ANNUAL ACTIVITY REPORT

2022

EXECUTIVE VIEW

Europe's Rail

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EXECUTIVE VIEW

The Europe's Rail Joint Undertaking (EU-Rail) became the legal and universal successor of the Shift2Rail Joint Undertaking (S2R JU or S2R). Hence, EU-Rail has succeeded in the management of the S2R JU Research and Innovation Programme.

However, in this report, references are still made to S2R Programme, S2R Other Members, S2R R&I, S2R Regulation, S2R JU, S2R etc. to identify all the activities and governance inherited by EU-Rail and related to the former S2R JU.

Contents

Foreword

Adina VĂLEAN,
European Commissioner for Transport

2022 was a turbulent year for transport in general. Still recovering from the COVID-19 pandemic, the sector was also confronted with the consequences of Russia's aggression against Ukraine, including its impact on logistics chains and connectivity, on the economy, and on energy prices.

But rail once again proved its resilience. More than that, it helped create a lifeline for Ukraine, helping it to export its goods and import what it needs. On a human level, let us also remember the tens of thousands of Ukrainian refugees carried to safety by trains.

Rail has more than proved its value. It is now time to complete the Single European Railway Area. We urgently need a fully integrated rail system at the heart of a wider mobility system.

This will involve overcoming some remaining challenges; I look to Europe's Rail to help us make rail more attractive, user-friendly, competitive, affordable, and easier to maintain.

Shift2Rail (S2R) set the bar high: its results could help create energy savings of around 9–19%. We are already seeing some of these results, including in the car bodies, running gear, accessibility solutions and interiors displayed at InnoTrans2022 and elsewhere.

It is only a matter of time before we see Europe's Rail results on display as well. I know that I can count on Europe's Rail to help us build a coherent European rail system architecture, to take forward European systems for signalling, traffic management and other digital processes, and to modernise rolling stock and infrastructure. Priorities must also include the digital automatic coupler and its applications, and new positioning solutions that bring down system costs, especially for rural and regional lines.

I look forward to seeing progress in these areas in 2023.

Europe's Rail in 2022

2022 was an ambitious and successful year achieving the ramp up phase of the Europe's Rail Joint Undertaking and its Programme which are now fully operational, including Innovation Pillar, System Pillar and soon, the Deployment Group. At the same time, 2022 was a pivotal year for the innovation programmes of Shift2Rail. All the technical demonstrators have either already demonstrated results of the intense work that has been ongoing since the launch of the programme or are gearing towards final preparation steps for demonstrations to happen in 2023.

The Research and Innovation activities performed under the new EU-Rail integrated Programme are covering innovative solutions' lifecycle, from exploratory research to pre-deployment, and are designed to deliver the transformation of the rail sector needed to answer clients' needs, passengers and supply chain. Not only to contribute to addressing the European Green Deal but also the energy crises and new challenges. During 2022, the Founding Members have been working together to operationalise their commitment to the JU submitting major proposals to the Call 2022-1, that followed an open, transparent, and independent assessment resulted in 6 Flagship Projects covering Phase 1 of the EU-Rail integrated Programme. These projects were operational by the end of 2022. In parallel, the System Pillar activities were funded following a major call for tender.

2022 was marked also by the consistent implementation of a system approach to rail evolution, driven by the European Commission – DG MOVE policy, where EU-Rail represents the research and innovation arm length and ERA the key system authority for ERTMS and telematics applications. This creates the opportunity for the European rail industry to bring forward its views and ambitions with "one voice" with the expectation for a systemic and coherent approach at institutional level.

The launch of the Research and Innovation activities of the EU-Rail integrated Programme, building upon the results and advances of the S2R programmes, shapes the mission-oriented nature of the JU, building on openness and inclusiveness, answering the call of the Member States and Parliament to deliver impact, and added value to European citizens. Synergies with other European Union – as well as national and regional – programmes and partnerships shall provide opportunities to complement the series of actions expected from the rail sector, including interacting with ERRAC on complementary activities.

The JU was not only active in its R&I activities, but also in building relationships with other organisations and participating in more than 70 external and internal events and conferences including InnoTrans 2022, TRA 2022, and WCRR 2022. Together with its Members and partners, at InnoTrans 2022, the JU showcased innovative rail solutions of the Shift2Rail Programme and presented the new Joint Undertaking. InnoTrans 2022 was also the occasion to launch the Catalogue of Solutions 2022 Edition which brings together the innovative solutions and approaches delivered by Shift2Rail Members and projects' participants to transform the rail systems. Stakeholder relations, communication and dissemination of project results ensure the visibility and uptake of the progress achieved.

The cohesion that EU-Rail has created within the European rail industry builds upon a small team of passionate professionals dedicated to deliver this new ambitious integrated Programme. The Executive Director in charge until 28 February 2023 and myself would like to express all our gratitude to the EU-Rail Founding Members, the S2R Members, the EU-Rail staff, the Member States representatives and the observers for the collaboration and support during 2022 making all these significant results possible.

Giorgio TRAVAINI,
Executive Director a.i.,
Europe's Rail Joint Undertaking

Call 2022 in figures

2 **Calls** launched in **2022**

463 total number of beneficiaries in funded projects

€583.4 million of total project value started already from the first call

44 SME participations were part of the evaluated proposals in the two 2022 calls

€232.5 million EU-Rail funding awarded for the first call

20 SME participations were included in the proposals retained for funding

Executive summary

2022 marked the first year of the new institutionalised European partnership, Europe's Rail Joint Undertaking (EU-Rail) officially established on 19 November 2021 by Council Regulation (EU) 2021/2085. It is the new institutionalised European partnership on rail research and innovation established under the Horizon Europe programme (2021-2027) and the universal successor of the Shift2Rail Joint Undertaking. At the beginning of 2022, the Governing Board, following the setting up of the JU's bodies, was in the position to formally adopt the Master Plan, the Multi-Annual Work Programme and the first Work Programme 2022 – 2024.

The vision of EU-Rail is to deliver, via an integrated system approach, a high capacity, flexible, multi-modal, sustainable, and reliable integrated European railway network by eliminating barriers to interoperability and providing solutions for full integration, for European citizens and cargo.

EU-Rail aims to accelerate research and development in innovative technologies and operational solutions. This will support the fulfilment of European Union policies and objectives relevant for the railway sector and the competitiveness of the rail sector and the

European rail supply industry. In this way, EU-Rail will accelerate the penetration of integrated, interoperable, and standardised technological innovations necessary to support the Single European Railway Area (SERA).

EU-Rail builds upon the results and activities carried out by its predecessor, Shift2Rail (S2R), which was established as a public-private partnership under the Horizon 2020 Framework Programme[1] to manage and coordinate mission-oriented Research and Innovation (R&I) activities for a major transformation of European railway systems.

The S2R strategic objectives and targets remain more than valid also within the framework established by the new "Sustainable and Smart Mobility Strategy" adopted by the European Commission on 9 December 2020[2].

2022 activities were influenced by a new crisis resulting from the illegal aggression of Ukraine by Russia. Although EU-Rail research and innovation has not been directly impacted by the situation, it is not possible to anticipate at this stage the consequences of such dramatic events. At the same time, Covid-19

continued to impact the progress and finalisation of the S2R Programme R&I activities.

Beyond the operational activities, 2022 saw the preparation, design, and implementation of Article 13 of the Single Basic Act, where EU-Rail took over the responsibility for the coordination of the Back Office Arrangement (BOA) – Accounting Services. Other three BOAs were established under the leadership of other Joint Undertakings with EU-Rail taking up an active supporting role in those as well.

In terms of organizational changes, at the meeting of the Governing Board on 30 November 2022, the

Executive Director informed the Board of his intention to step down from his position in advance to the end of his second mandate. He notified the Governing Board that his decision would have been formalised in 2023, once the necessary administrative steps would be completed. This was formalised on 9 January 2023, when the ED notified his end of service as from 28 February 2023; on 30 January 2023 the Governing Board appointed Mr Giorgio Travaini, Head of the Programme, as Executive Director ad interim as from 1 March 2023..

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1   Regulation (EU) No 1291/2013 of the European Parliament and of the Council of 11 December 2013 establishing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020), OJ L 347, 20.12.2013 and Council Decision (EU) No 2013/743/EU of 3 December 2013 establishing the specific programme implementing Horizon 2020 (2014-2020), OJ L 347, 20.12.2013, p. 965.
2   https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0789

S2R Programme Status

The year 2022 played a crucial role in the innovation programmes of Shift2Rail. Within this year, all the technical demonstrations stemming from Shift2Rail's innovation programs have either demonstrated the outcomes of their continuous and dedicated efforts, which began when the program was initiated, or are currently in the process of making final preparations for upcoming demonstrations scheduled for 2023.

The operational impact of Covid-19 pandemic, with the 6 months of additional delays reported in 2021, could not be shortened in 2022. Therefore, the Programme itself is largely continuing with testing activities in 2023, having generated a number of additional extension amendments for those projects that optimistically thought they could catch up in 2022.

