8025

Researcher ID: C-6273-2016, ORCID: 0000-0002-9935-1956, IdRef: 130018023

he holds a PhD in biology with a specialization in entomology, and especially necrophagous insects. he is a lecturer at Lille University, Faculty of Legal, Political and Social Sciences (FSJPS, U-Lille), as well as an Associate researcher in the Social Ecology Unit, Bruxelles University, Belgium. Starting from entomology, his work thus extends in two main directions: A/ the biology of necrophagous insects, especially social group behavior and collective decision processes and B/ the place of scientific evidence (expertise) in decision making.

Key skills & abilities:

- o Researcher in Law History: forensic sciences & scientific evidence
- o Entomologist, specialist of gregarious behaviors
- o Biological and agent-based modelisation of collective decision processes
- o Human taphonomy & Carrion ecology
- o Expert witness in forensic entomology
- o Scientific & Broad public communication
- o Team management, project management, scientific and technical coordination

Degrees & qualifications

- o Complementary diploma in Pedagogy, Univ Lille, 2022-23
- o Habilitation to supervise research, Univ Lille, 2015
- o PhD thesis: Biology & Modeling of necrophagous insects, Univ Lille, 2008
- o Principal Investigator of 4 research grants: Scientific Justice (MESHS, 2021); Body farm project (region, 2016/17), Animal mortality and roadkill (ANIMAL-ITT, 2015), Necrophagous larvae (Region, 2015)

**Maud Herbert** (PhD, HDR) Maud Herbert holds a PhD in Management Sciences from the University of Paris-Dauphine, and she is now professor of marketing at the University of Lille. Since her PhD, her research interests have focused on resistant and minority consumers, changes in lifestyles, in particular responsible consumption, and voluntary simplicity. Adopting a Consumer Culture Theory glance, her research examines the place of consumers and consumer culture in the dynamics of ecological and social transitions, alternative business models and ecosystems. She adopts also a systemic and critical approach to the circular economy applied to the fashion industry.

Her work is published in French journals (*Décisions Marketing*, *Recherche et Applications en Marketing*, *Revue Française de Gestion*, *Etudes critiques en Management*) and English-language journals (*Journal of Business Research*; *Journal of Services Marketing*; *Consumption, Markets and Culture*; *Journal of Marketing Management*), index h=13, i10=15.

She is the co-founder of *Tex&Care*, the circular fashion chair supported by the University of Lille Foundation. This interdisciplinary chair brings together researchers in textile engineering, sociology, design, ecological economics and management. Maud Herbert is also Deputy Director of LUMEN, Lille University Management research unit (ULR 4999).

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#### **Appendix 4: Existing research projects developed in the DePERU Project Research Units**

**ANR ACES « Assignment of credit and constraints on eye movement learning »** (SCALAB, U. Lille; INT, AMU), under the supervision of Laurent Madelain (U Lille)

*Abstract: Saccades and smooth pursuit eye movements are extremely plastic and previous evidence demonstrated that human observers learn to adjust these movements depending on the reinforcement contingencies. However, limitations on eye movement contextual learning have been reported which we attribute to the assignment of credit, i.e. the ability to connect causes and effects. We propose a conceptual model accounting for contextual motor learning that rely on competing credit assignment hypotheses. The objective of ACES is to investigate the conditions under which the nature of the events might constrain contextual learning for pursuit and saccades. We will conduct a series of experiments in humans and develop a computational model based on the active-inference framework to probe our conceptual model. Overall, ACES should significantly enhance our knowledge regarding the eye movement plasticity and provide a solid general framework for contextual motor learning.*

**Project Carnot Cognition / Renault** (SCALAB U. Lille), under the supervision of Jeremie Jozefowicz  
*How to promote behavioral changes and new decisions in individuals driving cars*

