



## Digital World

### Digital Reliability: Preserving the Meaning of the Asset in a Data-Driven World

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For generations, reliability engineering has served a simple but noble purpose: to keep our assets performing, safe, and valuable. Through data, we have measured degradation, understood failure, and learned how to extend the useful life of what societies build and depend on. In this way, reliability has quietly underpinned our collective progress. It has given continuity to our infrastructures, stability to our industries, and confidence to our communities.

But the digital transformation is changing this relationship profoundly. The data that once documented the past is now shaping the future. Our assets no longer wait to be inspected or repaired — they generate their own knowledge, communicate their own condition, and, in a sense, begin to think.

Digitalisation has not only made our assets more connected; it has made them more expressive. Data has become the new language of reliability. It does not simply describe the performance of assets — it carries their evolving meaning. A bridge or a turbine, once seen as a static physical system, now becomes a living source of information, a participant in its own lifecycle.

This evolution forces us to reconsider what we mean by reliability. It is no longer just about preventing failure or ensuring uptime. In a data-driven world, reliability must also mean preserving the value and purpose of the asset across time — maintaining its relevance and trust as the world around it changes.

Artificial intelligence is entering this landscape not as a disruption, but as a deepening of understanding. At first, it allows us to see what was previously invisible — the subtle patterns that precede degradation. Then it helps us interpret context — connecting behaviour with environment, usage, and history. Finally, it begins to act — making small, informed adjustments that preserve performance and extend life without human intervention.

In this progression, machine learning enables perception; agentic intelligence introduces intention. The first reveals what may happen; the second decides what should be done. Through this evolution, reliability becomes less a static property of systems and more a living interaction — an ongoing negotiation between data, intelligence, and purpose.

Imagine a network of intelligent assets that coordinate their maintenance through shared data, balancing efficiency and risk. Imagine bridges that schedule their own inspections according to stress and climate forecasts, or turbines that regulate their output to optimise lifetime and sustainability. In such a world, reliability emerges from cooperation rather than control.

And yet, amid all this intelligence, the human role remains essential. We are still the ones who decide what value means, what must be preserved, and why. Data can inform, but not prioritise. Algorithms can optimise, but not define purpose. The reliability engineer therefore becomes more than an analyst — a custodian of meaning, ensuring that our digital tools continue to serve human values and collective memory.

Every asset, from infrastructure to industry, carries a story about how societies build, connect, and endure. Preserving the reliability of these assets is, ultimately, preserving that story — maintaining the tangible memory of progress, identity, and trust.

Digital reliability, therefore, is not about replacing human insight with algorithms, but about extending our capacity to care for what we build. Through data and intelligence, we are learning to preserve not only the performance of assets, but their meaning — and, through them, the continuity of our shared future.

### **About the author:**

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## **5G For a Better Tomorrow: 5G4LIVES Project**

### **Demonstrating 5G-Enabled Emergency Response Systems: Insights from the 5G4LIVES Project in Riga and Turin**

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Cities are becoming complex systems where connectivity and data play an increasingly central role in ensuring safety and sustainability. 5G4LIVES was launched in 2024 to test how fifth-generation mobile networks can support emergency management, rescue operations and environmental monitoring. The consortium unites nine partners — the City of Riga, Latvian Mobile Telephone (LMT), VEFRESH, Electronic Communications Office of Latvia (ECO), the Municipality of Turin, Politecnico di Torino, Wind Tre — combining expertise across telecommunications, urban governance, aviation regulation, and innovation ecosystem to develop a common approach for deploying 5G in mission-critical applications.

The two pilot cities reflect distinct geographies and risk contexts. Riga focuses on water and coastal safety operations at Vecāķi Beach and Ķīšezers Lake, testing 5G connectivity for real-time aerial surveillance and lifeguard coordination. Turin, surrounded by mountainous terrain and river valleys, examines how 5G-enabled drones can support flood and landslide response scenarios while integrating satellite data and local command centres.

#### **System Design and Architecture Development**

During its first year, the project defined a comprehensive Reference Architecture linking UAVs, sensors, 5G base stations and command centres into a unified operational ecosystem. The design establishes how 5G networks can reliably sustain Beyond-Visual-Line-of-Sight (BVLOS) drone operations for public safety. A study on the essential minimum requirements for 5G coverage identified key performance indicators such as network latency, uplink/downlink throughput, signal-to-interference ratio and coverage range. These benchmarks ensure stable command and control links and real-time payload data transfer for aerial missions.

A methodology for EU-level BVLOS validation, aligned with EASA’s Specific Operations Risk Assessment (SORA 2.5), was established to standardise risk mapping and mission planning. This approach integrates ground risk maps, population density data and dynamic flight-path re-planning to maintain acceptable risk levels throughout operations.

#### **Technology Implementation and Testing**

LMT is leading the implementation of the 5G4LIVES technological ecosystem — a combination of 5G standalone network infrastructure, AI-driven video analytics and mission control software. This system enables real-time monitoring, situational awareness and automated decision support for rescue teams. Data flows seamlessly between drones and the Remote Operations Control Centre through secure, low-latency links.

The testing campaigns confirmed the network’s capability to support continuous video transmission at high altitude and to maintain control channels under dense urban and coastal conditions. Latency measurements during flight tests were within the operational target of < 20 milliseconds, ensuring stable command and data exchange.

In Latvia, two dedicated 5G drone corridors (Ķīšezers – EVR53 and Vecāķi – EVR54) were authorised by the Civil Aviation Authority, enabling safe testing of emergency-response flights. This marks one of the first permanent drone airspace zones for state operations in the Baltic region.

### **Demonstrations and Operational Scenarios**

The first public 5G-enabled rescue demonstration was held in Riga on 25 September 2025, representing the transition from laboratory integration to field deployment. The scenario at Ķīšezers Lake showcased a lifeguard-rescue operation supported by 5G connectivity, where a drone equipped with a thermal camera transmitted live video and operational data to the command centre via a dedicated 5G network.

The test validated key system functions including thermal target identification, real-time data relay, automated mission planning, and inter-agency coordination between lifeguard units, police and municipal services. In addition to demonstrating technical readiness, the event served as a benchmark for regulatory and ethical compliance in U-space operations.

A second demonstration was carried out in Turin, where the project tested how 5G connectivity provided by Wind Tre can support BVLOS operations in complex urban–mountain terrain. Using the DROMThub platform, an automated mission followed a predefined route toward a ground target, with operators monitoring live video, telemetry, positioning data and system status through a remote-control room. The test confirmed stable real-time video streaming, reliable command-and-control links, and seamless integration between UAV telemetry and the situational-awareness dashboard.