As in 2021, given the context, the work of S2R Other Members, other beneficiaries and of the JU staff shall be commended as they have collectively and individually ensured the progress of the research and innovation activities showcased at the InnoTrans 2022 JU's and companies' stands, where for the first time innovative interoperable European solutions, worked in Shift2Rail, appeared in future commercial solutions.

By the end of 2022, the S2R Programme reached pivotal milestones in terms of Programme implementation:

- all S2R resources are committed to the Programme activities and all planned IPs/CCA related activities are running in granted projects,

- on average, approximately 89% of the Programme has been realised and 91% in terms of financial Programme execution, in view of reaching the TRL6/7 operational demonstrations planned for conclusion during 2023. In total, it is estimated that the total value of the activities performed in 2022 amounts to EUR 102,4 million, of which EUR 92 million delivered by the Members other than the European Union (hereinafter S2R Other Members).

During 2022, the JU assessed its R&I activities through a fourth Control Gate exercise[3]. This exercise took into account the deliverables and reports submitted in the context of the Annual Review of the active projects coordinated by the S2R Other Members. The JU also ensured through this process that the recommendations made during the previous Control Gate Assessment had been properly applied. The overall result is that the Programme benefited from such feedback, built upon external expertise.

This Programme assessment allowed the JU to confirm that overall, the progress of the activities has been in line with the expectations. In addition, the system approach activities within IPX allowed to provide various elements to accelerate the ramp-up of the EU-Rail System Pillar activities. Only a small number of TDs show delays compared to the initial scheduling, mostly due to the availability of resources and external factors. In such cases, the JU has requested the concerned Project Teams to put in place the necessary mitigating measures.

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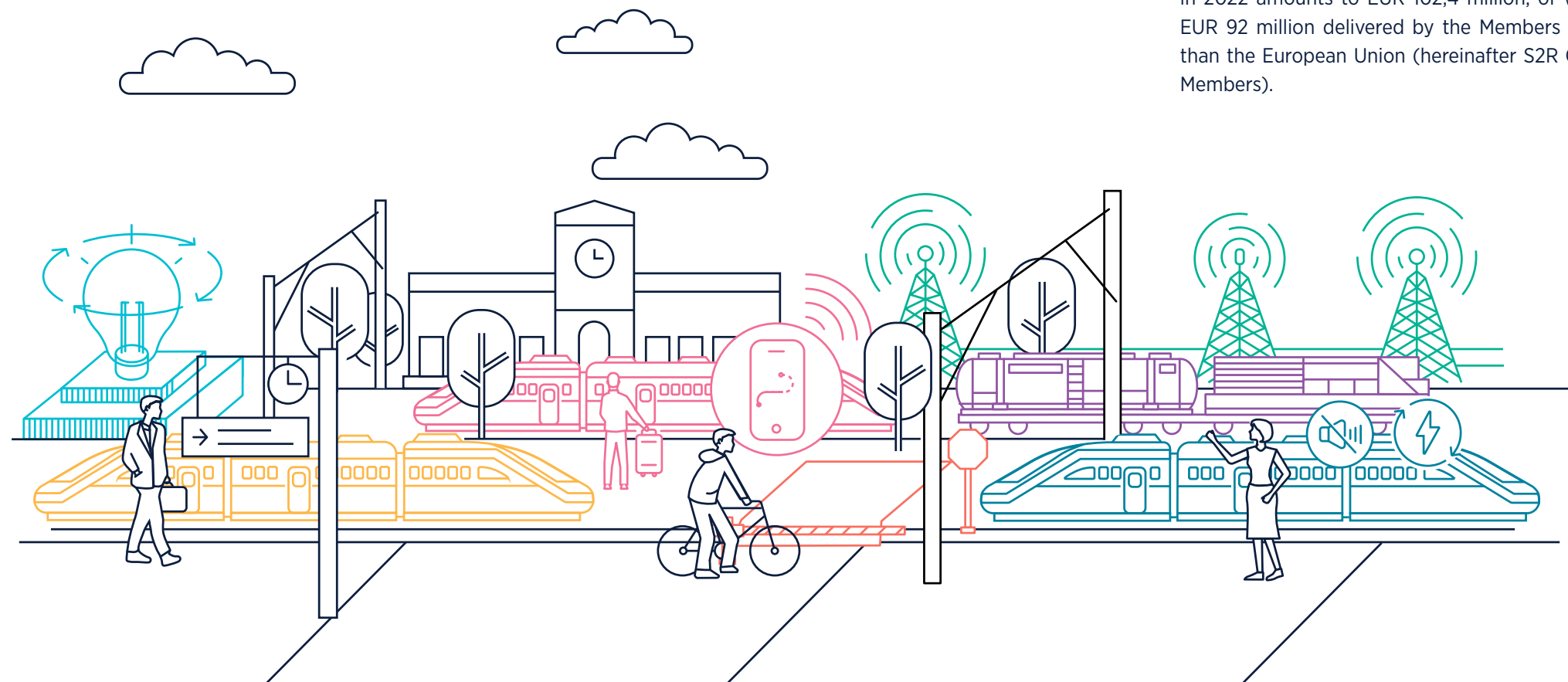
3   In accordance with the procedure set in the S2R Governance and Process handbook, transparently published on the JU's website: https://rail-research.europa.eu/wp-content/uploads/2021/03/S2RJU-Governance-and-Process-Handbook_20200303_v2.0.pdf

Passenger Trains

In 2022, IP1 TDs progressed significantly with a jump from the overall TD completion rate estimated in 2021 of 63%, to 83% in 2022. Overall IP1 finalised with submission of deliverables representing 86% of the estimated work planned in 2022. TD1.1 (Traction), TD1.8 (HVAC) and TD1.6 (Doors and Access Systems) were the main contributors in 2022 for this progress, catching up the delays they had in 2021. TD1.2 (TCMS) progress is more modest, in particular with regards to the submission of final deliverables, attributable to some delays in the electronics supply chains continuing in 2022. TD1.3 and TD1.4 also suffered similar delays in the submission of finalised deliverables in 2022. On the positive side, different demonstrations were showcased at InnoTrans 2022, contributing to the dissemination and exploitation activities, either at the JU stand or at the different members' stands, mostly representing EU-Rail rolling stock sub-systems innovations related to carbodies, running gear, accessibility solutions and interiors.

Regarding TD1.1, significant progress has been achieved during 2022. The lab tests performed on a sub-urban SiC based traction system, including a new traction motor, and final demonstrations carried out on regional trains, deserve a special mention in this respect. With reference to TD1.3, all subcomponents were manufactured for the demonstrators using all the moulds and manufacturing engineering that was developed, whereas under TD1.4, a bogie component health monitoring system for the detection of anomalies in running gear components was developed. Also, the work towards optimised materials enabling substantial weigh reductions continued.

As for TD1.5, a concept for electro-mechanical brake has been proved against the operational requirements and adhesion management solutions were also tested in operational conditions. Concerning TD1.6, the prototypes for door leaves were manufactured, the performance tests were finalised, and demos were made in coordination with the work carried out within TD1.7 on train modularity concepts.

The HVAC work within TD1.8 progressed with tests that shown the feasibility to achieve the same thermal comfort using an HVAC unit with natural refrigerants and the reduced consumption of energy with the introduction of heat pumps. Pre-standardisation work related to HVAC classes and interfaces has been also carried out.

IP1

Traffic Management

IP2
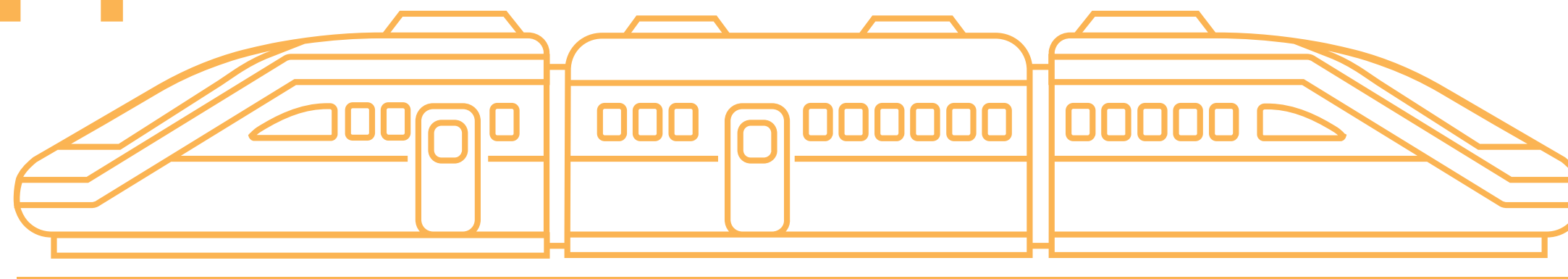
Significant progress has been reported on all TDs. For the whole IP2 a very good 96% completion rate of the work planned for 2022 was reached on average. The work on TD2.5 Train Integrity was finalised at the end of 2022 and laboratory activities with simulators and demonstrators were successfully carried out, including activities for on-board installation and on-field testing. Three demonstrators have been performed for OTI Class 1 and train length determination, Class 2 and train length determination as well as for Class 3 and train length determination. A full assessment is foreseen within the last project reporting related to 2022.

