ANNEX to GB decision no 01/2021

ANNUAL WORK PLAN and BUDGET 2021
adopted by the S2R GB on 12 April 2021

In accordance with the Statutes of the S2R JU annexed to Council Regulation (EU) No 642/2014 and with Article 31 of the S2R JU Financial Rules adopted by the Gouverning Board's Decision n° 21/2015.

The Annual Work Plan is made publicly available after its adoption by the Governing Board.

NOTICE RELATED TO THE AWP 2021 ON ACTIVITIES FUNDED UNDER THE 2014-2020 EU PROGRAMMES, INCLUDING HORIZON 2020

Please be aware that following the entry into force of the EU-UK Withdrawal Agreement on 1 February 2020 and in particular Articles 127(6), 137 and 138, the references to natural or legal persons residing or established in a Member State of the European Union are to be understood as including natural or legal persons residing or established in the United Kingdom. UK residents and entities are therefore eligible to participate under the call for proposals, call for tenders and prizes indicated in this annual work plan.

TABLE OF CONTENTS

LIST OF ACRONYMS 4

1. INTRODUCTION 8

1.1 THE SHIFT2RAIL JOINT UNDERTAKING 8
1.2 MISSION AND OBJECTIVES 9
1.3 R&I PRIORITIES 11
1.3.1 Innovation Programme 1 (IP1): Cost-efficient and reliable trains 11
1.3.2 Innovation Programme 2 (IP2): Advanced traffic management and control systems 11
1.3.3 Innovation Programme 3 (IP3): Cost Efficient and Reliable High Capacity Infrastructure 12
1.3.4 Innovation Programme 4 (IP4): IT Solutions for attractive railway services 13
1.3.5 Innovation Programme 5 (IP5): Technologies for sustainable and attractive European rail freight 13
1.3.6 Cross-cutting themes and activities 15
1.3.7 IPx - System Architecture and Conceptual Data Model (CDM) 15

2. WORK PLAN AND BUDGET 2021 17

2.1 EXECUTIVE SUMMARY 17
2.2 OPERATIONS 19
2.2.1 Objectives & indicators 19
2.2.2 Risks & mitigations 24
2.2.3 Scientific priorities & challenges 26
2.2.4 Operational activities planned in 2021 26
2.2.5 Call for proposals and/or Call for tenders - S2R JU members eligible only 28
2.2.6 Open call for proposals for non-JU members 28
2.2.7 Call planning 28
2.2.8 Call for tenders 29
2.2.9 Dissemination and information about projects results 30
2.3 CALL MANAGEMENT RULES 30
2.3.1 Types of calls for proposals 31
2.3.2 List of countries eligible for funding 31
2.3.3 Standard admissibility conditions and related requirements 31
2.3.4 Standard eligibility conditions 32
2.3.5 Types of action: specific provisions and funding rates 32
2.3.6 Evaluation rules 32
2.3.7 Budget flexibility 33
2.3.8 Financial support to third parties 33
2.3.9 Consortium agreement 33
2.3.10 Dissemination and information about projects results 33
2.4 SUPPORT TO OPERATIONS 34
2.4.1 Communication and events 34
2.4.2 Procurement and contracts 35
2.4.3 IT and logistics 36
2.4.4 S2R JU Programme Team – HR matters 37
2.4.5 Administrative budget and finance 37
2.4.6 Data protection 37
2.5 GOVERNANCE 38
2.5.1 Governing Board 38

2.5.2 Executive Director *39*
2.5.3 Scientific Committee *39*
2.5.4 States Representatives Group *39*
2.6 INTERNAL CONTROL FRAMEWORK 40
2.6.1 Financial procedures *40*
2.6.2 Ex-ante and ex-post controls *41*
2.6.3 Audits *42*
2.6.4 Risk Management *42*
3. BUDGET 2021 42
3.1 BUDGET INFORMATION 43
3.2 STAFF ESTABLISHMENT PLAN 50
4. ANNEXES 51
4.1 ANNEX I – 2021 CALL FOR PROPOSALS – TOPIC DESCRIPTIONS 52
S2R-IP5-01-2021: "Digital Automated Coupler innovation for the European Delivery Programme" *52*
S2R-CCA-01-2021: R&I impact and benefits to make rail attractive for stakeholders *56*
4.2 ANNEX II – INDICATORS AND SCOREBOARD OF KPIS 59
4.2.1 TABLE I - Horizon 2020 Key Performance Indicators common to all JTI JUs *59*
4.2.2 TABLE II - Indicators for monitoring H2020 Cross-Cutting Issues common to all JTI JUs *64*
4.2.3 TABLE III - Key Performance Indicators specific for the S2R JU *69*
4.2.4 TABLE IV – Initial estimation of Release 3.0 - of the Key Performance Indicators of the Shift2Rail Programme *71*
4.3 ANNEX III – LIST OF MEMBERS OF S2R JU OTHER THAN THE UNION 72

LIST OF ACRONYMS

Abbreviation	
AAR	Annual Activity Report
ABAC	Accrual Based Accounting
AI	Artificial Intelligence
ATO	Automatic Train Operation
ATP	Automatic Train Protection
A&V	Auralisation and Visualisation
AWP	Annual Work Plan
BEMU	Battery Electric Multiple Unit
BIM	Building Information Modelling
CA	Commitment Appropriation
CAPEX	Capital Expenditure
CBA	Cost Benefit Analysis
CBM	Condition-Based Maintenance
CCA	Cross Cutting Activities
CDM	Conceptual Data Model
CEI	Call for Expression of Interest
CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardization
CERT	Computer Emergency Response Team
CFM	Call for Members
(C)COLA	(Common) Collaboration Agreement
CSIRT	Computer Security Incident Response Team
CSA	Coordination and support action
D&E-Net	Dissemination and Exploitation Network
DMI	Driver Machine Interface
DOI	Digital Object Identifier
DRIMS	Dynamic Railway Information Management System
DSS	Decision Support System
EC	European Commission
ED	Executive Director
EN	European Norm
ERA	European Union Agency for Railways (formerly European Railway Agency)
ERRAC	European Rail Research Advisory Council
ERTMS	European Rail Traffic Management System
ETCS	European Train Controlling System
EU	European Union
FACTs	Flexible AC Transmission Systems
FFFIS	Form Fit Functional Interface Specifications
FIS	Functional Interface Specifications
FWC	Framework Contract

Abbreviation	
GA	Grant Agreement
GB	Governing Board
GIS	Geographic Information System
GNSS	Global Navigation Satellite System
GoA	Grade of Automation
H2020	Horizon 2020, EU Framework Programme for Research and Innovation
HMU	Hydrogen Multiple Unit
HST	High Speed Train
HVAC	Heating, Ventilation and Air-Conditioning
IA	Innovation Action
IAMS	Intelligent Asset Management System
IC	Innovation Capabilities
ICT	Information and Communications Technology
IEC	International Electrotechnical Commission
IKAA	in-kind contributions to additional activities
IM	Infrastructure Manager
IMU	Inertial Measurement Unit
IP	Innovation Programme
IPR	Intellectual Property Rights
ISO	International Standardisation Organisation
IT	Information Technology
ITD	Integrated Technology Demonstrator
JTI	Joint Technology Initiative
JU	Joint Undertaking
KPI	Key Performance Indicator
LCC	Life-Cycle Cost
LIDAR	Light Detection and Ranging
LTE	Long-Term Evolution (standard for wireless communication)
MAAP	Multi-annual Action Plan
MaaS	Mobility as a Service
MB	Moving block
MFF	Multiannual Financial Framework
MoU	Memorandum of Understanding
N&V	Noise and Vibration
NLOS	non-line-of-sight
NTP	Network Time Protocol
OC	Open Call
OCORA	Open CCS On-board Reference Architecture
ODM	Operational Data Management
OPEX	Operating Expenditure
OTM	On Track Machine
PA	Payment Appropriation
PTO	Public Transport Operator
RAIM	Receiver Autonomous Integrity Monitoring

Abbreviation	
RCA	Reference Command Control and Signalling Architecture
R-CSIRT	Railway Computer Security Incident Response Team
R&I	Research and Innovation
RU	Railway Undertaking
PPP	Public-Private Partnership
PRM	Persons with Reduced Mobility
PTC	Positive Train Control
PTI	Platform Train Interface
PTO	Public Transport Operator
RAL	Unpaid amount
RAMS	Reliability and Maintainability System
RBC	Radio Block Centre
RFID	Radio Frequency Identification
R&D	Research and Development
R&I	Research and Innovation
RIA	Research and Innovation Action
RoI	Return of Investment
S2R	Shift2Rail
SaaS	Software as a Service
SC	Scientific Committee
SERA	Single European Railway Area
S&C	Switches and Crossings
SiC	Silicon Carbide
SIL	Software in the Loop
SIWG	System Implementation Working Group
SME	Small and Medium Enterprise
SNE	Seconded National Expert
SPD	System Platform Demonstration
SRG	States Representatives Group
SWL	Single Wagon Load
SteCo	Steering Committee
TAF	Telematic Application for Freight
TAP	Telematic Application for Passengers
TCMS	Train Control and Monitoring System
TC	Tender Call
TD	Technology Demonstrator
TL	Train Load
TMS	Traffic Management System
TRA	Transport Research Arena
TRL	Technology Readiness Level
TSI	Technical Specifications for Interoperability
TSN	Time Sensitive Networking
TSP	Travel Service Providers
UAV	Unmanned Aerial Vehicle

Abbreviation	
URID	User Requirements Working Group
V&V	Verification & Validation
WA	Work Area

1. INTRODUCTION

The Annual Work Plan and Budget 2021 (AWP 2021) of the Shift2Rail Joint Undertaking (S2R JU) outlines the scope of the Research and Innovation (R&I) activities that will be performed as from 2021. It also details the governance structure of S2R JU and the underpinning 2021 budget. The AWP 2021 further includes a description of the ongoing work in view of the preparation of rail research and innovation activities post-2020, under the new Multi-Annual Financial Framework (MFF) Programme 2021 – 2027.

The AWP 2021 will result in the full commitment of the remaining budget allocations for the operational activities, which demonstrates that the S2R JU was able to engage the railway sector to an effective commitment to invest resources to start delivering the railway system transformation, through a more and more integrated Programme despite starting its operations almost two years after the start of H2020 programming period.

