Roadmaps for Artificial Intelligence integration in the raiL Sector

PROJECT MID-TERM WORKSHOP

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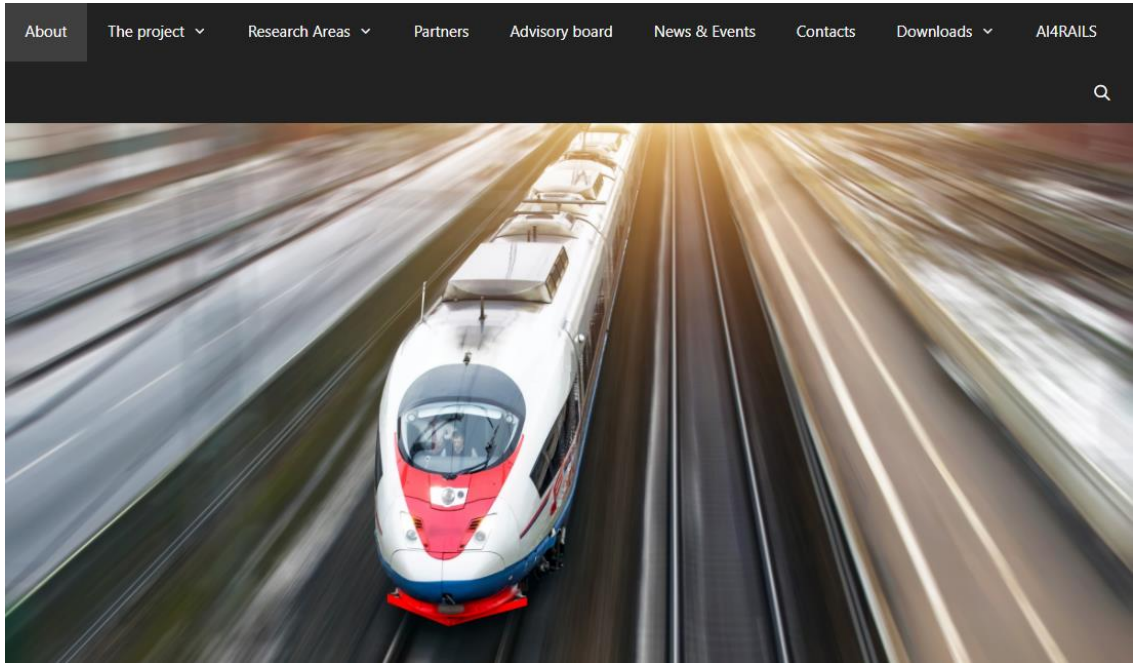
Horizon 2020
European Union Funding
for Research & Innovation

RAILS

Roadmaps for AI integration in the raiL Sector

https://rails-project.eu/



RAILS S2R Project

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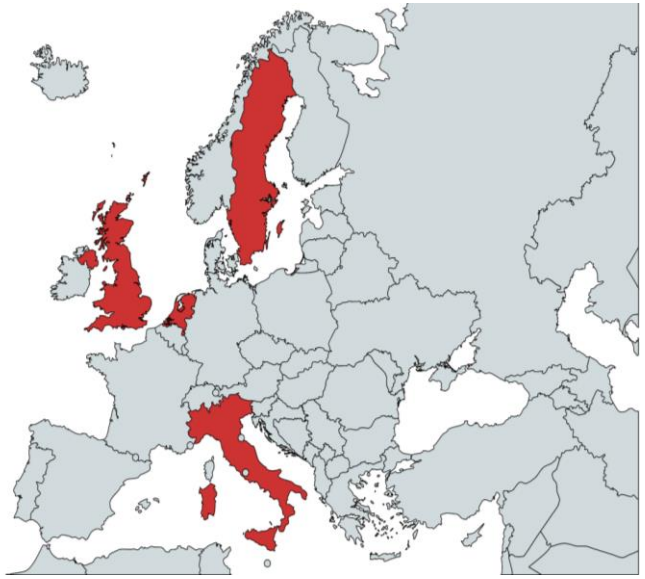
Partners

ID	NAME	COUNTRY
1 CINI	CONSORZIO INTERUNIVERSITARIO NAZIONALE PER L'INFORMATICA (CINI) (Coordinator)	IT
2 UNIVLEEDS	UNIVERSITY OF LEEDS	UK
3 LNU	LINNAEUS UNIVERSITY	LNU
4 TU DELFT	DELFT UNIVERSITY OF TECHNOLOGY	NL