**Project IBEBACC (ISITE funded, 96 k):** Fabrice Le Lec (U Lille) and Thomas Epper (CNRS), LEM

*Abstract: The purpose of the project “Identifying BEhavioral BARriers to tackling Climate Change: Myopia, Uncertainty or Collective Action?” is to study experimentally which are the behavioral barriers to climate-change fight. We test experimentally and in surveys the respective role of uncertainty, time, and the collective/social action problem, as well as combinations of these effects.*

**ANR DATAWAR** (Sciences Po Lille/CERAPS, Sciences Po Paris and Ecole Polytechnique-X in Paris, 2020-2023) under the supervision of Prof. Frédéric Ramel (CERI, Sciences Po Paris).  
Eric Sangar and Sami Makki are part of the WP 3 “Dissemination”.

*Abstract: How are representations of violence influenced by the ‘agency of data’, in other words the social practices of data collection, analysis, dissemination, and practitioner reception? The DATAWAR project builds on the hypothesis that scientific output in quantitative conflict studies is driven less by theoretical innovation than by the ‘politics of data’: the availability, reputation, and mathematical malleability of numerical observations of conflict. We anticipate that the perceptions of conflict developed by practitioners who employ quantitative methods and sources are prone to distortion as a result of the nature of the available data, the type of mathematical models used to analyse and potentially ‘predict’ conflict, and reliance on a selective subset of theoretical approaches. DATAWAR will carry out the first systematic investigation of scientific practices in the field of quantitative conflict studies as well as the impact of these practices on practitioners’ vision of war, covering the full lifecycle of conflict data, from collection and analysis to their use and dissemination by military and diplomatic institutions, humanitarian organisations, and the media. The unique, cross-actor and cross-national perspective of DATAWAR aims to improve our understanding of the interactions between scholarly and applied uses of conflict data, beyond the established divide separating ‘data pessimists’ and ‘data optimists’. The DATAWAR project seeks to explore the following research question: how do social practices of data collection and analysis in quantitative conflict studies influence practitioners’ representations of armed conflict?*

**ANR FORPEACE** (CERAPS, 2023-2027), under the supervision of Prof Jacobo Grajales (UdL, CERAPS). Sami Makki is a member of the team (with Marie Saiget)

Abstract: Forests of peace: Environmental conservation in the aftermath of war “How do post-conflict transitions shape, steer and constrain environmental policymaking?”

*“In recent years, social scientists have recognized how wars are deeply intertwined with environmental change. Environmental degradation can aggravate social, economic, and political grievances; environmental conflicts can fuel civil wars and political instability, polarizing antagonistic identities and making conflicts more intractable and difficult to settle. Moreover, warfare can have dreadful consequences for vulnerable environments, as forests and wetlands are transformed into battlefields, and extracting natural resources from the soil or subsoil becomes a critical priority for the wartime economy. [...] How do post-conflict transitions shape, steer and constrain environmental policymaking? This is the central research question addressed by the FORPEACE Project. In asking this question, we will consider forest conservation as a valuable perspective on the intrinsic contradictions of post-conflict transition. Ultimately, we will seek to understand how environmental protection can be compatible with peacemaking and peace-building objectives. These objectives require an interdisciplinary, multi-method and multi-level approach, which aims to push the boundaries of our knowledge about the production of postwar social and economic orders and the ecological dimensions of peace.”*

**UE\_TPCAE « L’Union européenne, un acteur des transitions post-conflit en Afrique au prisme des questions environnementales ».** I-SITE ULNE funded- Hub Cultures, Sociétés, Pratiques en mutation. Coordinator: Marie Saiget (CERAPS) Oct. 2020 – Mars 2022  
Sami Makki was a member of the research team.