Regarding TD2.1 on Adaptable communication, tests have taken place in France and Germany as well as in the United Kingdom to demonstrate the concept for both mainline/highspeed and suburban traffic. For moving block, the experts involved in the work have tested two concepts: fixed virtual blocks and full moving block.

As regards to TD2.3 it is close to finalisation, with ATO over ETCS Grade of Automation 4, the technical demonstrator has done preparatory work to be able to gear towards testing in 2023. Results will constitute a major basis for further evolution in the future. As for fail safe train positioning (TD2.4), work is advancing on the preparation of tests which will take place in 2023 as well. To note that as per April 2023, the ATO GoA2 specifications developed under S2R have been implemented in the Member States approved set of Technical Specification for Interoperability (TSI 2023 package).

TD2.4 on Safe Train Positioning reported small progress in 2022 and it is a point of the attention for the Programme finalisation in 2023, having reached an estimated TD completion rate of 68%.

Finally, the activities for TD2.9 Traffic Management were almost concluded in 2022, however not all delays of the previous year in deliverables submission could have been addressed in full. Despite that, demonstrations of the different prototypes developed inside the Programme were performed. The demonstrators covered the following areas: Connected Driver Advisory System (C-DAS), Wayside ATO (WATO), general TMS Business Applications such as Dispatching, Conflict Detection & Resolution, Possession Management, presentation of Field Data (Signalling) and Data Integration of different business services e.g. Weather Information and User Interfaces. These demonstrators enabled validation of the integration layer and interoperable data model developed inside the Shift2Rail Programme.

These results represent fundamental elementals which will be taken up to higher TRL and integrated in major demonstration activities in the follow-up of the Shift2Rail Programme under Europe's Rail.

Optimised Infrastructure

IP3

In 2022, this IP continued to progress evenly, with technical progress reported on all TDs, especially in the context of Intelligent Asset Management (IAMS) related TDs, i.e., TD3.6 to 3.8. In average, IP3 has reached an 85% completion rate of the estimated work planned in 2022, with some deliverable submission delays.

In TD3.6 to 3.8, Machine Learning models have been tested against "real/live" data to refine the methodologies applied, the algorithms were fine-tuned, and the results were validate based on the feedback coming from the end-users. Multiple anomaly detection and prediction algorithms have been trialled in different scenarios and targeting different assets (e.g., Track Circuits, Switch and Crossing), showing very good results.

Regarding Smart Energy, TD3.10 – Smart Metering – all the Programme activities have been concluded in 2022 with the validation of the tailored-made solutions into three different Uses Cases. It has been demonstrated that the use of Smart meters supports a better management and utilization of energy such as reduction in energy losses, better distributed power demand, etc. A full assessment is foreseen with the last project reporting of 2022.

For the infrastructure TDs, i.e., from TD3.1 and 3.5, significant progress towards the MAAP objectives has been made in terms of the various sub-system/components' developments. Among others, the development and lab testing of an innovative self-sensing cementitious geo-composite, for continuous monitoring and damage identification has been done in TD3.4. In TD3.1, the whole system modelling approach, including hybrid testing approaches with virtual evaluation, has been validated with data from real-world operations from the enhanced S&C Systems.
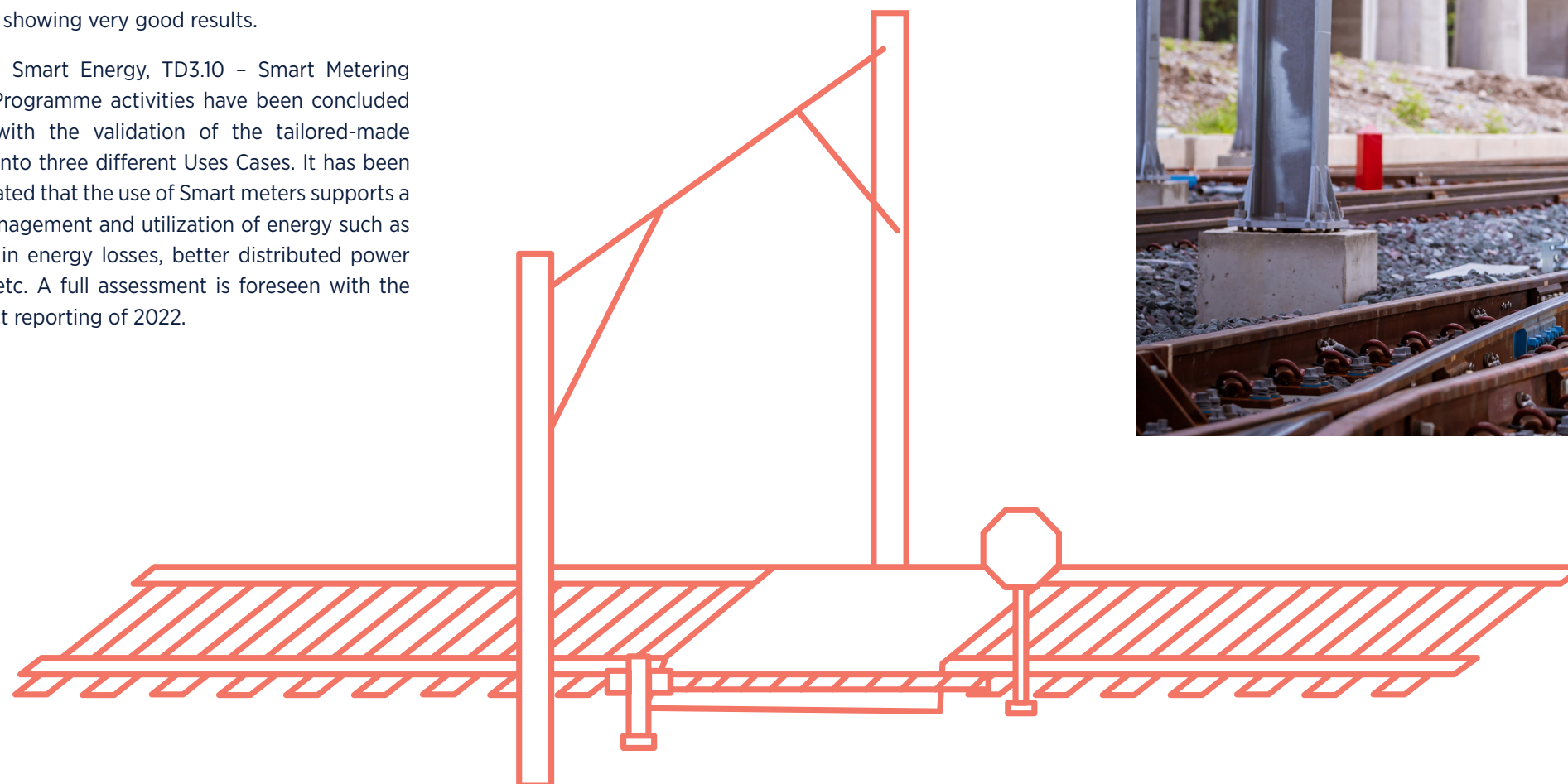
Digital Services

Solid progress has been reported on all IP4 TDs, with an average achievement rate close to 100% of the estimated work planned in 2022. The efforts focused on the final release (F-REL) of the Interoperability Framework. The implementation of the F-REL Interoperability Framework (IF) was based on the conclusions of the internal analysis carried out during previous phases, solving identified issues (e.g., related to performance) and responding to new requirements (e.g., Asset Manager and Travel Service Resolver).

Some of the most visible R&I results of 2022 are:

- Several Transport Service Providers (TSPs), from different transport modes, have been integrated to the IF and tested in the pilots (Athens, Helsinki and Brno). The integrated solution included six TSPs that provided Shopping, Booking and Issuing services (e.g., Taxiway, OASA, TMB, AMTU…).

- The travel shopping algorithm was enhanced to also provide itineraries with bike and car.

- Mobility Packages were enabled, as a kind of subscription or travel card that combines several transport products of different modes and operators.

- New validation method is being defined enabling ticket validation without physical interaction with the validation equipment.

- A desktop application dedicated for TSPs to manage real time travellers' supervision and PoI management allowing the display of travellers and network status, with direct messaging to travellers was developed.

- Several demonstrations were performed at InnoTrans 2022, among which the updated Travel Companion app with additional information such as delays, overcrowding, security constraints, and quality of service, but also the Business Analytics with new visualisations and new use cases together with an enhanced interoperability framework.