The demonstration also featured the first prototype of Politecnico di Torino’s web-based BVLOS planning and validation tool, which already includes several core SORA-aligned functionalities. Together, these results show how 5G connectivity can enable safe, continuous and data-rich remote operations — even over complex or partially obstructed terrain.

### **AI Vision and Risk Mapping**

An important technological pillar is the AI computer-vision module developed by LMT — described as the “Million Eyes in One Moment” concept. It uses deep-learning algorithms to interpret aerial and ground sensor data, detecting objects, people and movement patterns in real time. The system combines inputs from UAVs, IoT devices and fixed cameras to build dynamic maps of urban activity and risk.

This AI layer supports risk-based situational awareness, a core requirement for safe BVLOS operations and for automating early alerts during rescue missions. It also enables extended applications such as environmental surveillance, pollution monitoring, and traffic analysis — demonstrating cross-domain benefits beyond emergency use cases.

To ensure replicability across Europe, the project developed a comprehensive Training Package covering four modules: 5G network integration, operational safety and U-space compliance, data management and privacy, and cross-border coordination. The modules combine technical content with practical guidelines for public authorities and telecom operators. Training Package 1 is published on the 5G4LIVES YouTube channel, making the material openly available for other cities and research communities. Training Package 2 will follow next year, building directly on insights and evidence gathered during real-life demonstrations and test missions in Riga and Turin.

### **International Recognition and European-Level Visibility**

5G4LIVES had gained substantial visibility at the European level, being recognised as one of the standout initiatives in the 5G for Smart Communities portfolio. On 11 September 2025, the consortium welcomed a HaDEA delegation, including director Dr. Marina Zanchi in Riga, where the project was selected as one of four successful EU-funded initiatives invited to present interim results and demonstrate real-life operational progress.

The project has also been prominently featured at major international events, including the Smart City Expo World Congress (SCEWC 2025), the 5G Community Conference in Brussels and the Smart Country Convention in Berlin. At SCEWC, 5G4LIVES was referenced in expert discussions, visited by EU representatives, and presented through both Riga’s water-rescue scenario and Turin’s emergency-response demonstration. This visibility confirmed that the project’s solutions align with Europe’s strategic priorities in connected emergency management, urban air mobility and interoperable data ecosystems, while creating new opportunities for research collaboration and cross-project synergies.



Project team during the DEMO

### Next Steps and Outlook

The coming year will see the start of regular drone-operation winter and summer seasons in both pilot cities. Riga will expand testing to winter ice-rescue operations, while Turin will demonstrate flood-response missions using multi-sensor data fusion.

Ultimately, 5G4LIVES demonstrates how advanced communication infrastructure can become a foundation for safer and more resilient communities. By combining 5G, AI, and autonomous aerial systems in real urban contexts, the project contributes to Europe's vision of smart communities where technology directly protects citizens and the environment.

This work reflects the joint efforts of all 5G4LIVES partners from Latvia and Italy, uniting public authorities, research institutions, telecom operators and technology providers under a shared mission to make 5G serve society

### Scientific articles

*"HARNESSING 5G CONNECTIVITY AND UAVS FOR ENHANCED PUBLIC SAFETY" PRESENTED AT RTU CON 2024 AUTHORS: LAILA ZEMĪTE, ILONA PLATONOVA, EVIJA PLONE, VLADIMIRS PETROVS, STEFANO PRIMATESTA PDF LINK – [RTU CON 2024 paper](#)*

*"A 2.5D RISK-AWARE PATH PLANNING METHOD FOR SAFE UAS OPERATIONS IN POPULATED ENVIRONMENTS" PRESENTED AT ICUAS 2024 AUTHOR: STEFANO PRIMATESTA PDF LINK – [ICUAS 2024 paper](#)*

*"A RISK-AWARE MISSION PLANNING AND MONITORING METHODOLOGY FOR UAS OPERATIONS" PRESENTED AT ICUAS 2025 AUTHOR: STEFANO PRIMATESTA PDF LINK – [ICUAS 2025 paper](#)*

*"EXPERIMENTAL STUDY ON LTE MOBILE NETWORK PERFORMANCE PARAMETERS FOR CONTROLLED DRONE FLIGHTS" PUBLISHED IN [Sensors](#) 2024 AUTHORS: JĀNIS BRAUNFELDS, GINTS JAKOVELS, INTS MURANS, ANNA LITVINENKO, UĞIS SENKANS, RŪDOLFS RUMBA, ANDIS ONZULS, GUNTIS VALTERS, ELĪNA LIDERE, EVIJA PLONE LINK TO [paper](#)*

*"A HIGH-FIDELITY RISK ASSESSMENT FOR BVLOS UAV RESCUE MISSIONS IN URBAN LAKESIDE AREAS"*

*PUBLISHED IN LATVIAN JOURNAL OF PHYSICS AND TECHNICAL SCIENCES 2025, N 5. AUTHORS: L. ZEMITE, S. SEIKO, I. PLATONOVA, V. CELMINS, L. LABANOVSKIS, D. ZARINS, G. SAIDANS, K. SALINS, A. VERDINS, R. KURPNIKS, M. KLAUCS LINK TO [paper](#)*

### Project Resources

LATEST NEWS AND UPDATES ON 5G4LIVES: [HTTPS://WWW.LINKEDIN.COM/SHOWCASE/5G4LIVES](https://www.linkedin.com/showcase/5g4lives)

5G4LIVES TRAINING PACKAGE AND PROJECT VIDEOS: [HTTPS://WWW.YOUTUBE.COM/@5G4LIVES](https://www.youtube.com/@5g4lives)

### EXPRESSION OF INTEREST

TO RESEARCHERS, ESREDA MEMBERS AND EU EXPERTS WORKING ON 5G, U-SPACE, UAV OPERATIONS, AI-BASED EMERGENCY MANAGEMENT OR PUBLIC-SAFETY INNOVATION — IF YOU ARE INTERESTED IN LEARNING MORE ABOUT THE 5G4LIVES PROJECT OR EXPLORING OPPORTUNITIES

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## DIREKTION Awards 2025:

### Showcasing Innovation for Europe's Emergency Responders

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Europe's emergency responders face increasingly complex risks, from industrial and technological accidents to wildfires and cascading crises. Addressing these challenges requires not only preparedness and coordination but also the capacity to integrate innovative tools and technologies into daily operations.