CINI

- ✓CINI is a CONSORTIUM of Italian Universities founded in 1989
- ✓Educational non-profit organization under the supervision of the competent Italian Ministry for University and Research
- ✓**44 public Italian universities**, more than 1300 professors and researchers
- ✓**10 Laboratories** (e.g., AI and Intelligent Systems, Big Data, Cybersecurity, Embedded Systemes & Smart Manifacturing, Smart Cities & Communities…)
- ✓Its aim is to foster the cooperation of Italian computer scientists and engineers in nationwide and international projects
- ✓Research in the fields of Computer Engineering, Computer Science, and Information Technologies
- ✓CINI participates in RAILS mainly through the **CINI ITEM Laboratory**

University of Leeds

UNIVERSITY OF LEEDS

- ✓University of Leeds is acclaimed world-wide for the quality of its teaching and research, and has been frequently ranked within the top 100 universities worldwide.
  - Leeds hosts over 32,000 students from 141 countries attached to 560 different undergraduate and 300 postgraduate degree programmes.
  - Under Horizon 2020 Leeds is currently coordinating 71 H2020 projects and is a partner in a further 60 successful projects.
- ✓Institute for Transport Studies (ITS) at University of Leeds is the largest academic research groups in the transport field in the UK
  - Ranked 4th in the 2017 Shanghai Ranking on the subject of Transportation Science & Technology
  - ITS has participated in a large number of projects funded under H2020, as well as many projects funded by the rail industry and UK governments.

Linnaeus University (LNU)

- ✓ Linnaeus University is a modern university in southeastern Sweden with a strong international profile.
  - ✓ 1,600 international students every year and 750 partner universities in more than 60 countries.
  - ✓ One of Sweden's larger universities, with over 31,000 students and 2,000 employees.
- ✓ The Department of Computer Science and Media Technology has about 80 faculty members, who have conducted research in major areas of computer science such as software engineering, embedded systems, adaptive systems and networks, artificial intelligence and machine learning, etc.
- ✓ Recently, several new professors and researchers have joined the department with a strong expertise on cyber-physical systems security, computer dependability, model-driven and formal engineering methods. They also have specific expertise on smart-grid and transportation systems.

Delft University of Technology

- ✓ Founded in 1842
- ✓ Over 20,000 students and 2,500 staff members divided over eight faculties
- ✓ QS World University Rankings 2018:
  - ✓ Overall: 54th
  - ✓ Civil Engineering: 4th.
- ✓ Transportation Science & Technology (in the Shanghai Global Ranking 2018): 3rd

RAILS Key Objectives

1. Identification of the potential of AI for railways
2. Adherence to current work in railways innovation
3. Recognition of required innovation shifts
4. Development of methodological and experimental proof-of-concepts
5. Development of Benchmarks, Models and Simulations
6. Transition pathways toward the rail system scenario
7. Involvement of relevant rail stakeholders
8. Training of young researchers and promotion of research networks on AI in railways

Advisory Board

European Union Agency for Railways (ERA)

Hitachi Rail STS

First Rail

Netherlands Railways

ProRAIL

Aitek S.p.A.