IP4

Rail Freight

IP5

In 2022, the TDs reached an average implementation rate of 91%, progressing significantly since last year reporting, in particular thanks to the TD5.1 making progress in CBM, and the conclusion of the initial R&I work on Digital Automatic Coupling. Also, the progress made by TD5.3 converged on the expected wagon demonstrators that were successfully showcased at InnoTrans 2022. Similarly, in TD5.4 technical progress was achieved in the development of the last mile battery, traction batteries and auxiliary converters. Works on intelligent video gate, improved timetable planning, and real-time yard management in TD5.2 is reported to be on track. TD5.5 on Business analytics and implementation strategies which was concluded last year already, was positively assessed, and presented to the ED-SIPB.

Some of the most visible R&I results of 2022 are:

- Two successful test trains were performed for the digital automatic coupler head selection (in Sweden and Germany).

- The Core Market Wagon underwent laboratory tests and was operated on real tracks, with its brake redesigned and tested with positive results. The Extended Market Wagon was showcased at InnoTrans 2022, coupled with telematic solution prototypes on both wagons enabling future freight train digital operations.

- The last mile battery was developed and integrated into a container for testing with real use cases.
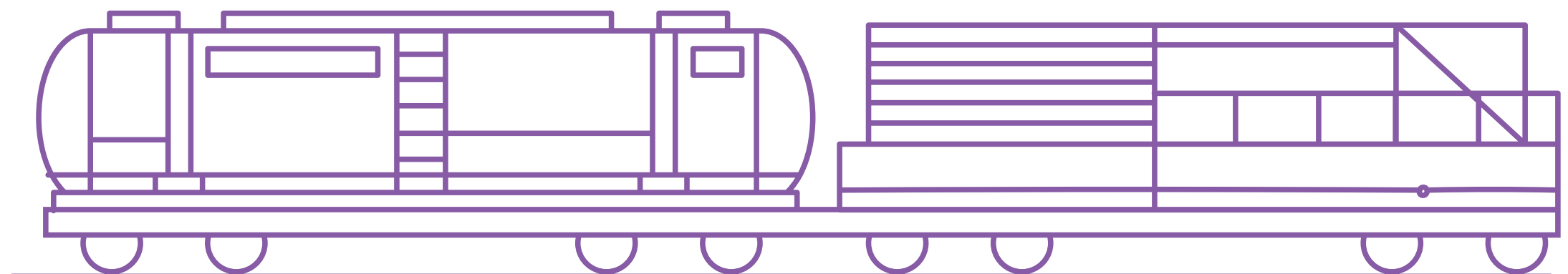
Cross-Cutting Activities

The Cross-Cutting Activities reached a 91% level of implementation of activities planned for 2022. During the year, most of the Work Areas have finalised their R&I activities. The only remaining Work Area is the one related to Noise and Vibration. A full assessment of the closed Work Areas is foreseen with the last projects reporting of 2022. In general, most of the WAs have progressed according to schedule. The testing activities which have been heavily impacted by the Covid-19 pandemic were successfully carried out in 2022 and the noise and vibration WA is recuperating from this delay.

Some of the most visible R&I results of 2022 are:

- The final release, Release 5 of the KPI model has been completed, which shows that the innovations of the Programme can potentially reach the punctuality and capacity for certain service types for life cycle cost reduction - 16 to 41% can be assumed.

- Last version of the Standardisation Rolling Development Plan was finalised, this will be provided as basis of the EU-Rail Standardisation and TSI Input Plan (for the System Pillar).

- Detailed standardisation roadmaps on specific topics such as TCMS, DAC, noise, etc. has been developed.

- In the Integrated Mobility Management Work Area, built on achieved results specifying and developing complementary business functions for rail freight operation, interfaces for the integrated communication infrastructure both for Freight and Passenger Transportation has been developed reaching TRL 3-5.

The energy Work Area defined the energy baseline and calculated the energy saving potential of the Programme, as an outcome of the research done within the S2R Programme. Overall, at system level, an energy saving of around 9 – 19% can be reached depending on the different service types with the application of the S2R solutions (high speed, regional, urban and freight).

CCA
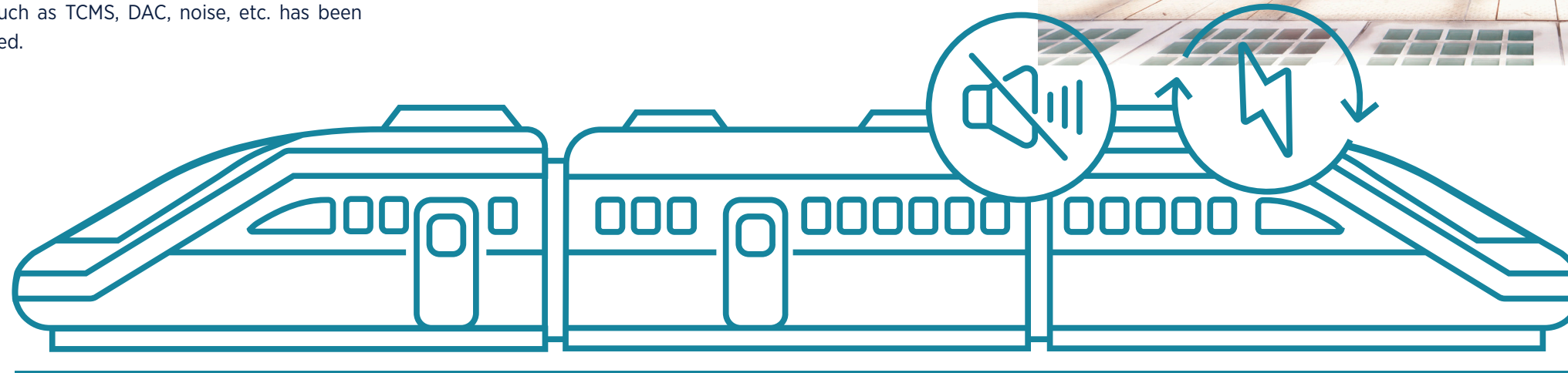
System Architecture and Disruptive Technologies

The System Architecture activities within the IPX continued to support the ramp-up activities and setup of the System Pillar. Resulting from the regular exchanges in the form of workshops and webinars throughout the year 2022, the projects delivered the prefigurating elements for the System Pillar:

- Two consecutive releases of the System Functional Architecture.

- The specification and the set-up of the formal definition of the Conceptual Data Model.

- The demonstration of the applicability of the CDM to concrete railway scenarios through 4 relevant use cases.

- Keeping up to date the ontology dictionary OntoRail by regularly uploading the newest versions of the source models.

The low TRL and PhDs research involving Artificial Intelligence (AI) adoption of AI in rail, focused on developing methodological and experimental proofs-of-concept, developing Benchmarks, Models and Simulations. Proof-of-concepts were developed to support the definition of roadmaps, covering the following topics:

- Railway Obstacle Detection and Collision Avoidance.

- Cooperative Driving for Virtual Coupling of Autonomous Trains.

- Predictive Maintenance for Rolling Stock.

- Smart Maintenance at Level Crossings.

- Graph Embedding for Primary Delay Prediction.

- Big Data on Incident Attribution Analysis.

In 2022, a prototype of a cloud-based rail common database for perception scenarios was also produced. This allows to label, analyse, and process data and simplify training and testing of AI models, aiming to eventually automatise the whole AI development pipeline.

Exploratory activities on enhancing the train positioning systems through additional perception sensors started in 2022, bringing the possibility of using SLAM – Simultaneous Location and Mapping - in railways. For that purpose, an urban rail vehicle (tram) was modified by fitting radars, lidars and cameras, and tests began in Summer in the Spanish city of Zaragoza under commercial service. First results are promising, and the experiments will continue in 2023.

PhDs results have also been achieved on the use of Blockchain in rail. A demonstrator was developed, which implements the necessary business flows to traceably exchange blocks of data between industry stakeholders in an ad-hoc context, using condition monitoring data from a third-rail monitoring platform mounted on an in-service passenger vehicle to an infrastructure manager in raw and processed forms.

Also, with the support of a PhD, flexible medium voltage DC electric railway systems (MVDC) traction power supply based on controlled bidirectional converters was investigated to improve the connectivity of the railway to the grid and to integrate renewable power sources to the railway electrification system. The developments in 2022 resulted in a lab demonstrator of a modular multilevel converter, developed, and used to test a small-scale medium voltage DC traction substation in various load conditions.