This Amended AWP 2021 takes is an evolution of the AWP 2021 adopted on 19 Nov 2020, to take into account the need to support two main key policy priorities related to the implementation of the Programme and its adjustments to the current objectives and forthcoming challenges,linked to the future concept of operations and functional system architecture, making use of the funds available under the provisions of Article 16.2 of the Statutes of the S2R JU.
It is another key step towards the digitalization and automation of railway systems, to achieve sustainable (climate neutral, life-cycle cost efficient, connected, integrated through a system approach) mobility for passengers and freight business.

The AWP 2021 shall be read in conjunction with the previous AWPs, Annual Activity Reports (AARs) and the work planned in the new S2R JU Multi-Annual Action Plan, finally adopted by the S2R JU Governing Board on 27 October 2017[1].

In the introduction (Section 1), S2R JU's background, mission and objectives are described. Section 2 outlines the activities planned for 2021 including the support to operations, the S2R JU governance and internal control framework. Section 3 explains the S2R JU 2021 Budget.

NB: The present document is based on the template provided by the Commission Services, with some adaptations to introduce the specific needs of the S2R JU and to provide an encompassing view to its Governing Board.

1.1 The Shift2Rail Joint Undertaking

The S2R JU was established by Council Regulation (EU) No 642/2014 of 16 June 2014 (S2R Regulation) with, in Annex I, the S2R JU Statutes.

The S2R JU is a public-private partnership in the rail sector established under Article 187 of the Treaty on the Functioning of the European Union, providing a platform for the rail sector as a whole to work together with a view to driving innovation in the years to come.

The primary task of the S2R JU is to establish the priority research and innovation activities to accelerate the penetration of integrated, interoperable, and standardised technological innovations to support the Single European Railway Area (SERA) and to achieve operational excellence of the railway system. The European Railway Research Advisory Council (ERRAC) and the European Union Agency for Railways (ERA) consultations contribute to this process. Research activities with impact on

[1] Decision N° 6/2017 of 27 October 2017

ERA activities e.g. the technical specifications for Interoperability (TSIs), vehicle authorisations, safety certification, are always performed in close cooperation with ERA.

In addition, the S2R JU shall manage all rail-focused R&I actions co-funded by the Union, including outside the resources it has directly received.

Rail Research & Innovation (R&I) conducted within the S2R JU must contribute to address the challenges faced by the rail sector, through a comprehensive and coordinated approach to research and innovation focusing on the needs of the rail system and of its users, including in Member States that do not currently have a railway system within their territory.

In addition to the Union, which is a Founding Member, the S2R JU has eight other Founding Members[2] and nineteen Associated Members[3] ('hereinafter jointly referred to as members other than the Union'). The latter were selected following a call for expression of interest to become associated member of the S2R JU[4].

1.2 Mission and Objectives

The S2R JU is a mission-oriented Programme delivering a major system transformation, bringing railway at the centre of advanced integrated mobility.

The Vision of S2R JU is

To deliver, through railway research and innovation, the capabilities to bring about the most sustainable, cost-efficient, high-performing, time driven, digital and competitive customer-centred transport mode for Europe.

Its mission statement is

"*Shift2Rail: moving European railway forward*".

In this respect, its main objective is to implement the S2R JU Programme and R&I activities in the railway sector in Europe, through the collaboration between stakeholders of the entire railway value chain, also outside the traditional rail sector, with particular attention to small and medium-sized enterprises (SMEs), research and technology centres and universities.

The rail R&I activities to be performed within the S2R JU are defined in the its Regulation and Statutes, translated in the strategic S2R Master Plan[5] and further detailed in the new S2R JU Multi-Annual Action Plan and its evolutions. Overall, the S2R JU shall:

- establish, develop and ensure the effective and efficient implementation of the S2R Master Plan, as referred to in Article 1(4) of the S2R Statutes;

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[2] Consisting of rail equipment manufacturers Alstom Transport, Hitachi Rail STS, Bombardier Transportation, Construcciones y Auxiliar de Ferrocarriles (CAF), Siemens AG, Thales and infrastructure managers Trafikverket and Network Rail

[3] AERFITEC consortium, Amadeus IT Group SA, AZD Praha s.r.o., CFW consortium, Deutsche Bahn AG, CS GROUP, EUROC consortium, Faiveley Transport, HaCon Ingenieurgesellschaft mbH, Indra Sistemas S.A., Kontron, Knorr-Bremse GmbH, MER MEC S.p.A., Patentes Talgo S.L., Railenium Swi'TRACK'EN consortium, Smart DeMain consortium, SmartRaCon consortium, SNCF, Virtual Vehicle Austria consortium+

[4] Commission Decision C(2014) 7084 final

[5] http://ec.europa.eu/transport/modes/rail/doc/2015-03-31-decisionn4-2015-adoption-s2r-masterplan.pdf

- contribute to the implementation of Horizon 2020 Regulation and in particular part of the Smart, Green and Integrated Transport Challenge under the Societal Challenges pillar of Decision No 2013/743/EU;
- contribute to the achievement of the Single European Railway Area, to a faster and less costly transition to a more attractive, user-friendly (including for persons with reduced mobility), competitive, efficient and sustainable European rail system, and to the development of a strong and globally competitive European rail industry;
- play a major role in rail-related research and innovation, ensuring coordination among projects within its overall Programme. It provides all stakeholders with relevant and available information on R&I activities funded across Europe. It shall also manage all rail-focused research and innovation actions co-funded by the Union;
- actively promote the participation and close involvement of all relevant stakeholders from the full rail value chain and from outside the traditional rail industry. In particular, it fosters the involvement of small and medium sized enterprises (SMEs), as defined in Commission Recommendation 2003/361/EC (8);
- develop demonstration projects in interested Member States including those that do not currently have a railway system established within their territory.

The S2R JU shall, more specifically, seek to develop, integrate, demonstrate, and validate innovative technologies and solutions that uphold the strictest safety and security standards, the value of which can be measured against, *inter alia*, the following key performance indicators:

- a 50 % reduction of the life-cycle cost of the railway transport system, through a reduction of the costs of developing, maintaining, operating and renewing infrastructure and rolling stock, as well as through increased energy efficiency;
- a 100 % increase in the capacity of the railway transport system, to meet increased demand for passenger and freight railway services;
- a 50 % increase in the reliability and punctuality of rail services (measured as a 50 % decrease in unreliability and late arrivals);
- the removal of remaining technical obstacles holding back the rail sector in terms of interoperability, product implementation and efficiency, in particular by endeavouring to close points which remain open in Technical Specifications for Interoperability (TSIs) due to lack of technological solutions and by ensuring that all relevant systems and solutions developed by the S2R JU are fully interoperable and fitted, where appropriate, for upgrading;
- the reduction of negative externalities linked to railway transport, in particular noise, vibrations, emissions and other environmental impacts.

R&I activities are performed by members other than the Union and any other eligible entity co-funded by the S2R JU in accordance with its budget availabilities and in compliance with the Horizon 2020 Regulation[6] and its Rules of Participation[7]. To this end, the S2R JU shall organise calls for proposals for supporting the R&I activities and/or call for tenders, as needed.

As specified in Article 17 of the S2R JU Statutes, up to 70% of the total Union financial contribution to the S2R JU overall budget may be allocated to the R&I activities performed by the S2R JU's members other than the Union and their affiliated entities following competitive and transparent calls for proposals open to them. A minimum of 30% of the total Union financial contribution to the S2R JU overall budget must be implemented through open, competitive calls for proposals or calls for tenders (S2R JU members other than the Union are not eligible).

[6] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:347:0104:0173:EN:PDF

[7] http://ec.europa.eu/research/participants/data/ref/h2020/legal_basis/rules_participation/h2020-rules-participation_en.pdf

1.3 R&I priorities

The S2R Master Plan identifies the key strategic priorities, looking at a 2030 horizon, therefore encompassing R&I activities beyond the programmatic period of S2R JU. It proposes a holistic approach of the rail system that takes into consideration the relevant railway subsystems and actors, as well as their complex interaction (system demonstrators).

The revised MAAP adopted by the GB on 14 November 2019 re-focuses and prioritizes research and innovation activities in line with the MAAP Part A: it details which innovative solutions resulting from Technology Demonstrators (TDs) deliver the Innovation Capabilities (ICs), more concretely captured in the Catalogue of Solutions presented by the JU at the WCRR2019. The TDs are organized in the following Innovation Programmes (IPs):

1.3.1 Innovation Programme 1 (IP1): Cost-efficient and reliable trains

The design of rolling stock plays a key role for the attractiveness of rail transport. Only trains that are comfortable, reliable, affordable and accessible can convince passengers to use rail transport instead of other modes. At the same time, the train design has to meet the requirements of the railway undertakings and the urban operators, who are the main customers of the rail supply industry, in order to deliver high quality and cost-efficient services to their customers.

If rail is to integrate more effectively with other modes and attract more passengers to further develop its role as the backbone of multi-modal mobility in the future, it needs a future generation of passenger trains that will be lighter, automated, more energy and cost-efficient, while at the same time providing a comfortable, connected, reliable and affordable travel experience for all passengers at a defined level of safety and security.

The S2R JU identified the following priority research and innovation areas in which activities should be undertaken with a view to achieving the ambition of IP1:

- Traction
- Train Control and Monitoring System
- Carbodyshell
- Running Gear
- Brakes
- Doors and Intelligent access systems
- Train interiors
- Heating, Ventilation and Air-Conditioning (HVAC)

Important areas of attention are those concerning noise and human factors (covered by CCA, and this IP has a significant contribution to make) and the link with the CCS system, in cooperation with IP2.

1.3.2 Innovation Programme 2 (IP2): Advanced traffic management and control systems

Control, command and communication systems should go beyond being only a contributor to the control and safe separation of trains, and become a flexible, real-time, intelligent, integrated and fully automated traffic management system.

Although European Rail Traffic Management System (ERTMS) has already become a worldwide dominant solution for railway signalling and control systems, it has the potential to offer increased functionalities and become even more competitive.

Current systems do not sufficiently take advantage of new technologies and practices, including use of satellite positioning technologies, high-speed, high-capacity data and voice communications systems (Wi-Fi, 5G and their future generations), automation, as well as innovative real-time data collection, processing and communication systems, which have the potential to move towards new traffic management concepts (including predictive and adaptive operational control of train movements), thereby delivering improved capacity, decreasing traction energy consumption and carbon emissions, reducing operational costs, enhancing safety and security, and providing better customer information.