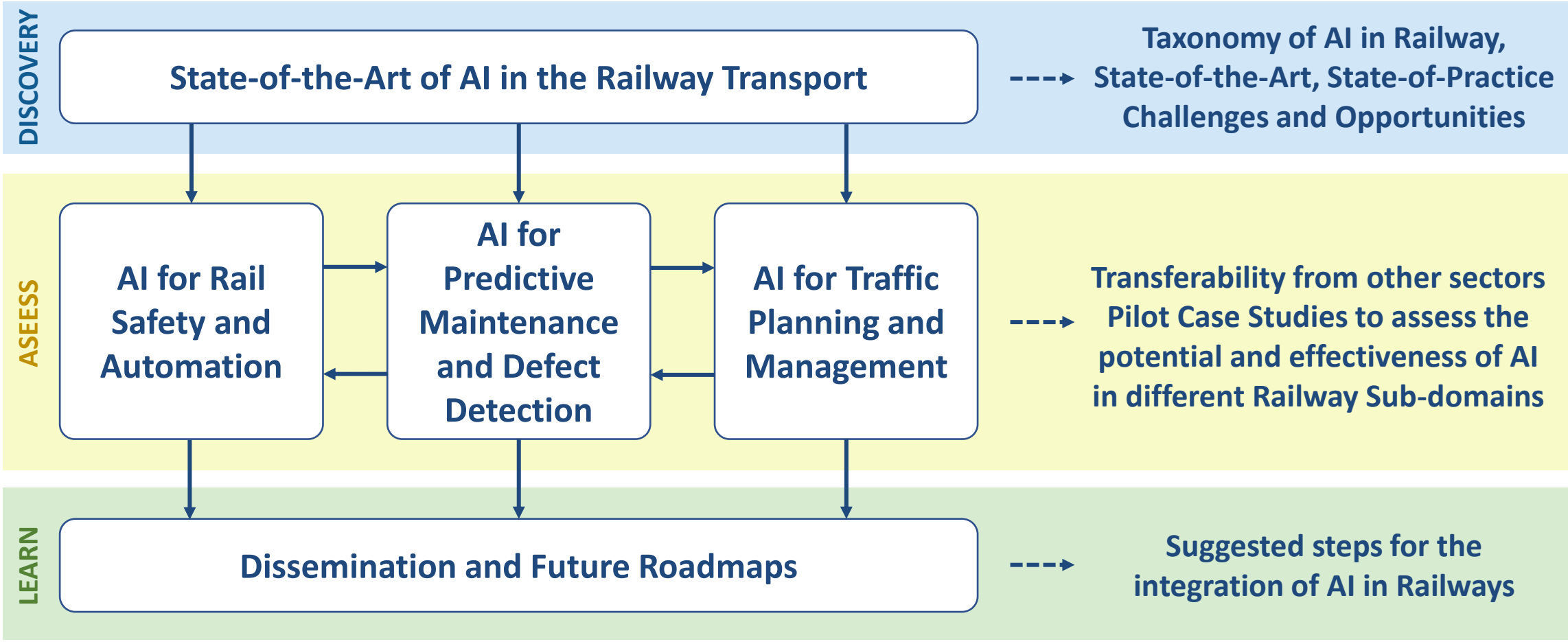
Comesvil S.p.A.

SYstems ENgineering for MAINTenance

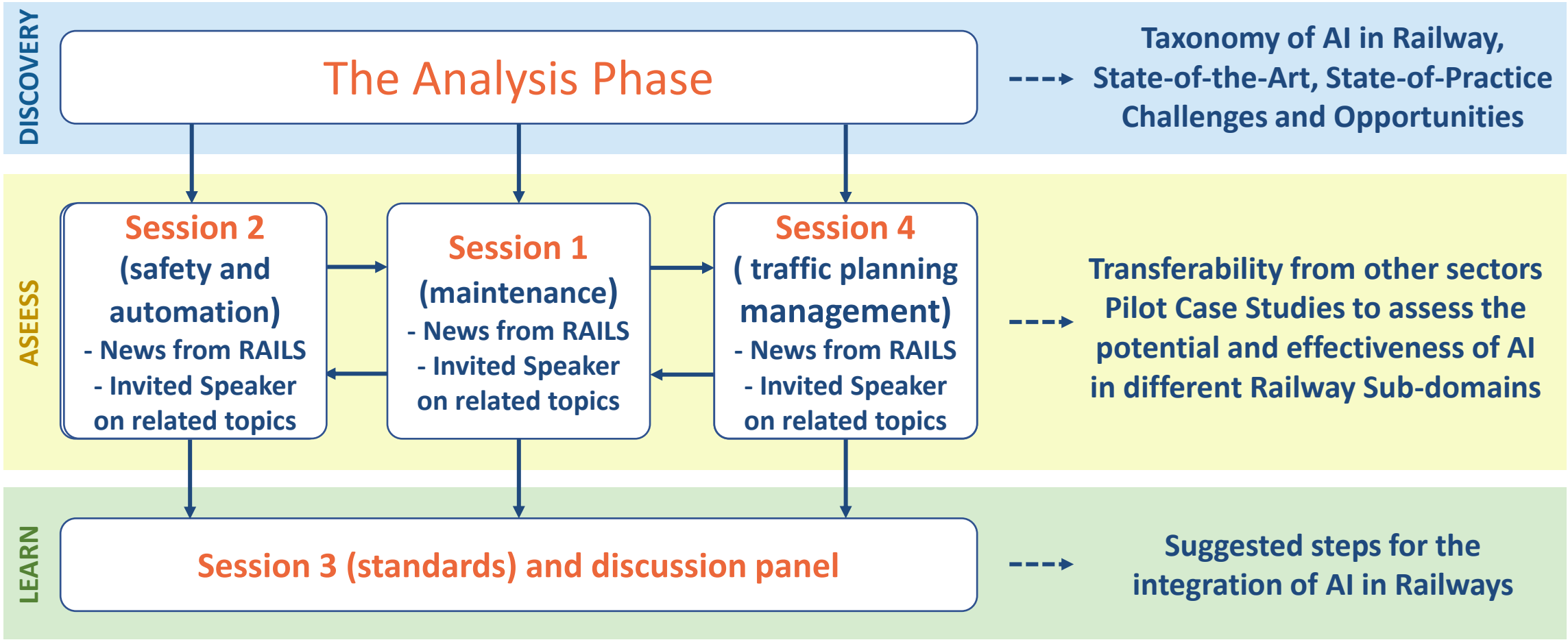
Nexttechnologies Ltd.