In 2022 the activities of the initial research on Hyperloop concluded by delivering the Observatory, the Technical definitions, and the Transferability and roadmap for future research.
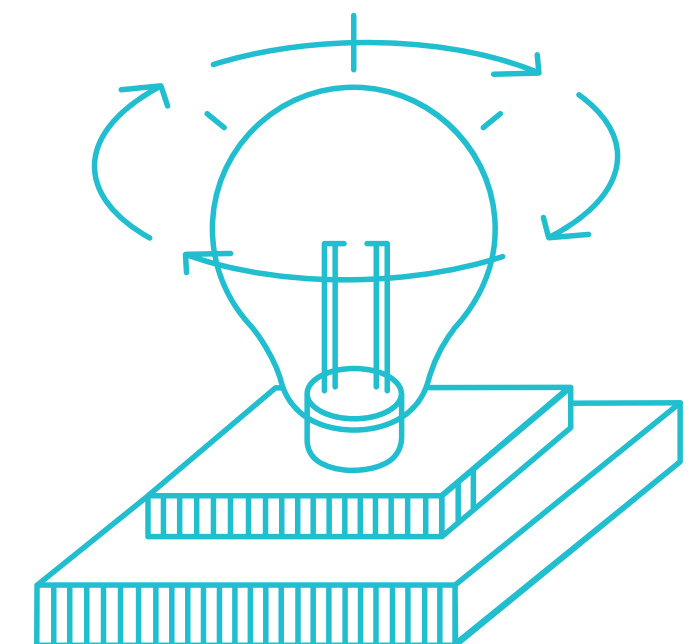
S2R Programme Management

In terms of Programme Management, 2022 was the third year during which reviews of Lump Sum projects took place. Experience so far has shown that from an operational perspective the use of Lump Sum for members' projects does not only result in an administrative simplification, but also effectively bundles efforts in the project review to focus on the achievements of results. The fact that the proof of concluded work packages (hence related focus on deliverables and milestone approval) provides the basis for the reimbursement of costs has allowed the JU and consortia to focus their efforts in an effective way to ensure the delivery of the projects.

2022 Programme Management continued to be influenced by the pandemic-related consequences of previous (or in some case still actual in part of 2022)

restrictions. Delays already occurred in 2021 could not be fully recovered by the concerned projects in 2022, consequently, some of the running activities were reported to continue until the end of 2023, however, still well within the S2R Programme schedule ending in 2024.

With a holistic approach, the role of the JU is also to ensure that interactions between the various IPs are adequately considered and managed, as technological developments in one part of the system could lead to changes in performance, or even create barriers, in other parts. In addition, cross cutting activities include research on long-term economic and societal trends such as customer needs and human capital and skills, which must be considered by the different IPs.

EU-Rail Integrated Programme Status

The EU-Rail Programme kickstarted in 2022 with an anticipated ramp-up phase of the System Pillar, while the Innovation Pillar marked the assessment of the first 6 Flagship Projects that started their R&I activities in December 2022, with the notable exception of FP5 which already started in July 2022 with a fixed early start date (before the signature of the Grant) to ensure the swift ramp-up of DAC prototypes in view of the 2025-6 demonstration activities.

A framework for continuous exchanges between the System Pillar and Innovation Pillar activities, as part of the Integrated R&I Programme, has been setup in 2022, allowing for a bi-directional flow: both pillars should provide input and output to each other against a clearly defined series of priorities and objectives

to be achieved. The Deployment Group, the third pillar of the integrated Programme, is expected to be operationalised in 2023.

In general, the objectives of the integrated Programme include the following:

- Contribute towards the achievement of the Single European Railway Area.

- Ensure a fast transition to more attractive, user-friendly, competitive, affordable, easy to maintain, efficient and sustainable European rail system, integrated into the wider mobility system.

- Support the development of a strong and globally competitive European rail industry.

DELIVER AN **INTEGRATED EUROPEAN RAILWAY NETWORK** BY DESIGN

DELIVER A **SUSTAINABLE AND RESILIENT RAIL SYSTEM**

DEVELOP A **STRONG AND GLOBALLY COMPETITIVE EUROPEAN RAIL INDUSTRY**

DEVELOP A **UNIFIED OPERATIONAL CONCEPT AND A FUNCTIONAL SYSTEM ARCHITECTURE** FOR INTEGRATED EUROPEAN RAIL TRAFFIC AND CCS/AUTOMATION

DELIVER A **COMPETITIVE, GREEN RAIL FREIGHT** FULLY INTEGRATED INTO THE LOGISTICS VALUE CHAIN

SYSTEM PILLAR

OPERATIONAL CONCEPTS

FUNCTIONAL SYSTEM ARCHITECTURE

A SINGLE COORDINATING BODY FOR THE WHOLE SECTOR EVOLUTION

OPEN INTERFACES TO OTHER TRANSPORT MODES AND BUSINESSES

SYSTEM REQUIREMENT SPECIFICATIONS

INNOVATION PILLAR

TECHNOLOGICAL AND OPERATIONAL SOLUTIONS FOR SERVICES OF FUTURE

FLAGSHIP PROJECTS

LARGE-SCALE DEMONSTRATIONS

EXPLORATORY AND FUNDAMENTAL R&I

EUROPEAN RAIL TRAFFIC AND MOBILITY MANAGEMENT
- Manage and improve rail traffic at EU level
- Adjust rail traffic management in function of the mobility demand

DIGITALISATION & AUTOMATION IN TRAIN OPERATIONS
- ATO implementation
- Digital train operations

SUSTAINABLE AND DIGITAL ASSETS
- Integrated assets testing & life-cycle framework
- Zero-emmission, silent rail system

COMPETITIVE, DIGITAL, GREEN RAIL FREIGHT
- New digital customer interaction & innovative rail freight services
- Multimodal and rail freight innovation integration

REGIONAL RAIL SERVICES IN LOW DENSITY AREAS
- New system approach to regional rail services in low density areas

DEPLOYMENT GROUP

FUTURE SOLUTIONS DEPLOYED IN A COORDINATED AND CONSISTENT WAY AT EUROPEAN LEVEL, TAKING INTO ACCOUNT ALTERNATIVE ROLLOUT SCENARIOS, BEHAVIOURAL AND ORGANISATIONAL CHANGES, SYNERGIES WITH OTHER MODES OF TRANSPORT

The System Pillar

The System Pillar is the "generic system integrator" for EU-Rail, and the architect of the future EU's railway system. It is established under the Single Basic Act as a fundamental activity of EU-Rail, alongside the Innovation Pillar and Deployment Group.

The System Pillar will provide governance, resource, and outputs to support a coherent and coordinated approach to the evolution of the rail system and the development of the system view, based on a formal functional system architecture approach to speed innovation and deployment. The System Pillar brings rail sector representatives under a single coordination body.

To achieve this, the System Pillar will deliver a unified operational concept and a functional, safe and secure system architecture, with due consideration of cyber-security aspects, focused on the European railway network to which Directive 2016/797 applies (i.e. the heavy rail network), for integrated European rail traffic management, command, control and signalling systems, including automated train operation which shall ensure that research and innovation is targeted on commonly agreed and shared customer requirements and operational needs, and is open to evolution.

During 2022 the ramp-up activities of the System Pillar were concluded, and the System Pillar governance and resource were put in place.

System Pillar Ramp-Up activities

In order to prepare for the launch of the System Pillar activities, preparatory activities were funded. These activities successfully delivered:

- The finalised Common Business Objectives.

- The operational vision for CCS, TMS and CMS.

- The governance and working arrangements for the System Pillar.

All these documents have been approved at the System Pillar Steering Group.

In addition, there was significant work carried out to consolidate architectural inputs from over 500 source documents to facilitate the beginning of the work of the System Pillar itself.

System Pillar start up

A framework contract with value up to EUR 45 million was successfully awarded in July 2022 to the System Pillar consortium. This contract included 3 lots:

- System Pillar Core Group

- System Pillar Tasks and Domains

- CCS TSI Maintenance Activities

The System Pillar Core Group was formally in place in September, and the Tasks and Domains part was set up in October 2022.

All of the activities for the System Pillar start were on time and in line with the planning agreed with the sector.

The Innovation Pillar

The Innovation Pillar is set up to deliver user-focused research, innovation, and large-scale demonstrations. It is tasked to deliver the operational and technological solutions which provide the necessary capabilities to transform the European rail system. Its activities are organised in seven Flagship Areas and the Transversal Topics.

In 2022, with the conclusion of the grant agreements derived from the first call, the first 6 Flagship Areas and the Transversal Topics have been covered with the award of 6 Flagship Projects.

Focus was brought on ensuring the links between the different Flagship Projects, most notably when exchanges are expected at the level of requirements but also ensuring proper relationships for the demonstration activities which are expected, in most cases, to take place in 2025-6. The JU also ensured that the relationships between the FPs and the System Pillar were rightly set-up considering the input which the System Pillar will provide on the architecture, but also at a later stage on migration, standardisation, and regulatory aspects.