The S2R Master Plan identifies seven priority research and innovation areas in which activities should be undertaken with a view to achieving the ambition of IP2:

- Smart, fail-safe communications and positioning systems
- Traffic Management Evolution
- Automation
- Moving block (MB) and train integrity
- Smart procurement and testing
- Virtual coupling
- Cyber security

Important areas of attention are those concerning human factors (covered by CCA, and this IP has a significant contribution to make) and the link with shared train equipment, in cooperation with IP1.

Since 2019, the Programme integration, with particular regard to the IP2 activities, has also been ensured by a new stream of work (IPx) dedicated to the Functional System Architecture to be derived from a sector shared vision on future rail operations. This work is framed in the project Linx4Rail which takes stock of the input from different initiatives, in particular RCA and OCORA, and it is underpinning the “One Vision CCS” presented by the European Commission Services – DG MOVE at the CCRCC conference in October 2019.

1.3.3 Innovation Programme 3 (IP3): Cost Efficient and Reliable High Capacity Infrastructure

The design, construction, operation and maintenance of rail network infrastructure have to be safe, reliable, supportive of customer needs, cost-effective and sustainable. In order to deliver the benefits of market opening and interoperability and to reduce the life-cycle costs of rolling stock and on-board signalling systems, the network diversity needs to be eliminated, notably through a migration towards common high-performing infrastructure system architecture.

Activities that can support the reduction of infrastructure maintenance costs, such as simplified procedures or automation, need to be led in priority. They should propose solutions that can be rapidly and efficiently deployed. Furthermore, the infrastructures have to be managed in a more holistic and intelligent way, using lean operational practices and smart technologies that can ultimately contribute to improving the reliability and responsiveness of customer service, as well as the capacity and the whole economics of rail transportation.

Compatibility between different elements of cross-modal transport infrastructure (such as multimodal hubs charging points and stations) needs to be ensured and based on principles of interoperability and standardisation.

The S2R Master Plan identifies six priority areas in which activities should be undertaken with a view to achieving the ambition of IP3:

- New directions in switches and crossings
- Innovative track design and materials
- Cost effective Tunnel & Bridge solutions
- Intelligent system maintenance
- Energy efficiency
- Improved station concepts

Important areas of attention are those concerning human factors (covered by CCA, and this IP has a significant contribution to make).

1.3.4 Innovation Programme 4 (IP4): IT Solutions for attractive railway services

In order to become more attractive, rail must respond to customer needs to support seamless door-to-door multimodal journeys encompassing different modes of transport. Rail must achieve interoperability with other transport modes and mobility services, within different regions, cities and across borders. In order to achieve this, rail needs to take due advantage of the ever growing connectivity of people and objects, the availability of European Global Navigation Satellite System (GNSS) based location and other means of localisation, the advances in cloud computing, Open Data and Big Data Analytics and the wide dissemination of Internet and social media. Multimodal integration will also take benefit from existing rail standards as FSM and TAP TSI.

To achieve it The IP4 ecosystem aims to integrate and make interoperable all possible transport modes and travel services. In early stages of the program, modes such as rail, urban transport (metro, tram, and buses) and airlines were integrated. Afterwards, the ecosystem was enlarged to include also transport services that entail private cars (such as the use of toll roads and parking, which have an associated price) and also shared modes (cars and bikes). Thereby multimodality and the use of public transport are being fostered, and making it easier for travellers to connect with rail stations and airports, regardless of where and how they start their journey. For the future, Demand Responsive Transport and Ride Sharing will be included in the ecosystem to ease the access to everyone, even those living in now well connected areas, to long distance trips.

IP4 Ecosystem has also evolved to implement at European Level the new Mobility-as-a-Service (MaaS) paradigm, which considers the mobility system as a whole in order to achieve an optimal and sustainable transport scheme. This way, the IP4 ecosystems facilitates the task to create formal contracts that could involve the agreements, business rules and financial compensation that shall occur between the different stakeholders when combining their services into a joint product. In the future, this component will be evolved to be used also to create MaaS Packages that integrate a variety of transport services that could include multiple Transport Service Providers.

1.3.5 Innovation Programme 5 (IP5): Technologies for sustainable and attractive European rail freight

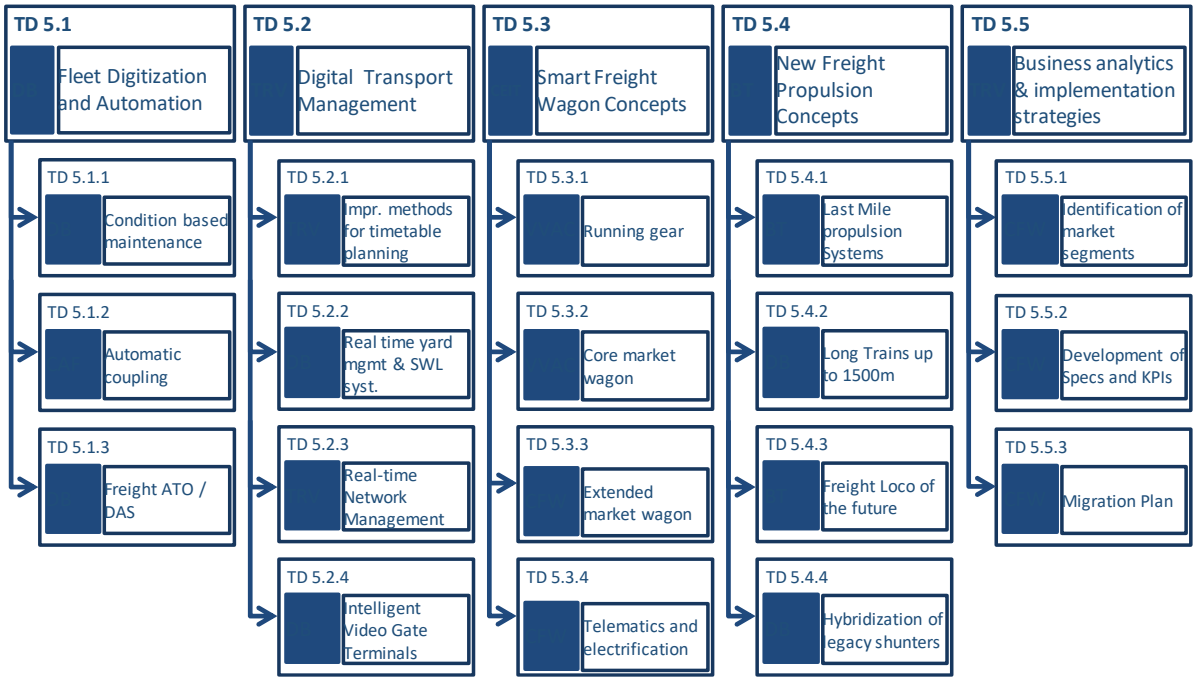
The cost competitiveness and the reliability of freight services need to be considerably improved if the rail sector is to meet the ambitious objectives that were set in the Transport White Paper[8] in terms of developing rail freight; almost doubling the use of rail freight compared to 2005, achieving a shift of

[8] WHITE PAPER Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system /* COM/2011/0144 final

30% of road freight over 300 km to modes such as rail or waterborne transport by 2030, and more than 50% by 2050. Rail freight must be in a position to offer a cost-effective, attractive service to shippers, helping to take freight away from the already-congested road network, and becoming the backbone of the Union inland integrated logistic system.

Different market segments with specific technical and operational characteristics and needs have to be identified in order to direct research and innovation projects towards present and future market needs. The first segment is the intermodal segment, which mainly relies on the use of containers/trailer trains and where continued growth can be expected. Reliability, service characteristics and cost competitiveness in this segment can progress significantly with an increase in train length, better length utilisation, innovative rolling stock features for value-added services, progress in the terminal operations, improved real-time customer information to customers and better data exchange between involved parties in the intermodal transport chain using open standards and specifications (including TAF TSI). A second market segment is the wagon load activity segment (either Single Wagon Load (SWL) or Train Load (TL) services), which relies on the use of specific freight wagon. The SWL services have significantly declined in the past years and its significant growth potential can only be fully exploited if a step change is made in terms of service quality and reliability. Solutions such as automated coupling and decoupling and tagging of all wagons with automatically readable Radio Frequency Identification (RFID) tags, provide a huge potential to speed up and reduce costs in train formation and to improve the overall performance of wagonload services. An IT framework with high added value needs to be created for all topics described in this section. The need of comodality/multimodality of freight mobility, i.e. the linkage to other freight modes, has to be ensured.

During the past years, IP5 has re-prioritized its TDs. IP5 includes the following TDs which are a reference point for the present AWP2021.



Important areas of attention are those concerning human factors (covered by CCA, and this IP has a significant contribution to make).

1.3.6 Cross-cutting themes and activities

In addition to the five Innovation Programmes, the work of R&I activities will include cross-cutting activities (CCA) relevant to each of the different sub-systems and taking into account the interactions between these sub-systems.

These CCA activities will ensure that the R&I activities within the different Innovation Programmes are closely aligned in terms of their objectives and their requirements, as well as the methodologies for evaluation and assessment of impacts. These activities include elements already taken into account in the different Innovation Programmes that require horizontal coordination (such as energy and noise management) and additional R&I that will be necessary to complement the technical work of the S2R JU.

The S2R Master Plan identifies five priority research and innovation areas in which activities should be undertaken with a view to achieving the objectives of the CCA:

- Long-term needs and socio-economic research
- Smart materials and processes
- System integration, safety and interoperability
- Energy and sustainability
- Human capital

Beyond the technical challenges addressed by IPs and CCA, the market uptake of innovative solutions shall address barriers such as: product acceptance, development of specific business cases, development of appropriate charging mechanisms, development of appropriate standards for innovative products, etc.

In addition to the concept underpinning the S2R JU that contributes to eliminating the aforementioned barriers, the new solutions will be supported by cost-benefit analyses (CBA). The overall S2R JU activities will embed, when applicable, suitable work to prepare for future technical standardisation/regulation related to the proposed innovations.