The MathWorks

RAILS Structure



Today's Event



MID-TERM Project Picture

Shift2Rail

RAILS

4 EU Partners
10 AB Members
2 Ph.D. Students

Activities

AI4RAILS
(RAILS supported Workshop Series)

1 AB Meeting

1 Survey

KoM meeting
Mid-Term WS

Papers and Articles

- Roadmaps for AI Integration in the Rail Sector – RAILS (ERCIM News 121)
- "Low-Power Wide-Area Networks in Intelligent Transportation: Review and Opportunities for Smart-Railways (IEEE ITSC 2020)
- **A Systematic Review of Artificial Intelligence Public Datasets for Railway Applications (MDPI Infrastructures)**
- Software Verification and Validation of Safe Autonomous Cars: A Systematic Literature Review (IEEE Access)
- Artificial Intelligence in Railway Transport: Taxonomy, Regulations and Applications (IEEE Trans. on Int. Trans. Systems, 2021 - Early Access)
- A Vision of Intelligent Train Control (Accepted at RSSRail 2022)
- Trustworthy AI for safe autonomy of smart railways: directions and lessons learnt from other sectors (Accepted at WCRR 2022)

DISCOVERY WP1

ASSESS WP2,3,4

LEARN WP5

WP6

Talks and Presentations

IEEE ITCS 2020
DisCoRail 2021
INFORMS 2021
InnoRail 2021

Organized WS

AI4RAILS 2020
co-located with EDCC2020

AI4RAILS 2021
co-located with EURO2021

Upcoming

RSSRail 2022
WRCC 2022

Planned

AI4RAILS 2022
co-located with EDCC22
Zaragoza (Spain)
12 September 2022

Deliverables accepted and published

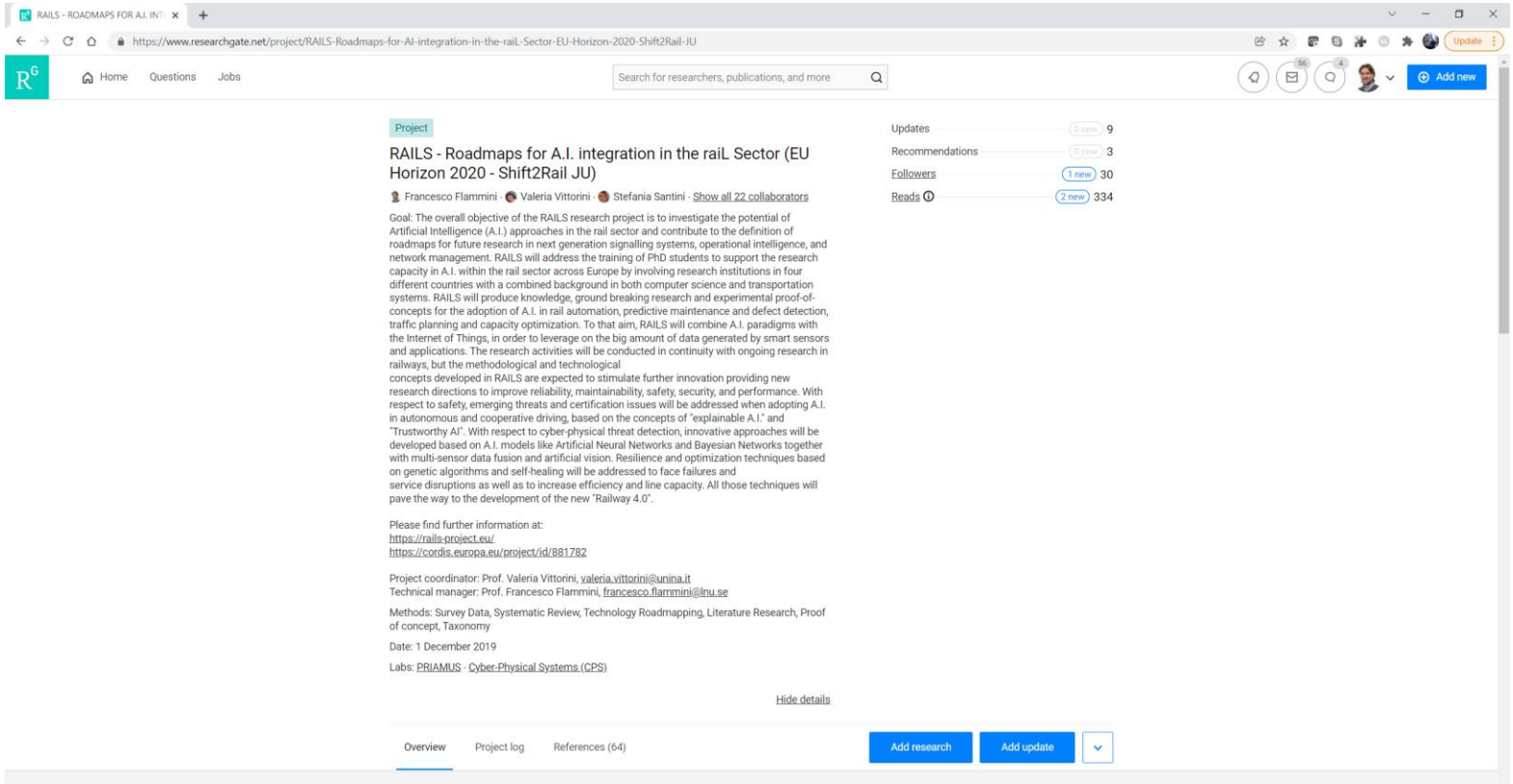
(https://rails-project.eu/downloads/deliverables/)