The DIREKTION project, funded by Horizon Europe, aims at connecting responders, innovators, and institutions to accelerate the uptake of innovation in disaster resilience. Within this framework, the first DIREKTION Awards for Innovation in Disaster Resilience were launched in 2025 to identify and support solutions addressing critical capability gaps mapped by the project.

The first edition of the Awards took place on October 7th, 2025 in Athens, during the CERIS Disaster Resilience Days organised by the European Commission's DG HOME. The event highlighted how European initiatives can serve as powerful platforms for connecting communities of practice and showcasing operational innovation.

The ten winners of the 2025 edition illustrate the diversity of approaches contributing to resilience across Europe. Their solutions were selected through a rigorous evaluation process led by responder experts for their relevance, usability, and potential impact on the field:

- Predict4ALL (France) – AI-driven predictive analytics for multi-hazard forecasting.
- AUM – Air Unique Monitoring (PhotonSense Tech) – Real-time air monitoring for hazardous environments.
- Live-Lage (DLR) – Live situational awareness and operational coordination.
- Hybrid Edge (Excelerate Technology Ltd) – Resilient communications for field operations.
- SitGard (MidGard) – Decision-support platform for crisis management.
- Terramind FX (Tyndall FX) – Data fusion and intelligence for rapid response.
- Colossus (Shark Robotics) – Robotic firefighting and hazardous-area intervention.
- INA Intervention App (Gemsotec BV) – Mobile access to critical operational data.
- Cobra Response Methodology for EV Battery Fires (Cold Cut) – Safer suppression of electric-vehicle fires.
- FireFence (HoZe Solutions GmbH) – Modular barriers for fire containment.



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Each winner contributes to closing specific capability gaps identified through the DIREKTION network, such as situational awareness, interoperability, communication, CBRN protection, and responder safety. Together, they represent Europe's growing ecosystem of innovation for disaster resilience.

Following the ceremony, all winning solutions will be accompanied at INTERSCHUTZ 2026 in Hannover, the world's leading exhibition for fire and rescue services.

The Awards mark a new step in building a shared innovation culture among Europe's emergency management community, where collaboration and evidence-based assessment help ensure that innovation truly serves those on the front line.

Discover the ten winners and other innovations: [www.direktion-network.org/solutions-assessed/](http://www.direktion-network.org/solutions-assessed/)



DIREKTION project team

## Enhancing Fault and Event Tree Analysis for Modern Engineering Systems

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The Next Generation Prediction Methodologies and Tools for System Safety Analysis (NxGen) is an innovative research project led by the Resilience Engineering Research Group at the University of Nottingham and funded by the Lloyd's Register Foundation. One of its core objectives is to enhance the widely used Fault Tree (FT) and Event Tree (ET) Analysis methods to better reflect the complexities of contemporary engineering systems.

FT and ET methodologies have been central to safety and risk analysis for around 5 decades. During this time, industry has made significant investment in building robust risk models based on these tools. They have served the community well in helping to control the risk posed by industrial systems. However, as systems evolve in complexity and operational context, the traditional methods face limitations in adequately capturing real-world dynamics.

### **Dynamic and Dependent Tree Theory (D<sup>2</sup>T<sup>2</sup>)**

To address these limitations, the NxGen project has developed a new analytical framework: Dynamic and Dependent Tree Theory (D<sup>2</sup>T<sup>2</sup>). This framework modernises the legacy Kinetic Tree Theory, introduced by Vesely in the 1970s. D<sup>2</sup>T<sup>2</sup> preserves the familiar FT and ET logic structures while integrating advances that have taken place in this time, such as Binary Decision Diagrams (BDD) and Petri Nets, enabling it to model system failure causality more effectively.

Since the conception of the risk assessment methods, engineering systems and their operating environments have changed dramatically. Technology has advanced and system designs, their operational practices and maintenance strategies, are now significantly different to the types of systems that existed 50 years ago. For example, modern system features can include:

- An Increased use of new technologies
- Operational regimes which restrict the opportunity for maintenance
- Operation of systems, in infrastructure intensive industries, stretching beyond their planned design lifetime to avoid the need for costly new build programmes
- An increased exploitation of condition-based maintenance
- The use of complex, phased maintenance strategies, which improve the system condition at the time it is needed

Traditional FT/ET analysis methods have limitations in their ability to represent these characteristics due to both their implicit assumptions and features of their commercial implementation. For example, basic events need to be independent, components failure and



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repair rates are assumed constant, and there is a very limited ability to represent modern maintenance strategies.

D2T2 overcomes these challenges by combining the strengths of BDDs, Stochastic Petri Nets, and Markov models. The most appropriate method is applied to each segment of the analysis for optimal efficiency. D2T2 also introduces a modularisation scheme to simplify BDDs and enhance computational performance.

#### Key Capabilities of D<sup>2</sup>T<sup>2</sup>:

1. **Flexibility in Failure and Repair Modelling;** Allows for any probability distribution to represent failure and repair times.
2. **Representation of Complex Dependencies;** Models interactions and dependencies between components or sub-systems, due to design, operation, or maintenance.
3. **Advanced Maintenance Modelling;** Captures sophisticated asset management and maintenance processes.
4. **Dynamic Event Sequencing;** Permit dynamics in the form of event sequences to contribute to the system failure logic.

#### Further Resources:

of Comprehensive details about the D<sup>2</sup>T<sup>2</sup> framework and the NxGen project can be found on the official website: NxGen Project Website:  
<https://www.nottingham.ac.uk/research/groups/resilience-engineering/nxgen-project.aspx>

#### Outputs and Publications:

Access research papers, presentations, and more: NxGen Publications:

<https://www.nottingham.ac.uk/research/groups/resilience-engineering/nxgen-project/outputs-and-publications.aspx>

#### Educational Video Series

To support learning and dissemination, a series of 10 educational videos have been developed. These explain the D2T2 methodology and offer illustrative case studies. Scripts were authored by John Andrews, Silvia Tolo, and Derek Yan. Apart from the introductory video, all feature professional narration.