1.3.7 IPx - System Architecture and Conceptual Data Model (CDM)

As indicated in the section dedicated to IP2, since 2018 work started at the initiative of some Infrastructure Managers on the Reference Command Control Signalling Architecture (RCA) and recently by some Railway Undertakings with an Open CCS On-board Reference Architecture (OCORA). In addition, the S2R JU during 2019 launched its activities related to the development of a Conceptual Data Model that will contribute to overcome “data” and “systems” fragmentation with a view to produce a system of systems approach; this will become the standardized way for legacy and new systems to interact, ensuring their interoperability.

With the award of the Linx4Rail Project in 2019, the S2R JU has now, formally, research and innovation activities dedicated to an encompassing Functional System Architecture that cover safety and non-safety aspects, bringing together the different railway subsystems with a modular approach, standard interface between key functional components while preserving know how and competitiveness. It will be a cornerstone of the R&I Programme, including after 2020, and it will contribute to achieve a major transformation with the creation of an integrated and connected railway system, introduce a structured approach to the functional evolution of the railway systems, integrating within the S2R JU the Members and actors currently not directly involved in the JU, relying on the progress achieved within different stakeholder groupings, or at company level, in view of providing the sector with a

shared path and vision of the future operations of rail systems, under the policy leadership of the European Commission and in strict coordination and collaboration with ERA.

2. WORK PLAN AND BUDGET 2021

2.1 Executive Summary

With the European Green Deal, President Ursula von der Leyen presented the Commission's vision for a climate neutral continent in 2050. The European Commission's *Communication on The European Green Deal* of 11 December 2019*, 'resets the Commission's commitment to tackling climate and environmental-related challenges that is this generations's defining task'.* Responding to these challenges, the European Green Deal '*is a new growth strategy that aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy'.* It requires '*mobilising research and fostering* innovation: **New technologies, sustainable solutions and disruptive innovation are critical to achieve the objectives of the European Green Deal'.**[9]

In this context, the S2R JU and its Programme should enhance their impact to meet the expectations of the European citizens as framed in the President priorities, thus contributing to the key actions provided in the Commission's Roadmap[10]. In the same context, the S2R JU Programme will continue to assess its contribution to the Sustainable Development Goals of the United Nations and report on them.

In this respect, the MAAP - Part A provides an Executive View, clarifying the S2R JU vision and its contribution to delivering European Union societal goals and identifying the associated set of twelve new Innovation Capabilities that the S2R JU will help develop and bring to the market. It describes the S2R JU Programme as a whole, summarising its purpose, structure, methodology and content and focuses on the series of intermediate steps through which it will bring about a radically improved railway system (urban/suburban, regional and high-speed passenger rail, freight), shaping the future mobility of people and goods. These steps will be taken through the development and implementation of the R&I activities planned in the MAAP Part-B, complemented by the commitments identified in the MAAP 2015 if needed, while capturing new technologies and following a European wide system of systems approach that is novel for the sector

Year 2020 has been affected by the C-19 pandemic; as much as Industry Members and beneficiaries have been capable to put in place mitigating measures to address the impact of the pandemic, the overall effect will become clearer early next year. This may substantially impact and require an adjustment of 2021 planned activities.

In 2021, the priorities will be on:

1. delivering the ERTMS game changers (telecoms, localization, moving blocks, automation), also in view of their integration in the TSI 2022 package, with the objective to ensure the evolution of the system towards Baseline 3 and its market uptake;
2. reach higher TRL level towards demonstrators, completion and possibly future ITDs (Integrated Technology Demonstrators) in the different IPs;
3. explore new areas and new technologies that will contribute to foster the system transformation of railway;
4. adjust the current objectives to the forthcoming challenges of S2R, linked to the future concept of operations and functional system architecture, with particular reference to the L4R projects.

all activities embedded within the S2R ongoing Members' and OC' projects (indicatively 2018 – 2020) which are expected to be phased out between 2021 and early 2023.

[9] https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

[10] https://ec.europa.eu/info/sites/info/files/european-green-deal-communication-annex-roadmap_en.pdf

In accordance with Article 1(1) of the S2R Regulation, the S2R JU has planned to launch a Call for Proposals under the current MFF no later than 31 December 2021, due to the need to support specific policy priorities in relation to the European DAC Delivery Programme. Additional activities will be funded in relation to the forthcoming challenges in the definition of the future concept of operations and functional system architecture, building upon the work of L4R Projects.

These priorities will build upon the monitoring and review of the R&I activities with the overall objective of ensuring the delivery of the results expected for the demonstrators and of paving the way for the next generation of the Rail Research and Innovation Programme.

In the domain of stakeholder management and external relations, stakeholders include European and national decision makers, S2R JU Members, other participants to the JU activities, European and national funding bodies, and also forwarders, carriers and the transport as well as passenger traffic associations.

The year 2021 will see the continuation of the close collaboration established between the S2R JU and:

- the European Railway Research Advisory Council (ERRAC),
- the European Union Agency for Railways (ERA),
- other programme and partnerships, such as the FCH JU, SESAR JU, etc.
- different associations representing the key stakeholders of the rail sector and beyond, in different areas.

The ongoing work on collaboration agreements, in the form of a Memorandum of Understanding (MoU) or cooperation agreement, signed by the S2R JU with various European regions and Member States, European and international organizations and bodies will be pursued. The following agreements are expected to be finalized during 2021:

- An MoU with UIC
- An MoU with ACRI
- And possibly MoUs or cooperation agreements with regions in EU Member States.

Stakeholder engagement will also continue to be developed within the context of the EU's external Transport policy.

The S2R JU will continue participating in specific activities, workshops and events in order to advertise, communicate and disseminate the successful achievements of its Partnership. The S2R JU intends to showcase its key achievements at events throughout 2021 either through on-site participation of virtual presence, depending on the overall situation of the Covid-19 pandemic. Envisaged events for 2021 include TEN-T Days (9 June – 14 July) across Europe, SIFER 2021 (26-28 October) in Lille, Rail Live Madrid (30 November – 1 December), Shift2Rail Innovation Days (9-10 December) in Brussels, and the UITP 2021 Global Public Transport Summit (14-17 December) in Melbourne.

Most importantly, 2021 will be the European Year of Railways, with ongoing as well as occasional activities and events organised throughout the year to convey the message to European citizens that rail can answer their concerns about unsustainable and unreliable mobility options. This year of rail celebrations will be particularly fitting as it will be the first year of implementation of the Commission's strategy for sustainable and smart mobility. The JU is planning a series of events that will contribute disseminating results and showing the future evolution of rail in terms of services for passengers and freight clients.

Together with the European Commission, the S2R JU will support the rotating Presidency of the Council on railway events organized in the different Member States. In the same manner, the S2R JU will interact with the European Parliament, in particular the TRAN and ITRE Committees.

In addition, the S2R JU will:

- continue raising awareness about R&I in railway as an instrument for the industry's sustainability and competitiveness, growth and jobs;
- promote stakeholder engagement;
- promote the S2R JU within the EU Institutional arena;
- maintain a network of press and media contacts;
- pro-actively publish communication material;
- manage the S2R JU website;
- continue leading a coherent dissemination strategy.

At a corporate level, the S2R JU will ensure an accurate baseline for workloads, costings and staffing levels needed to ensure successful delivery of the Programme. As part of a continuous learning/improving approach, relevant processes within the S2R JU will be configured and managed effectively throughout 2021 to ensure continuity of service delivery.

2021 will also be critical in the definition of the next generation of the railway research and innovation programme, as part of the Horizon Europe proposal of the European Commission to the Member States and European Parliament. In the last five years, the S2R JU has demonstrated the progress achieved through the commitment of its Members and stakeholders. The system transformation to which the S2R JU is expected to substantially contribute does not end in 2020, or 2024, but it requires a major effort in the years to come, connecting fundamental research – applied research – large scale demonstrations/deployment. The system approach brought forward by an institutional partnership such as the S2R JU has proved to be capable of delivering such major transformation, involving legislator, regulator, standardisation bodies and stakeholders. The draft proposal for the Transforming Europe's Rail System partnership published in July 2020 presents the sector commitment towards an ambition research and innovation programme for the decade, meeting the expectations of the Union policies and Sustainable Development Goals.

Finally, the S2R JU will also take direct actions to reduce the Carbon Footprint of its activities and will review the impact that its specific action plan, which has been implemented during 2020, will have achieved.

2.2 Operations

2.2.1 Objectives & indicators

The overall objectives for the S2R JU programme in 2021 are the following:

1. as already mentioned, particular focus will be on the ERTMS Game Changers to be integrated within the TSI 2022 package; similarly, prioritizing and accelerating activities to bring them closer to final operational demonstrations will be driving the Programme;

2. ensure the performance of the "European DAC Delivery Programme", towards the effective implementation of the freight Digital Automated Coupler around Europe;
3. ensure sound budget implementation through the effective and efficient management of operations, in particular through timely monitoring and assessment of technological and operational results, including the necessary financial flows;

4. promote S2R project results and achievements (outcome of R&I activities) through communication and dissemination activities, in cooperation with Industry Members;

5. together with the European Commission and other stakeholders, promote and deliver support activities for a successful European Year of Rail, to raise awareness of the potential of rail as a sustainable, innovative and safe mode of transport;

6. continue the formalisation of collaborations with specific stakeholders, in particular similar national and/or international programmes as well as other European regions;

7. continue supporting the European Commission and the sector in the setting up of the successor of S2R.

An updated overview of demonstrators with a Technology Readiness Level reaching at least 6 (technology demonstrated in relevant environment) which are foreseen to be performed until the end of the R&I Programme is displayed below, together with the provisional planning for test end.