D1.1: Definition of a reference taxonomy of AI in railways
D1.2: Summary of existing relevant projects and state-of-the-art of AI application in railways
D1.3: Application Areas (including guidelines, survey results, and recommendations)
D2.1, D3.1, and D4.1 which are "Reports on case studies and and analysis of transferability from other sectors" in the context of WP2, WP3, and WP4 respectively

To follow the project and get updates:

https://rails-project.eu/

https://www.researchgate.net/project/RAILS-Roadmaps-for-AI-integration-in-the-raiL-Sector-EU-Horizon-2020-Shift2Rail-JU



RAILS S2R Project

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RAILS MID-TERM WORKSHOP

25 FEBRUARY 2022

Chair: Zhiyuan Lin (Univ. Leeds)

All times are CET

10.00 - 10.15	Opening and Welcome to attendees	Ronghui Liu (Univ. Leeds), Gorazd Marinic Shift2Rail IPX Programme Manager (EU-RAIL)
10.15 - 10.30	RAILS: A Mid-Term bird eye view	Valeria Vittorini RAILS Project Coordinator (CINI and Univ. Napoli Federico II)
10.30 - 10.50	AI in railways - analysis phase: main outcomes and their relevance for the next steps	Rob Goverde (TU Delft)
	Session 1: Smart maintenance	
10.50 - 11.10	Preliminary results and next steps	Lorenzo De Donato (Univ. Napoli Federico II)
11.10 - 11.30	New steps forward in railways smart maintenance	Carlo Crovetto (Hitachi Rail STS) IN2SMART2 project Coordinator, Marco Borinato (Hitachi Rail STS)
11.30 - 11.40	**Break**	
	Session 2: Trustworthy AI and autonomous trains	
11.40 - 12.00	Preliminary results and next steps	Francesco Flammini (Linnaeus Univ.)
12.00 - 12.20	AI: trustworthiness, safety and validation issues	Guo Zhou (Scania Group)
	Session 3: The need for standardization	
12.20 - 12.40	Ongoing standardization activities in the area of AI and Digital Twin	Denis Miglianico (Alstom Transport) CENELEC TC9X Secretary and IEC TC9 Secretary
12.40 - 13.00	The need for Standard XAI	Autilia Vitiello (Univ. Napoli Federico II) Chair of the IEEE P2976 - XAI Explainable AI Working Group
13.00 - 14.30	**Lunch**	
	Session 4: Traffic & passenger management	
14.30 - 14.50	Preliminary results and next steps	Ruifan Tang (Univ. Leeds)
14.50 - 15.10	Machine Learning for Crowd Behaviour Understanding in Public Spaces	He Wang (Univ. Leeds)
15.10 - 16.15	**Panel** – discussion about the challenges for a fast take-up of AI in railways	**Moderators:** Zhiyuan Lin (Univ. Leeds), and Francesco Flammini (Linnaeus Univ.)
16.15 - 16.20	Closing remarks and wrap-up	Valeria Vittorini (CINI and Univ. Napoli Federico II)

Thank you for your attention!