#### Introduction

Introduction to the NxGen Project:

[https://mediaspace.nottingham.ac.uk/media/V2+Long+Introduction+to+the+NxGen+Project+with+subtitles+John+Andrews/1\\_75skp10p](https://mediaspace.nottingham.ac.uk/media/V2+Long+Introduction+to+the+NxGen+Project+with+subtitles+John+Andrews/1_75skp10p)

#### Dynamic and Dependent Tree Theory

##### Part 1:- Methodology Fundamentals

[https://mediaspace.nottingham.ac.uk/media/V3+D2T2+Methodology+Part+1+Fundamentals+with+subtitles+Scripted+JDA/1\\_o52te638](https://mediaspace.nottingham.ac.uk/media/V3+D2T2+Methodology+Part+1+Fundamentals+with+subtitles+Scripted+JDA/1_o52te638)

##### Part 2:- Integration of Fundamental Methodologies

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##### Part 3:- Minimal Cut Sets

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##### Part 4:- Importance Measures

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##### Part 5:- Event Tree Analysis

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#### Case Studies

##### Case Study 1: Fault Tree Analysis of an Offshore Platform Water Deluge System

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##### Case Study 2: Analysis of a Nuclear Power Plant Water Cooling System

[https://mediaspace.nottingham.ac.uk/media/V9++D2T2+Case+Study+2+Nuclear+Cooling+System+scripted+ST+with+subtitles/1\\_dd1t2g2x](https://mediaspace.nottingham.ac.uk/media/V9++D2T2+Case+Study+2+Nuclear+Cooling+System+scripted+ST+with+subtitles/1_dd1t2g2x)

##### Case Study 3: Aero Engine Cooling System

[https://mediaspace.nottingham.ac.uk/media/V10++D2T2+Case+Study+3+Aero+Engine+Cooling+System+scripted+ST+with+subtitles/1\\_iqxe3lwz](https://mediaspace.nottingham.ac.uk/media/V10++D2T2+Case+Study+3+Aero+Engine+Cooling+System+scripted+ST+with+subtitles/1_iqxe3lwz)

## Resilience Modelling

A Novel Modelling Methodology for Evaluating the Resilience of Nuclear Power Plants

[https://mediaspace.nottingham.ac.uk/media/V11++Resilience+of+Nuclear+Power+Plants+scripted+DY+with+subscripts/1\\_c0wegrhj](https://mediaspace.nottingham.ac.uk/media/V11++Resilience+of+Nuclear+Power+Plants+scripted+DY+with+subscripts/1_c0wegrhj)

# IA – Models & Tools for Safer World

## Developing IA – Based Mental Models to Support Advanced Safety Assessments

**Romain ROY – Research engineer in PSA and responsible for KB3 at EDF**

### Glossary

EDF : Electricité De France

PSA : Probabilistic Safety Assessment

IoT : Internet of Things

KB3 : EDF owned version of the RiskSpectrum ModelBuilder tool (for fault tree and simulation models automatic generation)

MBSE : Model-Based System Engineering

MBSA : Model-Based Safety Analysis

MBSDA : Model-Based Safety and Dependability Analysis

OCL : Object Constraint Language

UML : Unified Modelling Language (UML)



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In the EDF's probabilistic safety assessment (PSA) studies, sequence of events diagrams (Events Tree) represent all scenarios identified during qualitative analysis following an initiating event. These diagrams trace all possible paths involving successful or failed missions of backup systems or human actions. System missions identified in reliability studies are modelled using fault trees and generated with an MBSDA (Model-Based Safety and Dependability Analysis) 8tool, KB3, based on the FIGARO modelling language [3]. A key challenge for analysts is the modelling of complex systems from mechanical diagrams, usually available in very specific formats.

This technology is based on the industry 3.0 between 1970 and 2000. We are now in the Industry 5.0.

In the Industry 5.0<sup>1</sup>, cyber physical systems make autonomous decisions using machine learning (ML) techniques and Big Data analysis with interoperability through IoT and cloud technologies. The goal of the work depicted below is to use AI combined with an MBSDA tool (KB3) in order to take advantage of all the advances in this field and reduce engineering effort. The main risk is that AI either amplifies the excellence of a clean, well-structured dataset or worsens the degradation of a poor one, ultimately eroding the analyst's trust. To achieve our goals, we need to implement two methods: OCL (Object Constraint Language) and digital continuity.

OCL is a formal language that is widely used in the modelling community to complement UML models with textual constraints that precisely define additional business rules for the system. The goal of this work is to define a model and rules to cover all the data in the PSA sequences. This way, it becomes possible to reach a higher quality level of data. The main difficulty is to create an OCL model with FIGARO language.

Digital continuity is the ability to maintain the digital information of a creator in such a way that the information continues to be available, as needed. For example, thanks to Ariadne's thread, which keeps the path information available, Theseus manages to find his way out of the Minotaur's labyrinth.

For the pancake recipe, it is possible to use the same principle. To cook pancakes, you have inputs (ingredients) and a process (cooking recipe). The goal of digital continuity is to be able to retrieve the raw ingredients at any time.

If your pancake is bad, it is possibly because of a missing ingredient or that the heating power is not adequate because you cook at a different altitude (Lake Titicaca instead of Paris).

For a projection in the engineering sequence of design and operation of a system:

<sup>1</sup> [https://research-and-innovation.ec.europa.eu/research-area/industrial-research-and-innovation/industry-50\\_en](https://research-and-innovation.ec.europa.eu/research-area/industrial-research-and-innovation/industry-50_en)

It could be possible to identify errors in the design phase as the source of an operational problem and to know which data to act on to restore a good state.

References [1], [4] and [5] present a tool (CONFLUENT) capable of reading data from multiple sources (electrical, hydraulic, and control CAD descriptions) while preserving the raw data path. It can also manage system boundaries through path definitions. It supports “reduction” of control, hydraulic, and electrical systems helping reduce PSA models’ complexity, especially in the context of zoomable PSA [2]. Finally, the tool enables topological mapping of complex networks by displaying attributes like location, altitude, function, or support structures, which aids in redundancy analysis at the support systems level (e.g., power supplies). Reference [6] presents the connexion with MBSE (Model Based Systems Engineering) with postprocessing of data to automatically define system boundaries in the MBSDA.

All these features allow us to implement digital continuity with different visualizations at a lower cost. Once we achieve this goal, we can start integrating AI with a higher trustworthiness level. The same type of work (with MBSDA) is already conducted in the field of maintenance for the definition of preventive maintenance programs [7]. Furthermore, I believe that AI is a cyber tool that is a copy of human intelligence. A shared mental model is a characteristic of Homo sapiens intelligence. This is what allows for supremacy over other species. [8]. I would like to transform MBSA into MMBSA as Mental Model Based Safety Assessment to fully implement IA.