IP	Research Area	Specific Technological demonstration of	characteristics					Overall high level focus/objective
			Market	Testing time - YEAR start	Testing time - YEAR end	Country	TRL	
IP1	TD1.1 Traction	New Technology Traction Systems	Metro	2022	2022	ES	6/7	New generation traction converter based on advanced semiconductor technologies : Reduction in weight and size and increase in energy efficiency
			Regional	2021	2022	FR	6/7	SiC based powertrain demo on a Regional Train
		New Traction Architectures	High Speed	2021	2022	ES	6/7	Traction motor and traction drive architecture
	TD1.2 Train Control & Monit. System (TCMS)	Wireless TCMS	Metro	2022	2022	ES	6/7	Incorporate wireless technologies to the train communication network solutions (i.e. train backbone, consist network and train to ground communication).
			Regional	2022	2023	DE	6	
		Drive-by-data	Metro	2022	2022	ES	6/7	Provide a train-wide communication network for full TCMS support including the replacement of train lines, connecting safety functions up to SIL4 (incl. signalling).
			Regional	2022	2022	TBD	6	
		Functional distribution architecture	Metro	2022	2022	ES	6/7	New architectural concept based on standard framework & application profiles, distributed computing to allow execution of compliant functions on end devices distributed meeting different safety & integrity requirements
			Regional	2022	2022	TBD	6	
	TD1.3 Carbody Shell	New materials in train carbody structures	High Speed	2022	2023	ES	6	Full high speed intermediate coach interfacing with the adjacent coaches and the running gear, together with the internal interfaces of the main representative equipment of the train (HVAC, etc.) and integrated in a high speed train
	TD1.4 Running Gear	Sensoring functionality	Urban/Suburban	2022	2023	TBD	6/7	New health monitoring systems that allows a condition based maintenance of the track with Novel sensor system (hardware), Wireless communication of some sensor, Innovative algorithms
			Regional	2022	2023	TBD	6/7	Wireless on-board, in-service monitoring system with access to external information that provides the required data for a condition-based maintenance.
		Optimised Materials	Regional	2022	2022	FR	6/7	Composite Antenna Beam: Design of an Antenna Beam out of composite material to reduce weight
		Optimised Materials	High Speed	2020	2021	ES	6	Composite runnning gear from for independently rotating wheels
		Bogie Control	Generic	2019	2021	DE	6/7	Innovative wheelset guiding based on proven hydraulic actuators minimizing active control
			Generic	2022	2022	TBD	6/7	Active wheelset guidance system for reduction of wheelwear and therefore maintenance cost
			High Speed	2019	2021	ES	6	Active suspension to improve passenger comfort and vibration reductions
	TD1.5 Brakes	SIL 3/4 electronic solutions for Brake Control	Urban/Regional	2021	2022	TBD	7	Train braking system, based on new architectural HSIL concept, including the replacement of conventional train lines(tbc) and connecting braking safety functions up to SIL4.
		Innovative Friction Pair Solutions		2021	2022	TBD	7	High power and eco-friendly friction pairing solution to be tested in a relevant environment
		Adhesion Management	Generic	2021	2022	TBD	6	Function of a new adheison management concept/ function within an relevant environment on at test train
		Electro Mechanic Brake		2022	2023	TBD	6	Mechatronic brake actuator
	TD1.6 Door and Intelligent Access system	PRM access and communicating door	Regional	2022	2023	FR, ES	7	New door functionalities like platform detection, passenger detection, passenger protection during boarding aid deployment and retract…
		Light and high comfort door	Regional	2022	2023	FR and/or ES	6	Opening and closing mechanism and the leaves new innovative design: - one door will be based on metallic solutions - another door will be based on composite solutions
	TD1.7 Interiors	New Passengers Interiors	Regional	2022	2023	TBD	6	New users experiences on board thanks to modular interiors
	TD1.8 HVAC	HVAC-Technology with natural gases	Regional	2020	2022	DE	7	Test within a climatic chamber and in real operation of new soltuion and compatibility of Standardisation of interfaces, Reduction of climatic impact, Reduction of energy consumption and costs.

IP2	TD2.1 Advanced Communication System	markets applications	Mainline/High Speed	2021	2023	FR/DE tbc	6/7	The demonstrators will be used to validate aspects and capabilities defined in the ACS specification documents (incl. support VoIP communication) and assess them in the context of related FRMCS specifications.
		markets applications	Urban/Suburban	2021	2023	UK	6/7	
		markets applications	Regional/Freight	2021	2023	IT	6/7	
	TD2.2 Automatic Train Operation	feasibility of GoA2 solution	Urban/High Speed/Regional	2019	2021	UK, CH	6/7	For GoA2, to check the behaviour of the system (ATO on board and ATO trackside) in a real pilot line.
		Demonstrate the feasibility of GoA3/4 solution on actual pilot train and line	Urban/High Speed/Regional/Freight	2022	2023	DE, IT, NL	6/7	For GoA3/4, to check the behaviour of the system (ATO on board and ATO trackside) in a real pilot line.
	TD2.3 Moving Block	Higher Capacity	Urban/Suburban	2021	2023	UK	6/7	Moving Block Demonstration for Urban / Suburban, High Speed and Low traffic railway, aiming to show capacity increase on existing infrastructure, compared with traditional signalling, in lab environment
		Higher Capacity	High Speed Railways	2021	2023	DE, FR	6/7	
		Lower Cost	Low Traffic Railway	2021	2023	SE, IT	6/7	
	TD2.4 Safe Train Positioning	functional block integrated into an ERTMS based solution	Regional/Freight	2021	2022	IT	6	Under review for successful Fail Safe Train positioning demonstration innovative solution integrated with an ERTMS based system
		standalone train positionning demo	All	2021	2022	DE, ES, FR	4/6	
	2.5 On-board Train Integrity	On-Board Train Integrity	Low density traffic lines	2022	2022	CZ	6/7	On-Board Train Integrity, wired on-board communication
		On-Board Train Integrity	Freight	2022	2022	UK	6/7	On-Board Train Integrity, wireless on-board communication and energy harvesting
		On-Board Train Integrity	Regional	2022	2022	IT	6/7	On-Board Train Integrity, wired on-board communication, ETCS backward compatibility.
	TD2.6 Zero on-site testing	Simulation and testing environment able to support automated laboratory testing	Mainline/Regional/Freight	2021	2023	N/A	6	Corridor 1 of ETCS System could be used for verification of the testing activities with distributed test environments connected to each other from different trackside and on-board suppliers + Human Factors testing
	TD2.9 Traffic management system	Connected Driver Advisory System	Generic	2021	2022	IT	6	Prototype that implements the computation of speed profile and driving modalities to feed a Connected Driver Advisory System (C-DAS)
		Conflict Prediction System		2022	2023	CZ	6	Prototype demonstrating complex Conflict Prediction System.
		Wayside ATO constituents		2022	2023	SE, PL	6	Constituents needed for ATO GOA2 operation based on data management based on the integration Layer.
		Integration of field status information		2021	2021	DE	6	Modules for integrating field status information + forecast from trains, asset and train control into one single, consistent data source; (re-)planning of maintenance activities…
		TMS Business Applications		2021	2021	ES	6	TMS Business Applications focused on the mitigation of the impact that traffic disturbances and unexpected infrastructure restrictions
		Conflict Detection and Resolution		2020	2022	DE	6	Business service applications for the detection of future conflicts, the presentation of the results to the operator and conflict resolution measures and integration into workflow.
		Application Modules		2020	2022	DE	6	Interaction between the TMS providing indication of asset failure on the Integration Layer + selected features of Operator workstation with 3rd party application HMI
	TD2.10 Smart radio-connected all-in-all wayside objects	Verification of Wireless Low Power Object Controller	Generic	2021	2022	ES	6	Autonomous (energy power) object controller prototype to interface with ERTMS balises, signals and track circuits on areas far from stations.
		Track vacancy detection SWOC		2021	2022	DE	6	Track Vacancy Detection (axle counters) with optional signal management and with safe and secured communication over wireless networks.
		Verification of Multiple Networks Scalable SWOC		2021	2022	IT	6	A prototype of wayside object controller that will be able to communicate using the available heterogeneous wireless public networks (e.g. 2G/3G/4G, satellite, ..)
		Verification of SWOC network for managing WOs demonstrator		2021	2022	N/A	6	SWOC and a Wireless Sensor Network for a safe and secure communication as well as transparent routing for the IXL to the object to be controlled.
		Verification of a LX Smart wayside objects		2021	2022	CZ	6	SWOC connected via radio connection to the IXL or to the level crossing (LX) controller to control wayside objects commonly used at an LX – axle counter, gate signal, warning light, light signal or barrier drive.
		Verification of SWOC for points machines		2021	2022	ES, DE	6	Controlling of point machines with wireless communication, advanced diagnostic features, optimized distribution, low power consumption + autonomous power supply and storage
		Verification of adaptable Wireless sensor Network for way side objects		2021	2022	FR	6	New generation of low-power and resource-constrained wireless sensor networks (WSN) for adaptive data collection and forwarding for railway environment

IP3	TD3.1 Enhanced Switch & Crossing System Demonstrator	RAMS optimised S&C	Generic	2019	2023	AT	6/7	Monitoring programme foe S&C including: Geometry and overrunning, casting, novel rail grade, resilient pads, rail fastening system, base plates, switch roller system, etc.
		Joint Welding of bainitic components		2020	2023	FR	5/6	Experimental evaluation of fatigue of cast manganese-crossing for welding technology to join bainitic with pearlite steel components.
	TD3.2 Next Generation Switch & Crossing System Demonstrator	Next Generation S&C System	Generic	2021	2023	UK	5/6	Test next generation design, control, materials and manufacturing to provide a step change in asset performance as a whole (sub)system
		Low N&V Tramway Crossing	Urban/Suburban	2021	2023	TBD	6/7	Test overall performance of a girder rail swing nose crossing in service for the reduction of N&V
		Materials and Components	Generic	2019	2023	UK, SE, FR	4/7	Next generation S&C materials and components tests (*i.e.* adjustable fastening systems)
		Asphalt Track		2021	2023	UK	6/7	A site trial for demonstration to assess future assessment of asphalt performance.
	TD3.3 Optimised Track System	Transition zone	Generic	2019	2023	SE	5/6	tests on improvement of the transition between open track and bridges, open track and S&C, ballasted track and slab track
		Fastening system		2019	2023	SE	5/6	Test of a new design of fastenings system
		Innovative use of materials		2019	2023	AT	5/6	test of innovative use of materials and advanced manufacturing techniques
		Laser clad coating on rails		2020	2023	AT	5/6	test of laser clad coatings on rails nearby and on rail joints; laser hardening and laser cladding of worn rail zones
	TD3.4 Next Generation Track System	Next Generation Track System Demonstrator	Generic	2021	2023	UK	5/6	Test next generation design, control, materials and manufacturing to provide a step change in asset performance as a whole (sub)system
		Rail Defect Repair		2020	2023	UK	5/6	Thermocouple instrumented trials on process for different rail steel grades
		Innovative Slab Track Solutions		2019	2023	FR	6/7	Innovative slab track concept through manufacturing and installation processes, monitoring and integration
	TD3.5 Proactive Bridge and Tunnel Assessment, Repair and Upgrade Demonstrator	Tunnel improvements	Generic	2020	2023	FR, UK	7	Reduce track and tunnel closure by offsite manufacturing and increase quality
				2020	2023	AT	7	Predict calcite clogging over time
				2021	2023	TBD	6	Technology to enlarge tunnel gauge.
		Bridge improvements	Urban/Suburban	2020	2023	DE	6	Efficient monitoring of noise emission and installation of passive noise dampers.
			Generic	2020	2023	UK	7	Extend bridge service life by lowering fatigue
				2021	2023	SE	7	Increase bearing capacity and remaining fatigue life of concrete bridges and increasing safety.
			High Speed	2020	2023	SE	7	Make high speed traffic possible on existing bridges with proven dynamic properties
	Integrated Technological Demonstrators Asset Management (TD3.6, TD3.7, TD3.8)	Strategic long-term	Generic	2021	2022	PT, UK	6	Test of a strategical decision support tool based on the tactical planning tool
		Tactical and Operational short term		2021	2022	UK, SE DE NL, ES, FR	6/7	maintenance process and strategies through knowledge extracted from information coming from available data and monitoring systems
		Metro/ Tram Asset Management	Urban/Suburban	2021	2022	IT	7	Demonstrator focusing on minimising maintenance costs, optimising the use of resources while maximising network