Europe's Rail Flagship Projects - Phase 1

Rail Research and Innovation to make Rail the Everyday Mobility

FP6: FUTURE
Innovative rail services to revitalise capillary lines and regional rail services

Value: EUR 32.9 million
Partners involved: 50
Duration: 48 months

FP1: MOTIONAL
Mobility management in multimodal environment and digital enablers

Value: EUR 92.6 million
Partners involved: 88
Duration: 46 months

FP5: TRANS4M-R
Transforming Europe's rail freight

Value: EUR 95.1 million
Partners involved: 71
Duration: 45 months

FP2: R2DATO
Rail to digital automated up to autonomous train operation

Value: EUR 160.8 million
Partners involved: 76
Duration: 42 months

FP4: RAIL4EARTH
Sustainable and green rail system

Value: EUR 95.1 million
Partners involved: 71
Duration: 48 months

FP3: IAM4RAIL
Holistic and integrated asset management for Europe's rail system

Value: EUR 106.9 million
Partners involved: 94
Duration: 48 months

Additionally, in 2022, the JU launched a second call to cover the Flagship Area 7 on "Innovation on new approaches for guided transport modes" and the "Exploratory Research and other activities". This latter call was still under evaluation, as planned, at the beginning of 2023.

The European DAC Delivery Programme under the leadership of EU-Rail

In July 2020, the Governing Board of the JU endorsed the creation of the European DAC (Digital Automatic Coupler) Delivery Programme (EDDP) proposed by the Executive Director, voicing the request of the railway sector. Building upon the outcomes achieved in S2R's freight related R&I activities (Innovation Programme 5), this Programme brings together the rail sector beyond the Membership to bridge the research work with innovation, including migration planning, towards the deployment of a European DAC solution, built on open and transparent standard specifications. This activity constitutes a major step ahead of the digital rail freight, enabling new operations and services that will contribute meeting the expectations of the Sustainable and Smart Mobility Strategy of the European Commission.

The EDDP integrates, with an independently managed delivery programme (with Mr Mark Topal, CTO of OEBB, appointed as the European DAC Delivery Programme Manager supported by the Co-Manager Jens Engelmann, owner of Railiable), projects like DAC4EU, funded by the German Federal Ministry of Transport and Digital Infrastructure, as well as relevant results from S2R projects, under its Innovation Programme 5 on European rail freight.

In 2022 the following were achieved:

- The EDDP participation continuously increased, counting on more than 300 experts and more than 80 companies and organisations involved across Europe and beyond.

- For the first time in Europe work has been achieved with the DAC target operational procedures for the first DAC use cases.

- EU-Rail Flagship Project 5 (FP5-TRANS4M-R, 2022-2026) was awarded and started its activities with 27 beneficiaries and 71 partners in order to achieve:

  ◦ The DAC specification for "mechanical/pneumatical", "energy" and "communication".

  ◦ The Demonstration of Digital Freight Trains in 2025 with DAC Type 4 & 5 incl. Energy and Data Supply, Hybrid Coupler and automated brake test (at TRL 8).

  ◦ Preparing further development of Full Digital Freight Train for future demos.

- Operational DAC tests took/are taking place in European countries.

- The development of possible solid and feasible migration scenarios, for the first time in Europe, which will be further worked on by the partners.

- The first iteration of the Cost-Benefit Analysis was performed under the leadership of the European Commission, supported by the previous LCC analysis commissioned by EU-Rail.

- The first European Investment Plan was contracted by EU-Rail and finalised in early 2023[4] by the company EY, setting the basis for further steps for the DAC implementation and deployment strategy.

In 2022 several meetings took place with the ERA DAC Topical Working Group with the aim to agree on a DAC spec that could be adopted in future TSI, supporting the harmonization across EU rail network. In parallel the S2R project DACcelerate has supported additional CEN CENELEC meetings to standardise DAC specification.

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4 https://rail-research.europa.eu/publications/european-dac-investment-plan/

Other activities

The current EU-Rail Staff Establishment Plan was adopted by the Governing Board on 1 March 2022. It introduced new Temporary Agent positions in relation to the new role of the JU in the System Pillar and to further strengthen the support to policy activities with its integrated R&I Programme. According to the Staff Establishment Plan, EU-Rail shall be staffed with 29 staff members including 2 Seconded National Experts. In 2022, most of the vacant posts were being progressively filled, while having no staff members leaving, the JU still experienced some temporary leaves. To fill temporary gaps or long-term absences, the JU also made use of external competencies and expertise to achieve its operational activities, as well as of temporary outsourcing of some administrative tasks.

With regard to communication and dissemination activities, the JU focussed primarily on supporting the activities linked to the establishment of the newly launched Europe's Rail Joint Undertaking, with a particular focus on the promotion of the new Programme and its objectives and mission, the introduction of the role of the new System Pillar, while also enhancing Europe's Rail focus on demonstration activities and dissemination of relevant results for market uptake, for the ongoing Shift2Rail projects. A dedicated launch ceremony for EU-Rail was organised during the informal Railway Ministerial meeting held in the context of the French Presidency of the Council (Paris, 21st February 2022).

Furthermore, project results were disseminated at various events with Europe's Rail participation, including at the World Congress on Railway Research, Connecting Europe Days, InnoTrans 2022, TRA, Rail Live and during the Europe's Rail Innovation Days (online).

During 2022, the JU also continued its efforts to increase cooperation with Member States, notably through the Portuguese Presidency with the JU's participation to TRA, as well as with international parties. An MoU was signed during the Connecting Europe Days event with CER, UNIFE, and ALL Rail on the launch of a study on the costs and benefits of High-Speed Rail in Europe.

In addition to the efforts on stakeholder involvement, the JU further continued improving its internal organisation as to provide continuous support to its Members and beneficiaries. Attention was paid to the continuous implementation of the internal control framework and to the assessment and management of risks. The JU cooperated with different stakeholders engaged in audit activities, such as the European Court of Auditors, the Internal Audit Service of the Commission, the Common Audit Service exercised by DG RTD or the external auditors auditing the Annual Accounts of the JU. All these activities have contributed to the continuous assurance regarding the sound financial management of EU funds managed by the Joint Undertaking.

In 2022, the JU submitted to the European Parliament a follow-up report on the Parliament's observations provided in its Resolution related to the decision on discharge in respect of the implementation of the JU's budget for the financial year 2020. In this follow-up report, the JU explained its way in which it addressed these observations or intends to address them in the upcoming period. More specifically, it was elaborated on how EU-Rail contributes to developing, integrating, demonstrating, and validating innovative technologies and solutions in order to remove the remaining technical obstacles holding the rail sector back in terms of interoperability. Furthermore, the JU confirmed in the report that the issue with publishing of the CVs as well as of annual declarations of interests of the EU-Rail Governing Board members had been addressed. Explanation was also provided of how the JU addressed the deficiencies identified by the Court of Auditors with regard to the particular sampled operational payments, as well as how EU-Rail in general undertakes to tackle the systemic errors in grants, most importantly by applying simplified cost options, in particular, by means of the lump sum form of funding.

It can be concluded that thanks to the commitment of both the JU Members and the Programme Office, 2022 has seen the JU further continuing its important progress towards delivering the Shift2Rail Programme, and, in parallel, towards initiating its new Programme by launching two calls for proposals or by carrying out tasks related to the System Pillar.

European Green Deal, the United Nations Sustainable Development Goals, the Sustainable and Smart Mobility Strategy and the Digital Decade

SDG 9: Building resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
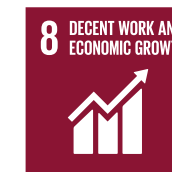
SDG 12: Ensure sustainable consumption and production patterns

SDG 13: Take urgent action to compact climate change and is impacts

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

SDG 5: Achieving gender equality and empower all women and girls

The European Green Deal was presented in December 2019, setting out a clear vision of how to achieve climate neutrality in Europe by 2050[5]. Transport accounts for a quarter of the EU's greenhouse gas emissions, and still growing. To achieve climate neutrality, a 90% reduction in transport emissions is needed by 2050. As a matter of priority, a substantial part of the 75% of inland freight carried today by road should shift onto rail and inland waterways.

"To transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use." (European Green Deal, p. 2).

Priority areas include accelerating the shift to sustainable and smart mobility: *"Automated and connected multimodal mobility will play an increasing role, together with smart traffic management systems enabled by digitalisation. The EU transport system and infrastructure will be made fit to support new sustainable mobility services that can reduce congestion and pollution, especially in urban areas" (European Green Deal, p. 10).*

In July 2021, the so-called "Fit for 55"[6] package was introduced by the European Commission – a package consisting of a set of inter-connected proposals making the existing legislation more ambitious, where possible, and even putting on the table new proposals, where needed. The main ambition of the EU under this package is cutting emissions by at least 55% by 2030 by also supporting a faster roll-out, relative to prior objectives, of sustainable transport solutions such as rail. Overall, the package strengthens eight existing pieces of legislation and presents five new initiatives, across a range of policy areas and economic sectors: climate, energy and fuels, transport, buildings, land use, and forestry.

The European Green Deal is also an integral part of the Commission's strategy to implement the United Nation's 2030 Agenda and the 17 Sustainable Development Goals (SDGs).[7] The JU has been reporting in its Consolidated Annual Activity Reports already under the S2R Programme on its contribution to the SDGs since 2018. The Joint Undertaking, under its current Programme, will continue in this endeavour, more specifically with regard to these SDGs[8].