If you are interested by collaborative works on this type of topic within an existing or a new ESReDA project group, please feel free to contact me.

## References

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## About the author

Romain ROY is a Research Engineer in PSA and responsible for KB3 at EDF. He is lead the 'Methodological Research' Working Group of IMdR (Institute for Risk Management) ([https://www.imdr.eu/offres/gestion/actus\\_818\\_33998-1/recherche-methodologique.html](https://www.imdr.eu/offres/gestion/actus_818_33998-1/recherche-methodologique.html))

He is also participating in AFNOR standardization activities in CN X60 and UF56

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RescheachGate :

[https://www.researchgate.net/profile/Roy-Romain?ev=hdr\\_xprf](https://www.researchgate.net/profile/Roy-Romain?ev=hdr_xprf)

## Call for Expressions of Interest:

# I-Risk Initiative: To Build a European network in the field of natural mass-driven hazards

### **Julien Baroth**

**University of Grenoble-Alpes, (France)**



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of

I-RISK is a national network in the field of natural, mass-driven hazards. It gathers companies, research laboratories and universities working in the field of landslides, rockfalls, mudslides, torrential floods, and avalanches. I-RISK is placed under the auspices of the National Pole Infr@2050. I-RISK organises strategic workshops on various topics to increase the resilience against mass-driven hazards:

- management and resilience against exceptional natural hazards
- dynamic behaviour of structures subjected to natural hazards
- snow cover in the climate change context
- the role of water in landslides
- impacts of permafrost melting on mountain infrastructure.

I-RISK also helps to adapt training offers responding to the needs expressed by the concerned Industrial sectors and end-users. It supports the development of specific and oriented training sessions for natural mass-driven risk practitioners and other stakeholders. The last two new professional educational offers and a summer school series were for Swiss I-Risk partners.

Besides, I-RISK conducts a series of webinars to shed light on, and share within the community, the tools and knowledge developed by the companies and the laboratories who are members in its national network. Still, I-Risk is launching its new initiative to “Build a European network in the field of Natural Mass-Driven Hazards”.

### **Why this initiative**

The initiative aims at:

- Promoting and stimulating interactions between research and private stakeholders.
- Extending the existing I-Risk Network to the European sphere to foster multi-collaborative EU actions between different EU partners.
- Contributing into the development and the design of technical standards and recommendations.

We recognize the necessity to build a European partnership to answer EU Research & Innovation calls for projects, regularly emitted by the EC. We are convinced that we should improve our collective practices by exchanging on the different above-mentioned goals, and especially by changing the scale at which we organize these exchanges.

### **Next steps and proposed organisation**

Setting up a European network will start with a first exchange with all potential partners through brain-storming meetings and discussions to build up a common shared ambition.

The next steps, including the creation of specific working groups, will be structured according to the outputs of the preceding phase of exchanges and consultations with other EU entities who will express their interest. Basically, the timeline could be as follows:

- Regular meetings (video and face-to-face if necessary) between all the partners engaged in the network - about 3 per year to share information on specific actions of interest, opportunities to build projects, etc. One of these meetings will be devoted to the strategy purposes for the coming year, including specific events to be conducted and related funding matters.
- Workshops to work on a specific topic.
- Organization of specific events to disseminate and share widely the problems encountered and the innovations obtained or participation of the collective in partner events.

### **Expression of interest**

To all ESReDA members and EU experts in the field, if you are interested to get more information or want to contribute to the birth of the EU I-Risk Collaborative Network in the field of natural mass-driven hazards, please, contact [julien.baroth@univ-grenoble-alpes.fr](mailto:julien.baroth@univ-grenoble-alpes.fr), with [i-risk@i-risk.fr](mailto:i-risk@i-risk.fr) in Cc.

## Artificial Intelligence in Safety and Security (AISS)

*Sever Paul - chairperson of the PG*  
*Agenția de Investigare Feroviară Română - AGIFER*

A new ESReDA project group— Artificial Intelligence in Safety and Security (AISS)—has been given the go ahead. It will report in 2028.

The project group recognises that safety and security cannot be meaningfully separated in discussions of technology and its associated risks and benefits. The group won't create new AI tools, but will examine the added value and potential risks posed by AI to safety and security. Accordingly, these two domains will be considered jointly.

In this project, safety will be considered in the classical sense of industrial and occupational safety and security, rather than the existential risk to humanity (often referred to as "AI safety"). Accordingly, the project will look at the role of AI in safety and security from deep within the field of safety - and not looking at safety/security from the outside, the viewpoint of AI technology.

The objective of the project is to identify how AI—as both an enabling and disruptive force—is changing the world of safety and security. To this end, , the group will develop and share ideas aimed at helping national and international authorities (including those concerned with certification and assurance), private organisations, and third-sector bodies, as well as citizens and consumers, to harness AI effectively and responsibly.

The PG will develop a toolbox of principles and guidance to address questions such as:

- What added value can AI bring to traditional safety and security practices?
- How can we harness AI in the engineering design process without compromising integrity (Lawrence, 2023 )?
- What practices and methods can support the development of trustworthy AI-based components and systems, particularly when handling vast amounts of data?
- What impact does unverifiable information (from influencers, social media, or AI-generated content) have on accident investigations? Can the introduction of real-world accident data into machine learning models assist investigations?
- How will AI and other emerging technologies shape the safety-security interface in law and society?
- In a world of unprecedented data volumes and increasing system interconnectivity, the dual nature of AI—as both a safety asset and a source of novel risks—defines today's technological landscape.

To be a net gain, AI in safety and security must be grounded not only in innovation, but in integrity, reflection, and understanding shared by everyone—and indeed everything—with a say in how our socio-technical systems work.

If you would like to join this Project Group please send an email to: Sever Paul - chairperson of the PG ([sever.paul@agifer.ro](mailto:sever.paul@agifer.ro)) or to [ajguillen@us.es](mailto:ajguillen@us.es) (Antonio Jesus Guillen Lopez – ESReDA secretary).

For more information, please see <https://zenodo.org/records/15736652>

## Call for Expressions of Interest: ESReDA's Open Data Initiative

**Dr. Manuel Chiachío**  
*University of Granada, Spain*



*Dr. Manuel Chiachío*  
*Associate professor*  
*University of Granada*  
*(Spain)*

[mchiachio@ugr.es](mailto:mchiachio@ugr.es)

Developed countries are facing a nascent digital revolution fuelled by human-like artificial intelligence, bioinspired engineering, and deeply intelligent robots, where humans and digital assets will work together within a large smart ecosystem.