Abstract: *Since 2011, there has been a reinvestment by the European Union (EU) in post-conflict management. As a major player in development cooperation and humanitarian aid on a global scale, spearheading democratization programmes, the EU can put forward in this area a wide range of funding, techniques and different tools. Yet, except for a few case studies, its practices and concrete actions were little studied in context, compared to the attention paid to United Nations operations. This project responds to existing gaps by examining the EU in action and in the contexts of its interventions, particularly in sub-Saharan Africa by highlighting environmental issues and challenges.*

**ANR VISION3E « Expectation, Exploration and Exploitation in active Vision »** (SCALAB, U. Lille; INT, AMU; LPNC Gipsa-Lab Grenoble), under the supervision of Anna Montagnini (AMU)

Abstract: *Perceiving is essentially a decision process, whereby our brain has to deal with multiple uncertain and often ambiguous elements from the sensory input to make sense of the world. This is particularly evident with multistable, ambiguous visual stimuli, where multiple interpretations (percepts) are possible for a single physical stimulus. In this condition, human observers spontaneously alternate between the possible percepts at unpredictable times. This phenomenon has intrigued brain scientists and philosophers for decades, who have addressed questions like “What pushes our brain to switch to a new percept?”, “What factors, in the observer’s experience, conscious will, or learnt behaviors, can help or interfere with perceptual multistability?”. Another important property of human visual processing is that it is strongly non uniform, meaning that only the central part of the image projected to the eye, reaching the fovea, is processed with high resolution. Therefore, a reliable analysis of the sensory input requires a sequential sampling of information (e.g. collecting different viewpoints and local detailed observations), which is achieved with incessant eye movements: we call this active vision.*

**ANR INDUCED (INtegrating Deep Uncertainty in ClimatE Change ModElling):** (LEM, ANR, avec European Institute on Economics and the Environment, University Bocconi)  
Horizon Europe CAPABLE (participation du LEM, porté par la Fondazione Centro Euro-Mediterraneosui Cambiamenti Climatici, 3 M budget).

Abstract: *The purpose of the project is to provide robust, resilient and actionable recommendations for the design of socially and economically acceptable climate policy measures for 2030 and beyond. The role of LEM in particular is to study the role of uncertainty in behavioral responses.*



Production and consumption decision processes regarding the transition of the textile industry towards a circular economy (circular fashion).

**Maud Herbert** (Pr in Management Sciences, deputy director of the LUMEN Laboratory (ULR 4999), member of the Consumption, Culture and Markets research team, University of Lille, IAE Lille) is leader or partner in the following projects:

2020-2024: leader of the **DELPHI Transition project**, co-financed by the **Hauts de France Region**: adaptation of the Delphi foresight method to crisis and uncertainty situations in the textile sector using collective intelligence methods (prospective transition of the industry in a highly sustainable uncertain condition).

2022-2026: co-founder of the **Tex&Care interdisciplinary chair (University of Lille/University of Lille Foundation)**, dedicated to the analysis and support of textile companies in their ecological and social transition towards a circular fashion. A team of 20 research professors (LUMEN, Gemtex) whose research focuses on considering negative externalities throughout the value chain (from the creation of fibers to recycling, including the optimal adjustment of production and distribution through new circular business models) and paying increased attention to radical changes in consumption (sufficiency) and the human conditions of textile production.

2023-2025: leader of the **MODERATHOM project**: men's fashion and sufficiency in consumption, co-financed by the **Hauts de France Region and the brand JULES**.

2023-2025: partnership in the **REVALOTEX project** (augmented LCA, environmental labelling in co-creation with consumers), led by ENSAIT (Prof. Ludovic Koehl), co-financed by the **Hauts de France Region and the clothing brand La Gentle Factory**.

2023-2025: partnership of the STIMULE LPJP project led by ENSAIT (Pr. Sebastien Thomassey), co-financed by the **Hauts de France Region**. Artificial intelligence, modeling of the quality/price ratio and decision models for a more efficient management of production and consumption volumes of textile products (+ seasonal adjustment).

2023-2025: Partner of **PEPR on Recycling** with the VLAN project, in partnership with ENSAIT, Arts Décoratifs and INSA Lyon (textile recycling), supported by **CNRS and ministry of economy**. Research program on industrial and individual scale of textile reuse and revalorization.

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