More specific insights into how EU-Rail aims at contributing to the broader objectives represented by the SDGs can be obtained from Annex E and Annex F of the Annual Activity Report Consolidated Version providing information on the Key Performance Indicators/Key Impact Pathway Indicators.

Moreover, the Sustainable and Smart Mobility Strategy of the Commission, launched in December 2020[9], includes more concrete milestones for the railway sector to enhance a smart and sustainable future. Its underlying Action Plan of 82 initiatives lays the foundation for how the EU transport system can achieve its green and digital transformation and become more resilient to future crises. In particular, it provides the visionary ambitions that the next rail R&I Programme will have to contribute to insofar as possible and notably:

- By 2030 the high-speed rail traffic will increase by 50%; the scheduled collective travel of under 500 km should be carbon neutral within the EU and automated mobility will be deployed at large scale.

- By 2050 rail freight traffic will double; high-speed rail traffic will triple and the multimodal Trans-European Transport Network (TEN-T) equipped for sustainable and smart transport with high-speed connectivity will be operational for the comprehensive network.

Additionally, rail transport will also need to be further electrified; wherever this is not viable, the use of hydrogen should be increased. And the roll out of the European Rail Traffic Management System (ERTMS) will be pursued including further efforts to develop train automation, for instance through joint undertakings.

Further to the topic of "Digital Decade", the Commission indicated in its Communication of March 2021[10] how digital transformation can improve the ecosystems related to mobility and transport. Digitalisation can improve environmental and cost performance and simultaneously increase safety levels contributing to a higher quality of life. It will be achieved through more advanced levels of automation, faster and more reliable connectivity, and IT enabled profound transformation of the management of mobility services. The public could also benefit from fast internet connectivity for

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5   European Commission (2019). The European Green Deal. COM(2019) 640 final, Brussels

6   https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0550 and https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/

7   United Nations General Assembly (2015). Transforming Our World: The 2030 Agenda for Sustainable Development. Draft resolution referred to the United Nations summit for the adoption of the post-2015 development agenda by the General Assembly at its sixty-ninth session. UN Doc. A/70/L.1. New York

8   As also indicated in the Biennial Monitoring Report 2022 on Partnerships in Horizon Europe, page 295: https://op.europa.eu/en/publication-detail/-/publication/a6cbe152-d19e-11ec-a95f-01aa75ed71a1/language-en/format-PDF/source-search

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9   European Commission (2020). Sustainable and Smart Mobility Strategy – putting European transport on track for the future. COM(2020) 789 final, Brussels

10   European Commission (2021). 2030 Digital Compass: the European way for the Digital Decade. COM(2021) 118 final, Brussels

passengers on most stations and lines, user-oriented telematics and facilitated multi-modality.

In this context, EU-Rail and its Programme will strive for speeding up the development and deployment of innovative technologies in railway transport in order to contribute to achievement of the above-mentioned milestones. This will require a significant transformation of the railway sector, addressing long overdue changes in legacy operational processes, systems, and governance models, as well as integrating with other transport and mobility solutions for passenger services and cargo logistics.

Besides the efforts made via its R&I Programme, the JU itself and its staff, to the extent corresponding to the size of the organisation, also strive to contribute to the fight against climate change when conducting the day-to-day business. Those "little things" that the JU applies to be as green as possible include:

- Separating waste in the JU's premises,

- Suppression of single-use items,

- Reducing paper consumption by applying paperless workflows to the extent possible,

- Encouraging staff not to commute to work by car by providing a scheme for reimbursement of public transport cost and arrangements supporting commuting by bike,

- Increased usage of online/hybrid meetings and events to reduce the carbon footprint related to travelling.

While the option of moving office in 2022 or early 2023 was eventually not realised, any future decision-making of EU-Rail in this respect will include due considerations regarding the energy-efficiency parameters of the respective premises.

Flagship Projects 2022

Topic Code	Topic Description	Project value € M	Partners Involved	Duration
HORIZON-ER-JU-2022-FA1-TT-01	Network management planning and control & Mobility Management in a multimodal environment and Digital Enablers	92.6	88	46 months
HORIZON-ER-JU-2022-FA2-01	Digital & Automated up to Autonomous Train Operations	160.8	76	42 months
HORIZON-ER-JU-2022-FA3-01	Intelligent & Integrated asset management	106.9	94	48 months
HORIZON-ER-JU-2022-FA4-01	A sustainable and green rail system	95.1	71	48 months
HORIZON-ER-JU-2022-FA5-01	Sustainable Competitve Digital Green Rail Freight Services	95.1	71	45 months
HORIZON-ER-JU-2022-FA6-01	Regional rail services/ Innovative rail services to revitalise capillary lines	32.9	50	48 months

Europe's Rail overview

Name	Europe's Rail Joint Undertaking – as of 30/11/2021 (hereinafter EU-Rail)
Objectives[11]	EU-Rail is an autonomous body with its own legal personality. It is an institutional European partnership as per Article 187 of the Treaty on the Functioning of the European Union dedicated to managing and coordinating mission-oriented R&I activities for a major transformation in rail systems in Europe. The general objectives of EU-Rail are to: a. contribute towards the achievement of the Single European Railway Area; b. ensure a fast transition to more attractive, user-friendly, competitive, affordable, easy to maintain, efficient and sustainable European rail system, integrated into the wider mobility system; c. support the development of a strong and globally competitive European rail industry. The main task of EU-Rail is to deliver a high-capacity integrated European railway network by eliminating barriers to interoperability and providing solutions for full integration, covering traffic management, vehicles, infrastructure, and services, aiming to achieve faster uptake and deployment of projects and innovations.
Legal basis	Article 187 of the Treaty on the Functioning of the European Union[12]. The founding legal Act of EU-Rail is the Council Regulation (EU) 2021/2085[13] of 19 November 2021, which entered into force on 30 November 2021, establishing the Joint Undertakings under Horizon Europe (hereafter the "Single Basic Act" or the "SBA"). By means of SBA, the EU-Rail was established and became the legal and universal successor of the former S2R JU, which it replaced and succeeded as from that date. In addition, in its first meeting, the EU-Rail Governing Board approved the list of decisions adopted by the S2R JU that will continue to apply for EU-Rail in accordance with Article 174(12) of the SBA[14].

Executive Director (ED)	Mr Carlo M. Borghini, until 28 February 2023[15]. Mr Giorgio Travaini, appointed ED ad interim as from 1 March 2023[16].
Governing Board of EU-Rail	**European Commission (EC) members:** • Henrik Hololei, DG MOVE until 31 March 2023

EC alternates:

• DG MOVE	Kristian Schmidt
• DG RTD	Rosalinde Van Der Vlies

Industry members:

• ADIF	Luis Fernando López
• ALSTOM	Nicolas Castres Saint Martin
• ANGELRAIL consortium led by MER MEC	Francesco Inzirillo
• AŽD	Vladimir Kampik
• CAF	Jorge De Castro
• CEIT	Juan Melendez
• ČD	Tereza Kunertová
• DEUTSCHE BAHN	Ralf Marxen
• DLR	Christian Sattler
• eSGR JV	Noemi Jimenez Redondo
• Faiveley Transport	Roberto Tione
• Ferrovie dello Stato Italiane	Roberto Tundo
• HITACHI RAIL STS	Antonella Trombetta
• INDRA-TALGO	Jose Miguel Rubio Sanchez
• Jernbanedirektorate	Preben Saethre
• KNORR-BREMSE	Hans-Christian Hilse
• ÖBB	Mark Topal Goekceli
• PKP	Jancewicz Zbigniew
• ProRail-NS Groep	Karel van Gils
• SIEMENS	Roland Edel
• SNCF	Christophe Cheron
• Strukton	Tjark de Vries
• THALES	Alberto Parrondo
• TRAFIKVERKET	Bo Olsson
• Voestalpine Railway Systems	Jochen Holzfeind

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11   The key objectives pertaining to the S2R Programme, pursued by the former Shift2Rail Joint Undertaking, and inherited by its successor – EU-Rail, are the following:
• a 50 % reduction of the life-cycle cost of the railway transport system (i.e. costs of building, operating, maintaining and renewing infrastructure and rolling stock),
• a 100 % increase in the capacity of the railway transport system,
• a 50 % increase in the reliability and punctuality of rail services (measured as a 50 % decrease in unreliability and late arrivals).
12   OJ C 202, 7.6.2016, p. 131–131
13   OJ L 427, 30.11.2021
14   EU-Rail GB Decision n° 02/2021

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15   Based on the confirmation of early retirement of Mr Borghini by means of the EU-Rail GB Decision n° 01/2023.
16   Based on the EU-Rail GB Decision n° 02/2023.