The built environment, particularly industrial and civil infrastructure, will certainly be part of this revolution since infrastructures (roads, railways, cities, energy facilities, etc.) are the foundation upon which this future smart ecosystem will be based. Deep integration of smart technologies into infrastructure has the potential to reduce European spending on infrastructure asset management while significantly increasing reliability and resilience.

However, achieving this advanced level of digitalization requires learning from and responding to high-quality data. The creation, updating, and refinement of predictive models for smart digital twins demands substantial amounts of high-value data.

Those who are working with digital twin technologies already recognize the limitations due to data insufficiency to train and test these systems effectively. When available, data are often siloed within specific applications or components, making it difficult to use for training decision-making models across pervasive systems commonly found in industry and infrastructure.

In light of this, this is an opportunity for ESReDA to become a key player in providing open, high-value datasets related to asset management, reliability, and maintenance of physical and digital assets across various industries.

### **Call for Expressions of Interest:**

To all ESReDA members and EU experts in the field, if you are willing to collaborate actively in the **Open Data Initiative**, please, send your expression of interest to Dr. Manuel Chiachío ([mchiachio@ugr.es](mailto:mchiachio@ugr.es)) and Dr. Antonio J. Guillén ([ajguillen@ucm.es](mailto:ajguillen@ucm.es)).

## ESReDA Running Project Group

### **DMAD ESReDA Project Group: Building the Future of Digital Asset Management – Report from our recent meeting in Madrid**

*Antonio Sánchez, Aitor Goti*



*Antonio Sánchez*  
*INGEMAN-*  
*Univesidad de Sevilla*  
*(Spain)*

[antoniosh@us.es](mailto:antoniosh@us.es)

The DMAD (Digitalization of Maintenance and Asset Data) Project Group continues to demonstrate remarkable momentum. On October 21, 2025, the group held its second regular meeting at the ICEI (Instituto Complutense de Estudios Internacionales) of Complutense University Madrid (Spain), bringing together 25 participants from universities, research institutions, and leading companies across Europe.

### **A Day of Collaboration and Innovation**

The event, framed within the "Road to WCEAM/Congrega 2026" initiative, featured rich discussions on asset management challenges in strategic sectors. Experts from ISDEFE and ENAGAS shared insights on cybersecurity, energy transition, and the complexities of hydrogen infrastructure—highlighting that major transformations require not just technology, but decades of strategic planning.

### **Key Initiatives Moving Forward**

The afternoon session showcased the group's ambitious agenda with, among others:

- Open Source Community Pilot – Under the scientific leadership of Joaquín Ordieres (UPM) and Manuel Chiachío (UGR), DMAD is developing a collaborative platform for sharing datasets, failure mode libraries, and predictive models using GitHub and HuggingFace.



**Aitor Goti**  
 Associated Professor  
 Univesidad de Deusto  
 Bilbao (Spain)  
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- Agentic AI for Maintenance – The group explored cutting-edge applications of Large Language Models integrated with specialized agents for intelligent maintenance planning—a promising frontier for predictive maintenance.
- Digital Twins – Presentations from Quantia and SGS opened new collaboration pathways for applying digital twin technology to real-world asset management challenges.
- International Maintenance Association (IMA) Document Review – The critical review of IMA's Digitalization of Assets, Facilities and Maintenance Management framework continues, aiming to create a practical roadmap that prevents "digital islands."

### Looking Ahead

DMAD members are actively preparing proposals for national and European funding calls, organizing specialized seminars, and planning the IMS+AMEST 2027 event in Seville. A new DMAD meeting is scheduled for early 2026 in the Basque Country.

### Join Us!

The DMAD Project Group welcomes researchers, practitioners, and organizations passionate about digital transformation in asset management. Whether your expertise lies in AI, digital twins, maintenance optimization, or industrial data management, there is a place for you in this vibrant community.



### Interested?

Contact the DMAD coordinators Antonio Sanchez Herguedas ([antoniosh@us.es](mailto:antoniosh@us.es)) and Aitor Goti ([aitor.goti@deusto.es](mailto:aitor.goti@deusto.es)).

## Forthcoming ESReDA Seminars

### 68th ESReDA Seminar Multidisciplinary Approaches to Resilience Assessment in Critical Infrastructures and Digital Systems May 14th - 15th, 2026, ISMA University of Applied Sciences, Riga, Latvia

#### Brief description

The evolving complexity and interdependence of critical infrastructures- alongside their growing reliance on digital technologies- pose unprecedented challenges for resilience assessment and management. As infrastructures become increasingly interconnected, the potential for cascading failures, systemic disruptions, and hybrid threats (both physical and cyber) demands a comprehensive, multidisciplinary approach.

The 68th ESReDA Seminar on “Multidisciplinary Approaches to Resilience Assessment in Critical Infrastructures and Digital Systems” aims to provide a platform for the exchange of scientific knowledge, practical insights, and methodological advancements related to the resilience of complex socio-technical systems. This seminar will explore the integration of engineering principles, information and communication technologies (ICT), risk and systems sciences, human and organizational factors, and public policy to advance a holistic understanding of resilience.

Building upon the outcomes of previous ESReDA seminars, this event will foster collaborative dialogue among academic researchers, industry practitioners, regulators, and other stakeholders. The seminar seeks to promote the development of rigorous, evidence-



**Pr. Laila Zemite**  
 University of Applied  
 Sciences, Riga, Latvia  
[Laila.Zemite@rtu.lv](mailto:Laila.Zemite@rtu.lv)

based frameworks and tools for resilience assessment and enhancement, in the context of increasing uncertainty, technological transformation, and societal expectations

**Key dates:**

- Submission of abstracts: **20 December 2025**
- Notification to authors: **20 January 2026**
- Submission of camera-ready papers: **31<sup>st</sup> March 2026**

For follow up and more details you may contact Prof. ([Laila.Zemite@rtu.lv](mailto:Laila.Zemite@rtu.lv)) with Antonio Guillén ([ajguillen@us.es](mailto:ajguillen@us.es)) in Cc

Call for papers is available on [ESReDA website](#)

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## Past ESReDA Seminars

### 67th ESReDA Seminar

**Trustworthy Complex and Intelligent Systems**  
**September 25th – 26th, 2025, DNV Headquarters, Oslo (Norway)**

#### Scope

We are pleased to announce this 67 th ESReDA seminar dedicated to exploring the challenges and solutions associated with developing and deploying trustworthy complex and intelligent systems. The seminar will delve into various aspects of building and managing trustworthy systems, focusing on the following topics:

- Autonomous Systems: Advancements and challenges in the deployment of autonomous vehicles, vessels, drones, and robots, emphasizing safety and trust.
- AI Agents: Issues related to trust and safety of agentic AI systems.
- Complex Industrial Systems: The use of modelling, simulation, and AI for understanding, controlling, or managing complex systems.
- Multi-Agent AI: Trust and safety issues in systems involving multiple AI entities.
- Ethical and Social Implications and Governance: Societal impacts and governance of intelligent systems, including privacy, bias, and ethical considerations.