IP4	Integrated TDs of all IP4 ecosystem	Integrated multimodal ecosystem	Multimodal (rail, bus, metro,…)	2020	2021	PT (Lisbon), ES (Malaga), Central East Corridor	5/6	Demonstration of functional ecosystem, including integrated functionalities (operator Portal, CMMP, Journey Planning, Offer Building, Booking and Ticketing, Access to Ansilary Services, Trip Tracking, Location Based Experiences) within the different scenarios. Through the application show how to plan (booking,shopping, tracking, navigation, notification…) and perform the trip. Different corridors (Lisbon, Malaga and central east) will be presented with a specific use cases for each one covering business or family travel. Integration with a third-party application.
		Towards the MaaS concept	Shared modes and on-demand	2021	2023	PT (Lisbon), ES (Malaga), Central East Corridor	6/7	Demonstration of the functional ecosystem with the integration of the additional MaaS functionalities for (at least) three test sides. Test of a scalable eco-systems which enables pan European internmodel travels and MaaS.
		Fully dynamic door-to-door travel	Multimodal (rail, bus, metro,…)	2021	2023	TBC (IT, GR, HR, ES, CZ, PL)	6/7	Demonstration of the functional ecosystem with the full integration of Ride- sharing and MaaS, including interaction (roaming) for multiple platforms on at least three test sides. Scalable (near-) market ready eco-systems enables pan European internmodel travels and MaaS, including cross-plattform approaches.

IP5	TD5.1 Fleet Digitalization and Automation	Automatic coupling	Freight	2020	2022	SE	6/7	Telematics and electrification, digital automatic coupling of TD5.1 will be tested. Test in extreme winter conditions. These testing activities will contribute to the compilation of enough evidence so final EU DAC Product specification can be standardised and safety/interoperability requiments updated in the TSI
		Condition based maintenance		2020	2022	DE	6/7	End-to-end solution for predictive maintenance, including processes, data handling, analytics and dashboards, for locomotives and wagons.
		ATO-application for industrial Freight trains		2020	2021	CH	6/7	Freight ATO (GoA2) use cases on ETCS Level 2 track in the open network, using ATO modules of IP2.
	TD5.2 Digital Transport Management	Improved terminals		2021	2023	SE	6	A gate equipped with intelligence as part of a connected decision platform optimizing the work process in a terminal. Sata exchange platform to ensure efficiency and security (of data handling) in the transport chain. Equipment prototypes with HMI interface validated in live demonstration for a selected large and complex terminal.
	TD5.3 Smart Freight Wagon Concepts	Core market wagon		2022	2023	SK	7	Modular, logistics-capable and cost-efficient, low weight, high-payload and aerodynamically optimised freight wagons
		Extended Market Wagon		2022	2023	TBD	5/6	Modular, logistics-capable and cost-efficient, low weight, high-payload and aerodynamically optimised freight wagons
		Telematics		2021	2022	SE	7	Demonstration activities of the intelligent wagon based on telematics and electrification
	TD5.4 New Freight Propulsion Concepts	Hybrid / advanced Propulsion		2021	2022	DE, SE	6/7	Demonstration of distributed power (3 Locos) technology developed using LTE with a 700 m heavy coal freight train with loco at the end of the train being remote controlled. Second demonstrator 835 m train.

The list is subject to regular updates to take into consideration the progress of projects and different elements which may influence a demo to take place (e.g. necessary authorizations, etc.).

An indicative list of Key Performance Indicators (KPIs) has been elaborated by the Commission aiming at the establishment of three groups of indicators, namely:

- Horizon 2020 Key Performance Indicators[11] common to all JTI JUs;
- Indicators for monitoring Horizon 2020 Cross-Cutting Issues[12] common to all JTI JUs;
- Key Performance Indicators specific for S2R JU, as a result of the new model established by year end 2018 and attached to the AWPs 2019 and 2020. Release 2020 is attached to the present AWP.

They can be consulted in the Annex III to this document.

2.2.2 Risks & mitigations

The table below indicates the main risks associated with the Programme activities and the corporate management of the S2R JU, as well as the corresponding risk mitigation actions. Only risks requiring continuous Executive Director (ED) and, where relevant, S2R JU GB attention and treatment, due to their criticality, are reported.

A new risk assessment exercise was performed from September to October 2020, the results of which are reflected in the present table.

[11] Based on Annex II to Council Decision 2013/743/EU
[12] Based on Annex II to Council Decision 2013/743/EU

Risk identified	Action plan
Cross-project collaboration required to achieve the programme objectives may not be achieved due to 'silo-project management' or restrictions related to 'licenses', 'patents', 'IPR Member's sharing policies' or 'accessibility of past OC project results'. Therefore, individual grant agreement implementation may lead to inefficient knowledge exchange across projects and IPs and may also impact the Programme outputs at system level.	- ED Programme Board in place (IP coordinators meets) - decoupling IP structure from AWP topics - further fostering the use of a common S2R JU Cooperation Tool and sharing functionalities - dedicated cross-IP meetings - TD leaders ad-hoc meetings - focus on the GAP phase on technical part of COLA between OC/CFM - end of project letter from the S2R JU to project and IP coordinators to ensure project results use within the Programme - models and guidance from the S2R JU - simplification of legal structure for collaboration. A S2R JU Common Collaboration Agreement (Common COLA, or 'CCOLA') is under preparation. - in order to ensure connection with national activities, the S2R JU will consider signing specific collaboration agreements with other European and international Organizations, Regions and Member States.
Efficiency of operations is impacted by high staff turnover together with difficulties for S2R JU to attract new people which may result in positions being filled in with delays, shortage of resources especially (during peak moments), and as a consequence leading to difficulties in getting the work done or achieving the JU's objectives (continuity); this may include a negative impact on other on employees' motivation.	- This risk is intrinsic to the S2R JU Staff establishment plan. Nevertheless, within the budget constraints, a career plan for staff has been prepared and business continuity is ensured. In 2018, the S2R JU GB adopted a revised decision on Learning and Development; implementing policy was adopted in April 2018 by the ED. - Enhancing the planning of activities will allow for better risk management. - Recruitment of short term resources (interim or trainees) has been extended.
Impediments during a project (e.g. changes in regulation/ non-achievement of harmonised requirements/unforeseen planning difficulties in resource planning etc.) might lead to the project not being executed in a timely and/or adequate manner preventing S2R solutions to reaching the market. This may in particular include force-majeure events (e.g. COVID) of longer duration which may lead to difficulties in obtaining the necessary authorisation(s) to organise project	- Ensure appropriate implementation/exploitation plans in GA and at TD/IP level + national migration strategies + investigate possible instrument to support deployment at EU level and implement JU strategy/support+regular follow up of S2R standardisation roadmaps + coordination with RASCOP, and also directly with ERA, CEN/CENELEC/ETSI + regular follow up at IPSteCo/SIWG +

demonstrations, resulting in non-completion of such activity in the project concerned.	regular updated with EURID WG + follow up of regulatory environment - change management approach (EDPB) - continuous risk management and risk response (e.g. regular Covid risk assessment at project level)
Coupling Reporting Period with the technical assessment of the project progress of the work and associated deliverables leads to inefficient and ineffective implementation of the action.	- continuous assessment of deliverables decoupled from the Periodic Techncial Reporting - sufficiently wide and qualified expertise from pool of experts

The risks listed here above take in particular consideration the situation of the S2R Programme, which enters in its final phases as from 2021; in this respect, many risks previously listed are not anymore relevant.

As regards the involvement of UK participants to the programme following the transition period, the S2R JU will implement activities in accordance with the instructions issued by the competent Commission services.

2.2.3 Scientific priorities & challenges

The R&I priorities of the S2R JU Programme are described in section 1.3. This section introduces the priorities which will be important in 2021 and are reflected in the topics included in the 2020 calls for proposals and/or for tenders.

The S2R JU published its first calls for proposals on 17 December 2015 and since then and up to 2020 around EUR 382 million of funding are committed. Moving from initial lower TRLs, the activities are now engaged in all IPs and TDs are well on their way to perform demonstrations activities, enabling the timely completion of TDs and their further incorporation into Integrated Technology Demonstrators (ITDs), where planned. The impact of the 2020 pandemic is monitored regularly and mitigating measures put in place as necessary.

2.2.4 Operational activities planned in 2021

During the first months of 2021, the S2R JU has performed an assessement of the progress of the Programme building upon the draft AAR 2020. This analysis resulted in the need to support some key policy driven activities, in particular in relation to freight, but also via existing contracts, in connection with the concept of operations and functional system architecture.

The operational analysis was matched and complemented by the budgetary assessment to ensure that the S2R JU has the necessary resources to launch the relevant additional activities.

In particular, the following three main activities were identified to complement the ongoing Programme implementation:

- IP5 following the progress achieved in the DAC R&I within IP5, the European DAC Delivery Programme has been developed to bridge reseach and innovation in a more sectorial structured approach. Nevertheless, the European DAC Delivery Programme identified gaps in terms of R&I (telematics, energy and

adaptation following ongoing demos) as well coordination activities to ensure a successful delivery of the European DAC for adoption. This will be the objective of a topic in the proposed Call for Proposals.