Governing Board of EU-Rail	*Industry alternates:*	
	• ADIF	David-Ibán Villalmanzo Resusta
	• ALSTOM	Richard French
	• ANGELRAIL consortium led by MER MEC	Vincenzo Scarnera
	• AŽD	Michal Pavel
	• CAF	Imanol Iturrioz Villalba
	• CEIT	Jaizki Mendizabal
	• ČD	Petr Jindra - Marek Zajic
	• DEUTSCHE BAHN	Hans-Peter Lang
	• DLR	Michael Meyer zu Hörste - Svenja Hainz
	• eSGR JV	David Sanz - Jose Solis Hernandez Celestino Martinez
	• Faiveley Transport	Paolo Pagliero
	• Ferrovie dello Stato Italiane	Riccardo Santoro
	• HITACHI RAIL STS	Carlo Crovetto
	• INDRA-TALGO	Alfredo Gonzalez Moreno
	• Jernbanedirektorate	Pal Midtlien Danielsen
	• KNORR-BREMSE	Martin Ertl
	• ÖBB	Bertram Ludwig
	• PKP	Fojud Arthur
	• ProRail-NS Groep	Jeroen Fukken
	• SIEMENS	Lars Deiterding - Ralf Kaminsky
	• SNCF	Gilles Quesnel
	• Strukton	Henk Samson
	• THALES	Yves Perreal
	• TRAFIKVERKET	Christer Lofving
	• Voestalpine Railway Systems	Uwe Ossberger
	Other participants:	
	• Giorgio TRAVAINI	Executive Director ad interim of EU-Rail
	Observers:	
	• Josef Doppelbauer (ERA)	
	• Ana Gigantino (ERA)	
	• Ny Tiana Tournier (ERA)	
	• Roland Moser (ERRAC)	
	• Marta Garcia (ERRAC)	
	• Angela Di Febbraro (SC)	
	• Miroslav Haltuf (SRG)	
Other bodies	System Pillar Steering Group Deployment Group States Representatives Group (SRG) Scientific Committee (SC)	
Number of staff	28 posts as at year-end 2022[17]	

Total budget 2022

By means of the GB Decision 08/2021 of 25 November 2021, the S2R Governing Board adopted the initial Annual Work Plan and Budget for 2022 which continued to apply to EU-Rail by means of adoption by the EU-Rail Governing Board of the so-called "omnibus decision".

By the time of such adoption, the budget appropriations included in the Budget 2022 were not foreseen to cover the full financial year 2022, but to ensure the running of the activities till the launch of the new partnership, the Europe's Rail Joint Undertaking, and to ensure the necessary business continuity of the activities.

There were three amendments to the initial budget adopted during 2022:

- *Amendment number 1:* to ensure that the EU-Rail Programme budget was included for the year 2022 following the official initiation of the new Partnership and with the Work Programme 2022 converted into a multi-annual work programme that included the activities that will be performed in 2022 related to the launch of its new Research and Innovation (R&I) Programme governed by the Horizon Europe rules (in particular two Calls for Proposals) as well as estimated figures for the following years up to 2024. This could be done in accordance with the new legal and financial regulatory options offered with the new SBA adoption.

- *Amendment number 2:* Following the signature in 2022 of a Contribution Agreement between the European Union, represented by the European Commission, and EU-Rail, with the objective to provide a financial contribution to finance the implementation of the action "Pilot project - IRS Smart Cities project: new railway station concept for green and socially inclusive smart cities", the revenue of EU-Rail 2022 was increased by EUR 700.000 in Commitment appropriations and EUR 350.000 in Payment appropriations. In accordance with the SBA Article 10(4), the new revenue in 2022 are corresponding to additional Union funds complementing the contribution allocated to the EU-Rail Programme implementing Horizon Europe. In this respect, and in accordance with SBA Article 10(6), this additional contributions from Union programmes corresponding to additional tasks entrusted to EU-Rail shall not be accounted for in the calculation of the Union maximum financial contribution to the EU-Rail Programme.
  In addition, the GB agreed to transfer the amount of unused appropriations for the running costs of the JU for the amount of EUR 1,5 million to Title 4 for operational activities. This possibility is established in accordance with SBA Article 28(5) mentioning that any unused part of the contribution for administrative costs may be made available to cover the operational costs of the JU, in particular an additional topic in relation to the European DAC Delivery Programme activities.

- *Amendment number 3:* minor adaptations of the budget appropriations per line considering the evolution of budget needs identified for the last quarter 2022, followed by budget transfers of appropriations authorised by the Executive Director in accordance with the JU Financial Rules Article 12.2.

As a result, the budget as finally adopted amounted to:
Commitment appropriations: EUR 171,4 million
Payment appropriations: EUR 180,8 million

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17   The full staffing as per the JU's Staff Establishment Plan comprises 29 posts. One SNE position was not yet filled as at yearend 2022. In addition, until the new Executive Director is appointed, as of 1 March 2023, the Head of Programme executes the post of the ED ad interim.

Budget implementation	The implementation rate of the operational budget in commitment appropriations was 100% and 79% in payment appropriations (84% in 2021). In 2022, a major portion of payment appropriations was used for the pre-financing of the grants resulting from the first 2022 call for proposal.

Commitment appropriations total consumption: EUR 169,5 million – 100%
Further breakdown by Titles in EUR and in % of total, excluding unused appropriations:

Title 1 – EUR 2,9 million – 100%
Title 2 – EUR 2,1 million – 100%
Title 3 - 4 – EUR 164,5 million – 100%

Payment appropriations total consumption: EUR 139,8 million – 79%
Further breakdown by Titles in EUR and in % of total, excluding unused appropriations:

Title 1 – EUR 2,7 million – 94%
Title 2 – EUR 1,5 million – 84%
Title 3 - 4 – EUR 135,6 million – 79%

The reported implementation also includes EUR 76.000 relating to the Expert Evaluators which is managed by the REA Services.

In 2022 with the conclusion of the grant agreements derived from the first call of 2022, the first 6 Flagship Areas and the Transversal Topics have been covered with the award of 6 Flagship Projects.

Additionally, in 2022 the JU launched a second call, to cover the Flagship Area 7 on "Innovation on new approaches for guided transport modes" and the "Exploratory Research and other activities". This latter call is still under grant agreement preparation, as planned, at Q2 of 2023.

For the Shift2Rail Programme, the year 2022 mainly entailed ensuring the proper execution of ongoing activities. By the end of 2021, the JU had signed 101 grant agreements in total since its autonomy in 2016. With the Calls 2021 R&I activities up and running, the R&I activities performed in the Programme will reach EUR 800 million (including Lighthouse Projects as part of the S2R initiative), of which EUR 650,7 million performed by the S2R Other Members with a funding made available by the JU up to a maximum of EUR 303,3 million. At the end of 2022, 56 of the 101 S2R projects were closed. Consequently, the S2R Programme is continuing its phasing out, with the objective of closing it by 2024. |
| **Grants/ Tenders** | The value of 6 signed grants resulting from the first 2022 call[18] corresponds to EUR 420,6 million of eligible costs, and EUR 583,4 million of total project value, that will be funded by EU-Rail up to EUR 232,5 million.

In 2022, contracts/orders (legal commitments) amounting to EUR 14,8 million were signed, of which EUR 12,7 million resulted from operational procurements and EUR 2,1 million from administrative procurements. |

Strategic Research & Innovation Agenda	In the context of EU-Rail, as defined in the SBA, the "Strategic Research and Innovation Agenda" (SRIA) represents the document covering the duration of Horizon Europe that identifies the key priorities and the essential technologies and innovations required to achieve the objectives of the JU. In accordance with SBA Article 86(5), the SRIA of EU-Rail is constituted by its Master Plan[19].
Call implementation	Number of calls launched in 2022: 2
Number of proposals submitted: 23
Number of evaluated proposals: 20
Number of proposals retained for funding: 14
Participation, including SMEs	Total number of beneficiaries in funded projects: 463

- 24,41% of which are SMEs receiving 13,43% of total EU funding provided by EU-Rail,
- 66,52% of which are private for-profit companies receiving 70,73% of total EU funding provided by EU-Rail.
- 8,86% of which are non-EU entities receiving 9,07% of total EU funding provided by EU-Rail.

44 SME participations were part of the evaluated proposals in the two 2022 calls combined, out of which 20 SME participations were included in the proposals retained for funding. |

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18   The grants resulting from the second 2022 call were awarded in the course of 2023 and the related figures will be presented in the 2023 CAAR.

19   https://rail-research.europa.eu/wp-content/uploads/2022/03/EURAIL_Master-Plan.pdf

Founding Members

adif | ALSTOM | MERMEC AN ANGEL COMPANY | AŽD | CAF

ceit MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE | ČD | DB | DLR | eSGR European Smart Green Rail

Faiveley Transport A Wabtec Company | FERROVIE DELLO STATO ITALIANE | HITACHI Inspire the Next | Indra Talgo | Jernbane-direktoratet

KNORR-BREMSE | ÖBB | PKP POLSKIE KOLEJE PAŃSTWOWE Spółka Akcyjna | ProRail | SIEMENS

SNCF | Strukton Rail | THALES Together • Safer • Everywhere | TRAFIKVERKET | RAILWAY SYSTEMS by voestalpine