#### Brief description

On 25–26 September, DNV hosted the 67th European Safety, Reliability, and Data Association (ESReDA) Seminar at DNV Høvik headquarters close to Oslo, bringing together researchers, industry experts, and government agency representatives to explore the theme of Trustworthy Complex and Intelligent Systems. The seminar addressed pressing challenges in developing and deploying autonomous systems, agentic AI, and multi-agent architectures, while also examining ethical governance and societal implications.

On day one, Prof. I.B. Utne set the stage by relating complex intelligent systems challenges and solutions to the important application area of autonomy. This was followed by industry and government contributions on safety and security issues and how to solve them. The Institute for Energy Technology (IFE) argued that critical safety systems can only contain AI if critical failures can be detected and an AI-free fall-back solution exists ('limp home strategy').



**Pr. Siegfried Eisinger**

**DNV, Norway**

[Siegfried.Eisinger@dnv.com](mailto:Siegfried.Eisinger@dnv.com)

After lunch, the seminar continued diving into the questions of how trust in AI systems is related to interpretability and how regulatory frameworks and governance initiatives can support trusted AI solutions.

The day concluded with an investigation into the role of simulation when building trust in complex and intelligent systems, as well as an excursion into quantum physics for electronic reliability estimation.



In the evening, we continued the conversation among the participants during a nice dinner at Louise Restaurant in the city of Oslo.

Day two was opened by Prof. G.T. Einevoll, who connected complex and intelligent systems to computational neuroscience, followed by Assoc. Prof. H. Zenil's deep dive into the world of algorithmic complexity – valuable contributions to better understand what we mean when discussing complex intelligent systems.

Throughout the day, several issues within the large seminar theme were followed up: usage of large language models for maintenance decision support; AI support with respect to safety and security issues; the transition from static certification towards continuous assurance; the link between complexity and risk; the shape of complexity; and cyber-security issues with respect to AI-enabled systems.

The seminar was with an open discussion on research gaps and future research opportunities.

The seminar provided a lot of insight into the huge area of trustworthy complex and intelligent systems. Within ESReDA, it marks the conclusion of the webinar series with the same name and the starting point for the newly founded ESReDA project group 'How Can AI and Other Emerging Technologies Strengthen Safety and Security (AISS)?', where more than ten European institutions will collaborate over the next three to four years to drive progress in this important area.

Furthermore, the seminar successfully combined online and in-person participation from both presenters and the audience.

The seminar presentations will be published shortly. Video recordings can be made available to ESReDA members upon request via e-mail to:

Siegfried Eisinger ([Siegfried.Eisinger@dnv.com](mailto:Siegfried.Eisinger@dnv.com)) and Andreas Hafver ([Andreas.Hafver@dnv.com](mailto:Andreas.Hafver@dnv.com))

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## **66<sup>th</sup> ESREDA Seminar**

### **Transformative safety and resilience models in a smart digital and sustainable world**

**May 22<sup>nd</sup> – 23<sup>rd</sup>, 2025, University of Salento, Italy**

#### **Topic brief description**



*Pr. Maria Grazia Gnani  
Full professor  
Innovation engineering Dpt.*

Several factors are contributing to increase dynamism and complexity of current approaches to prevent accidents and to guarantee business continuity: one critical factor to evaluate is the massive diffusion of digital technologies, which is forcing the adoption of new models to prevent accidents and to support more effective resilience models. Briefly, from one side, digitalization is characterized by a transformative potential mainly oriented to improve operational performance, reduce accidents and increase system reactivity through several ways. One example could be related to the enabling effectively the potential of acquiring in real time and huge quantity of safety data – also related to early warning signals – which will be treated and analysed by AI models for extracting knowledge to prevent accidents. New risk management models and approaches are, thus, required. Moreover, from another side, digitalization is the source of new emerging risks, e.g. due to the massive use of intelligent robotics systems interacting directly with humans (like collaborative robots), to the use of decision support systems (e.g. based on

algorithmic management) that provide automatic feedback to humans, e.g. workers as well as safety managers and/or analysts.

### Seminar short report

The seminar has pointed out the contribution of digital technologies in transforming risk assessment and management as well as resilience in several industrial sectors and from different perspectives, such as from company point of views to researchers and institutions. Discussions have moved from the contribution of digital technologies in improving risk assessment models and in supporting prevention of industrial accidents; furthermore, studies about how to develop more human centric digital solution were also discussed and analysed in different industrial and service sectors. A special session was dedicated to the “Collaborative intelligence and human in the loop for the future of safety critical systems. A human centered perspective.”

The breakdown of the participants per EU country is shown in figure 1.