- IP1 following the collaboration arrangements reached between PIVOT2 and CARBODIN, IP1 requested the JU, in the context of the delivery of the Technological Demonstrators on Doors and Interiors, to launch a tender procedure to procure the necessary services and products to complement the work for the two demonstrators in 2022. Consequently, a new Procurement procedure is added in the amended AWP2021 and the relevant budget appropriations adjusted.

- IPX following the results of the funded projects and activities, adjustments to the current objectives and forthcoming challenges of S2Rlinked to the future concept of operations and functional system architecture, , should be implemented and supported via existing operational framework contracts, as the most cost-efficient approach.

- CCA the ERRAC Chair if WG1 and the Chair of its Scientific Committee, brought forward the importance to identify the overall benefits for the stakeholders, end users in primis, of the R&I work resulting from S2R and its future successor.

The table below identifies the additional operational activities that the S2R JU is planning to launch in 2021:

Activity	**Type of procedure**	**Value of the actions (*)**	**Maximum S2R co-funding (*)**	**In-kind contribution (*)**	**Other contributions from non Members**	**Indicative publication date**
Call for Proposals	Open call	1.8	1.8	*Depending on the beneficiaries*	*Depending on the beneficiaries*	Q2 2021
Call for Tenders	Open Procedure	3.0	n/a	*Depending on the beneficiaries*	*Depending on the beneficiaries*	Q1 2021
	Specific Contract(s)	1.6	n/a	*Depending on the beneficiaries*	*Depending on the beneficiaries*	Q2 2021
Operational Experts	Open, including through REA, review and Call for expression of interest (CEI)	0.3	n/a	-	-	All year
Total		**6.7**				

(*) indicative figures in EUR million

2.2.5 Call for proposals and/or Call for tenders - S2R JU members eligible only

The Call for Proposals to planned to be launched in 2021 is open to S2R Members and any other beneficiary. See the following chapter for additional information. In case any of the S2R Members will be a beneficiary of the grant, the provisions of the Membership Agreement will be applicable.

2.2.6 Open call for proposals for non-JU members

In 2021, the S2R JU is planning to issue a call for proposals without restrictions in terms of eligible participants. The budget for this call is estimated at EUR 1.8 million (in S2R funding).

The topic description is provided in the Annex I to this amended AWP 2021.

It is foreseen that the call for proposals will be launched in Q2 2021, with activities expected to start towards the second half of 2021.

Proposals should be invited for the following topics:

Topic number - IP	Topic name	Type of action and expected TRL	Value of the actions (*)	Maximum S2R co-funding (*)	In-kind contributions from members other than the Union (*)
S2R-IP5-01-2021	European DAC Delivery Programme	CSA	1.600.000,00	1.600.000,00	*Depending on the beneficiaries*
S2R-CCA-01-2021	R&I impact and benefits to make rail attractive for stakeholders	RIA	170.000,00	170.000,00	*Depending on the beneficiaries*

(*) indicative figures in EUR

2.2.7 Call planning

2021 Management process for the call for proposals	Indicative timing
Preparation of the call for proposals	Q1 2021
Publication of the call for proposals	Q2 2021
Deadline for the submission of proposals	Q2 2021
Selection of the experts and evaluation of proposals	Q2 2021
Preparation and signature of S2R JU Model Grant Agreement for S2R JU members (*)	Q3 2021

(*) Maximum Time to Grant of 8 months from the deadline for the submission of proposals.

2.2.8 Call for tenders

In 2021, the S2R JU is planning to implement the following call for tenders within framework of the S2R MAAP.

Number	Subject of tender	Indicative scope	Maximum budget* EUR
1 – contract (implementation)	Support to ERTMS European Action Plan to pave the way for the deployment of the future S2R JU Innovative Solutions	Implementation of a 4-year framework contract with a total estimated value of EUR 8 million.	1,400,000 (specific contracts for 2021)
2 - contract (implementation)	Strategic support to the S2R JU (open procedure - framework contract)	Ad-hoc activities in view of refocusing the programme and integration of a new architecture. In addition, as part of the CCA activities, it may cover • exploring the potential socioeconomic costs and benefits for the four SPD´s when the achievements obtained in the S2R JU have been implemented in the railway system. Expected advance in competing modes and future policy frameworks; • the migration from Status Quo to the final achievements; • an innovative methodology to analyse the costs and benefits of S2R JU's results.	500,000 (specific contracts for 2021)
3 - contract (implementation)	Railway operators, staff and passengers expertise (open procedure framework contract)	Implementation of a 4-year framework contract with a total estimated value of EUR 2 million.	500,000 (specific contracts for 2021)
4 – contract (implementation or launch of an ad hoc procedure)	DAC support for Programme Management and WPs	Subject to the possible use of existing framework contracts or the need to launch an ad hoc procedure, the forecasted amount is planned to support S2R activities in the context of the European DAC Delivery Programme	350,000 (specific contracts for 2021, CEI Procedure or launch or an ad hoc procurement procedure for a framework contract

Number	Subject of tender	Indicative scope	Maximum budget* EUR
			with an amount to be defined)
5 (new) – contract (implementation or launch of an ad hoc procedure)	Concept of Operationsa and Functional system architecture	Subject to the possible use of existing framework contracts or the need to launch an ad hoc procedure, the forecasted amount is planned to support S2R activities in the context of the future concept of operations and functional system architecture building upon the Linx4Rail Projects	1,600,000.00 (specific contracts for 2021 or launch or an ad hoc procurement procedure)
6 (new) – contract	Moulding tender	Delivery of moulding tools for innovative Doors and Interiors – work to complement the R&I work for the two realted S2R demonstrators	210,000
Total			**4,560,000.00**

2.2.9 Dissemination and information about projects results

The results of the ongoing activities and of projects/tenders that will be awarded in 2021 will be disseminated by the S2R JU via the S2R JU website (the platform for Railway R&I), press releases, newsletters, presentations at internal (EC, S2R JU Governing Board, Scientific Committee, States Representatives Group) and external (conferences, Info days, etc.) stakeholder events, and through social media.

The S2R JU participates to the different working groups established by the European Commission on dissemination and exploitation activities, to ensure that R&I results are integrated with the overall work performed in the rest of Horizon 2020 and where appropriate in the ERA activities. It is important to remind that access to information should always be driven by two principles: the need to be able to track and have access to all past information, while at the same time creating opportunities for further dissemination.

The main events where S2R JU will showcase its results in 2021 are: TEN-T Days (9 June – 14 July) across Europe, SIFER 2021 (26-28 October) in Lille, Rail Live Madrid (30 November – 1 December), Shift2Rail Innovation Days (9-10 December) in Brussels, and the UITP 2021 Global Public Transport Summit (14-17 December) in Melbourne. This will require to converge substantial budget for Communication activities and missions on these key events, subject to the evolution of the current pandemic situation.

2.3 Call management rules

The S2R JU follows the rules of the European Union's Horizon 2020 framework programme (Horizon 2020) and in particular the Horizon 2020 Rules for participation[13] which apply, unless specified otherwise, to both calls for proposals addressed to S2R JU members other than the Union and open calls for proposals addressed to non-S2R JU members.

[13] http://ec.europa.eu/research/participants/data/ref/h2020/legal_basis/rules_participation/h2020-rules-participation_en.pdf

2.3.1 Types of calls for proposals

Article 25 of Horizon 2020 Framework Regulation provides that "(…) *public-private partnerships shall make public funds accessible through transparent processes and mainly through competitive calls, governed by rules for participation in compliance with those of Horizon 2020. Exceptions to the use of competitive calls should be duly justified*".

In light of this and considering that by the end of the duration of the S2R JU Programme the Union financial contribution to the S2R JU shall be allocated in accordance with Article 17(a), (b) and (c) of the S2R JU Statutes, the S2R JU will publish the necessary calls.

Following the simplification provisions introduced by the Commission on the implementation of Horizon 2020, the S2R JU has decided to enter in a test phase making use of lump sum grants for the call open to its members other than the Union. The lump sum approach was implemented in 2018 fixing an overall ceiling per topic and leaving it to the candidates submitting proposals to define the level of resources to be requested to achieve the call topic objectives. The use of lump sum will introduce administrative simplification during the reporting phase, while ensuring that the focus will be on R&I progress and content results.

Considering the lessons learned from the implementation of lump sum pilot during the 2018 evaluation and first reporting period, the S2R JU may propose to further continue in 2021 with Call for proposals that will take the form of lump sums as defined in Commission Decision C(2017) 7151 of 27 October 2017[14].

In addition, as already foreseen in calls of previous years, in 2021 the S2R JU Grant Agreements will also include the options regarding 'complementary grants' of the S2R JU Model Grant Agreement and the provisions therein, including with regard to additional access rights to background and results for the purposes of the complementary grant(s). This should ensure the complementary of activities performed in the calls in the interest of the Programme and independently from the nature of the beneficiary. In this respect and as far as possible, the S2R JU may implement the "complementary" concept between calls launched in different years, if deemed necessary for the overall achievement of the objectives of the IPs and/or CCAs. Complementarity between particular topics is specified within their scope, in Annexes I and II to this AWP 2021.

2.3.2 List of countries eligible for funding

Part A of the General Annexes to the European Commission (EC) Horizon2020 Work programme 2018-2020 applies[15].

2.3.3 Standard admissibility conditions and related requirements

Part B of the General Annexes to the EC Horizon2020 Work Programme 2018-2020 applies.[16]

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[15] http://ec.europa.eu/research/participants/data/ref/h2020/other/wp/2018-2020/annexes/h2020-wp1820-annex-ga_en.pdf

[16] http://ec.europa.eu/research/participants/data/ref/h2020/other/wp/2018-2020/annexes/h2020-wp1820-annex-ga_en.pdf

2.3.4 Standard eligibility conditions

Part C of the General Annexes to the EC Horizon 2020 Work Programme 2018-2020 applies[17].

Notice for S2R JU Members

This call for proposal is open to all eligible entities in accordance with the Rules of Procedures of H2020. With regard to any Shift2Rail JU Founding or Associated member (including the constituent entities of members in the form of consortia or groupings, or affiliated entities either to the Shift2Rail JU members or to the constituent entities of members in the form of consortia or groupings), if it becomes a direct beneficiary of the grant, with an EU contribution, the Member in question shall comply with the provision of the respective Membership Agreement, in terms of in kind contributions to be provided against the funding expected to be received.