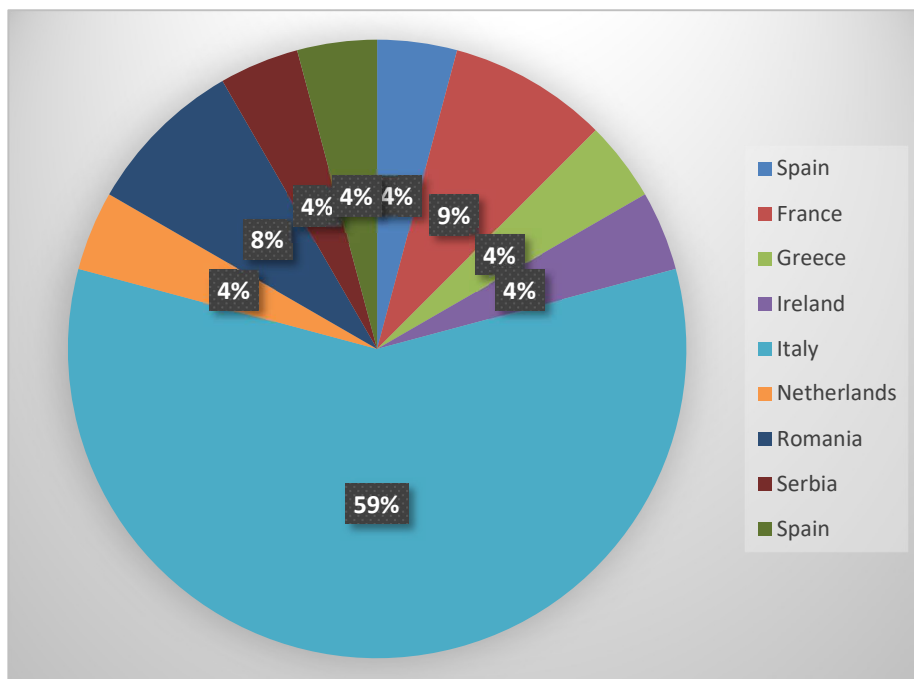


Figure 1: The breakdown of the participants per EU country

A multi-disciplinary audience (about 25 people) has participated to the seminar, i.e. from researchers, to company experts, as well as technicians from national institutions. The two-day one-session seminar has been organized in 5 sessions with 21 oral presentations, including 4 keynotes.

As follows some pictures of the seminar.



The official proceedings will be edited and available for free downloading within 6 months.

To follow up with this event, please, contact by mail Pr. Maria Grazia Gnoni ([mariagrazia.gnoni@unisalento.it](mailto:mariagrazia.gnoni@unisalento.it)) and Pr. Antonio J. Guillén ([ajguillen@ucm.es](mailto:ajguillen@ucm.es)).

## 65<sup>th</sup> ESREDA Seminar

**From risk imagination to safety intervention - Managing risks with knowledge, 14-15 November 2024, National Center for Scientific Research “Demokritos”, Athens, Greece**



Dr. Myrto  
Konstantinidou  
National Center for  
Scientific Research  
“Demokritos”

[myrto@ipta.demokritos.gr](mailto:myrto@ipta.demokritos.gr)

ESReDA’s ‘Risk, Knowledge, Management’ (RKM) project group (PG) addresses the intricate relationships between risk, knowledge and management, aiming to find new ideas for preventing accidents and improving safety management with better use of knowledge. The RKM PG organises the 65th ESReDA seminar to foster an exchange of ideas and expert debate. The National Centre of Scientific Research Demokritos in Athens will provide the forum.

Theories, concepts, and experiences of enhancing the use of knowledge for better risk analysis, management and governance were discussed between the gathered experts. The seminar has gathered some 60 participants: researchers, engineers, risk analysts and managers, and post-doctoral fellows, coming from different industrial and research sectors. During this two-day one-session seminar, about 21 oral presentations, including 5 keynotes, in 5 sessions were proposed.

The breakdown of the participants per EU country is shown in figure 2, below.

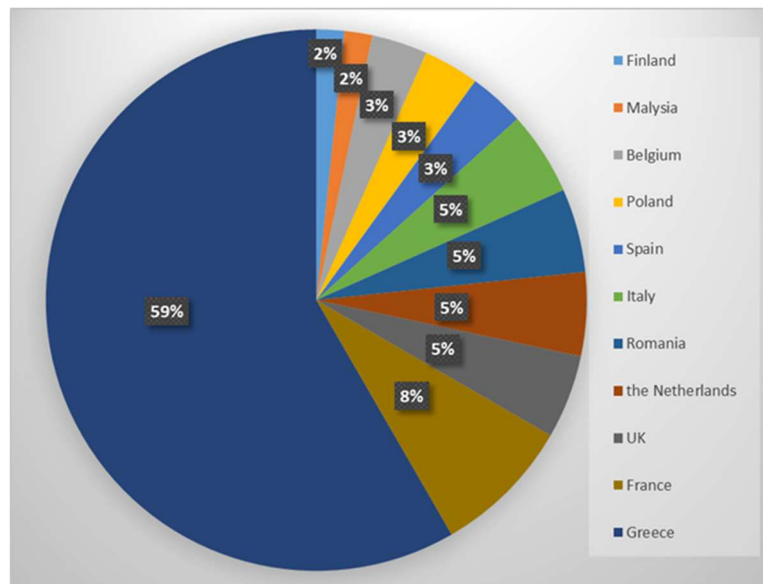


Figure 2: The breakdown of the participants per EU country

The seminar proceedings can be freely downloaded on the following link:

<https://zenodo.org/records/15782946/files/ESREDA%2065%20Seminar%20Book.pdf?download=1>

## New ESReDA Project Group: Artificial Intelligence in Safety and Security (AISS)

**By Sever Paul - chairperson of the PG  
Agenția de Investigare Feroviară Română - AGIFER**

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The objective of the project is to identify how AI—as both an enabling and disruptive force—is changing the world of safety and security. To this end, , the group will develop and share ideas aimed at helping national and international authorities (including those concerned with certification and assurance), private organisations, and third-sector bodies, as well as citizens and consumers, to harness AI effectively and responsibly.

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- What practices and methods can support the development of trustworthy AI-based components and systems, particularly when handling vast amounts of data?
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To be a net gain, AI in safety and security must be grounded not only in innovation, but in integrity, reflection, and understanding shared by everyone—and indeed everything—with a say in how our socio-technical systems work.

If you would like to join this Project Group please send an email to: Sever Paul - chairperson of the PG ([sever.paul@agifer.ro](mailto:sever.paul@agifer.ro)) or to [ajguillen@us.es](mailto:ajguillen@us.es) (Antonio Jesus Guillen Lopez – ESReDA secretary).

For more information, please see <https://zenodo.org/records/15736652>



Season Greetings &  
Wishes of Peace, Health, and Welfare  
From ESReDA



All ESReDA Members, are kindly invited to contribute to the ESReDA newsletter sharing news, announcement of events, your experiences, ideas, etc. You are supposed to elaborate proposals to create new Project Groups, host ESReDA Seminars or initiate collaborative activities

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**ESReDA: European Safety, Reliability & Data Association**  
Association internationale sans but lucratif, régis par la loi Belge du 27 Juin 1921-Titre III (Registration N°: 0452522618 - Siret:E00005802)  
Headquarter: ESReDA, rue Gachard 88 Bte 14, B-1050 Bruxelles, Belgium

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