2.3.5 Types of action: specific provisions and funding rates

Part D of the General Annexes to the EC Horizon 2020 Work Programme for 2018-2020 applies.[18]

This means that the funding rate for grants will be 100% of the total eligible costs for research and innovation actions (RIA) and coordination and support actions (CSA), and 70% of the total eligible costs for innovation actions (IA) (except for non-profit legal entities where a rate of 100% applies)[19].

2.3.6 Evaluation rules[20]

Part H of the General Annexes to the EC Horizon 2020 Work Programme 2018-2020 applies.[21]

Selection criteria include 'financial capacity' and 'operational capacity'. Award criteria include 'excellence', 'impact' and 'quality and efficiency of the implementation'.

For full proposals, each award criterion will be scored out of 5. The threshold for individual criteria will be 3. The overall threshold, applying to the sum of the three individual scores, will be 10. For innovation actions, to determine the ranking, the score for the criterion 'impact' will be given a weight of 1.5.

Details on the submission and evaluation process are described in the Grants Manual - Section on: Proposal submission and evaluation.

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17 http://ec.europa.eu/research/participants/data/ref/h2020/other/wp/2018-2020/annexes/h2020-wp1820-annex-ga_en.pdf

18 http://ec.europa.eu/research/participants/data/ref/h2020/other/wp/2018-2020/annexes/h2020-wp1820-annex-ga_en.pdf

19 As set out in Article 28(5) of Regulation (EU) No 1290/2013, the 70% upper limit for innovation actions does not apply to non-profit legal entities.

2.3.7 Budget flexibility

Part I of the General Annexes to the EC Horizon 2020 Work Programme 2018-2020 applies.[22]

2.3.8 Financial support to third parties

Part K of the General Annexes to the EC Horizon 2020 Work Programme 2018-2020 applies for actions performed by non-S2R JU members, supported by the S2R JU[23].Part K of the General Annexes to the EC Horizon2020 Work Programme 2018-2020 applies for actions performed by S2R JU members, supported by the S2R JU.[24]

2.3.9 Consortium agreement

The legal entities wishing to participate in a project shall form a consortium and appoint one of its members to act as its coordinator. They will conclude a Consortium agreement among themselves prior to the signature of the Grant agreement.

Following the introduction of the Lump Sum Pilot with the call of 2018, the respective Consortium Agreements should ensure to accommodate the new process in accordance with the changed provisions in the Lump Sum Grant Agreement.

2.3.10 Dissemination and information about projects results

Part L of the General Annexes to the EC Horizon 2020 Work Programme 2018-2020 applies for actions performed by non-S2R JU Members, supported by the S2R JU[25]. Part L of the General Annexes to the EC Horizon 2020 Work Programme 2018-2020 applies for actions performed by S2R JU Members, supported by the S2R JU.[26]

In addition to the dissemination of the results already foreseen in the Horizon 2020 portals, the results of the S2R JU calls will be disseminated by the S2R JU in accordance with the Communication Strategy adopted by the Executive Director in September 2017.

Together with the Scientific Committee, the S2R JU will investigate as well the possibility to disseminate and showcase the emerging S2R JU findings and impacts through key academic journals.

With regard to topics related to TSI, on the one hand, the ERA will ensure the necessary resources are made available to facilitate and accelerate dissemination. On the other hand, the S2R JU will provide the necessary material in a timely manner. Dissemination success is the result of a strong commitment towards innovation.

The S2R JU will participate in the activities of the new working groups of the Dissemination and Exploitation Network (D&E-Net). The D&E is a Horizon 2020 interinstitutional group created to coordinate and facilitate the exchange of best practices for project management between the Joint Undertakings through the creation of a dedicated collaborative platform as well as the organization

of joint meetings. D&E-Net will regularly submit progress reports to the Common Support Centre Executive Committee.

2.4 Support to Operations

2.4.1 Communication and events

In order to ensure strong engagement from a wide range of stakeholders, communication must be truly integrated into the overall framework of the S2R JU Programme.

Communication on S2R JU results and their impact on citizens' everyday lives will be one of the focus points of the S2R JU's efforts in 2021. Actions in this area aim to support and demonstrate the added-value of the S2R JU R&I Programme.

A major point of attention in communication activities will be the need to ensure the involvement of stakeholders from the entire rail value chain, including actors from outside the traditional rail sector.

S2R JU communication activities aim to:

- **Continue to raise awareness about the S2R JU** among key stakeholders across Europe from the rail sector and beyond, given the ambition of a better integration of rail with other modes for both passengers and freight managers.
- **Support and promote the recognition of S2R JU results at global level** to contribute to the competitiveness of the European railway industry.
- **Promote stakeholder engagement** along and across the value chain in order to facilitate cooperation and knowledge exchange. This objective will require the organisation of fora and conferences on specific topics stemming from the Innovation Programmes.
    - Both of the two aforementioned objectives will require close work with different stakeholders and their associations.
- **Promote S2R JU within the EU Institutional arena**. This objective consists of maintaining and further developing political support for S2R JU from the EU institutions and EU Member States through the promotion of S2R JU, its objectives and achievements. Target audiences for this objective includes the European Parliament and/or the Council and policy makers in EU Member States. This objective might require the organisation of events inside the European Parliament, participation in visibility events such as exhibitions, Open Days, and the production of publications and presentations of key achievements.
- **Lead a coherent dissemination strategy** regarding projects' activities and achievements, notably via coordinating web, documents and event management of the projects, and their presence on the S2R JU website as well as providing information to projects on Horizon 2020 dissemination tools.
- Pro-actively **publish communication material** with regard to external events and meetings related to the S2R JU. A broad dissemination of factsheets, leaflets and brochures will enhance the visibility of the S2R JU towards other stakeholders, including the general public.
- **Establish and develop a network of press and media contacts** in order to achieve considerable visibility in both specialised and general media. This network could be useful to provide visibility to the publication of press releases and specific articles related to S2R JU's activities.
- **Manage the S2R JU website, newsletters and social media platforms** in order to stimulate the public interaction on key issues and improve public awareness on S2R JU activities.
- **Support via all these communication activities and dedicated events the European Year of Rail 2021.**

Further to the above, the S2R JU will rely on key multipliers:

- S2R JU Members, including S2R JU project coordinators, corporate Communication managers and project participants, who will communicate the success of the S2R JU to various audiences;
- ERRAC members, including policy makers and decision makers;
- Members of the Scientific Committee (SC);
- Local stakeholders;
- Members of the SRG;
- Wider stakeholders reached through S2R JU Information days and online channels Global stakeholders present at key events, within and outside the Union;
- European railway associations, including those in relation to passengers and staff;
- S2R JU staff acting as ambassadors.

The implementation of the communication activities will continue to be supported through a framework contract established with a communication agency/ies, as well as through inter-institutional framework contracts put in place by the European Commission.

2.4.2 Procurement and contracts

In order to reach its objectives and adequately support its operations and infrastructures, the S2R JU will allocate funds to procure the necessary services and supplies. In order to make procurement and contract management as effective and cost-efficient as possible, the S2R JU makes use of Service Level Agreements (SLAs) concluded with relevant Commission Services and inter-institutional framework contracts (FWC) available to them.

In 2021, the S2R JU foresees to run several procurement procedures for middle or low-value contracts [27], implement existing FWC and select individual external experts based on a Call for expression of interest (CEI).

Indicative Title	**Indicative expenditure (EUR)**	**Type of procedure**	**Indicative schedule**
Communication and event services and supplies	500,000	Middle or low-value contracts or specific Contracts/order forms implementing a FWC	1Q, 2Q, 3Q and 4Q 2021
Subscriptions to journals & periodicals	Max. 10,000	Negotiated procedure for low-value contracts	Yearly
Assistance and support of external experts, for administrativeadministrativeadmin and operational activities	300,000	Ad-hoc support contracts, not for call evaluation nor review, based on a CEI	1Q, 2Q, 3Q and 4Q 2021
Basic Office Furniture	<15,000	Specific Contracts/order	1Q, 2Q, 3Q and 4Q 2021

[27] According with Article 43(2) of the new S2R JU Financial Rules adopted by the Governing Board's Decision n° 11/2019 and entered int force on 01/01/2020, for contracts with a value between EUR 60,000 and the thresholds laid down in Article 175 of Regulation (EU, Euratom) 2018/1046 the procedure set out in Section 2 of Chapter 1 Annex I of Regulation (EU, Euratom) 2018/1046 for contracts with a low value not exceeding EUR 60,000 may be used.

Indicative Title	Indicative expenditure (EUR)	Type of procedure	Indicative schedule
		forms implementing a FWC	
Catering services	35,000	Low-value contracts or specific Contracts/order forms implementing a FWC	1Q, 2Q, 3Q and 4Q 2021
IT support and supplies	150,000	Specific Contracts/order forms implementing a FWC or Negotiated procedure for middle or low value contract	1Q, 2Q, 3Q and 4Q 2021
Team Building and Training	20,000	Negotiated procedure for low value contract or Specific Contracts/order forms implementing a FWC	1Q, 2Q, 3Q and 4Q 2021
Finance and audit	25,000	Specific Contracts/order forms implementing a FWC	1Q, 2Q, 3Q and 4Q 2021

This list shall not be considered exhaustive and other procurement procedures may need to be launched within the budgetary limits approved by the S2R JU Governing Board. The Executive Director shall report to the Governing Board about the procedures put in place as part of the AAR 2021.

2.4.3 IT and logistics

The S2R JU has implemented common ICT tools designed and offered by the European Commission on the financial management, human resources management and Horizon 2020 call management. These tools are updated and maintained on a regular basis by the EC; they require continuous input from the side of the S2R JU, on the one hand, in terms of future developments to meet the expectations of the partnership and, on the other hand, to correct mistakes.

Since 2018, the S2R JU has implemented ARES (EC document management system) in order to streamline document flow as well as to ensure their proper archiving and registration and SYSPER for staff administration in 2019, thereby leveraging on the existing EC infrastructure and processes. The S2R JU has procured on behalf of the other JUs a tool for the management of the GDPR Register, which is used since 2020.

In addition, the S2R JU is making use of the training services offered by the EC on these applications to assure their correct usage and implementation.

The S2R JU is collaborating with the joint strategic ICT plan of the Joint Undertakings located in the White Atrium building. During 2017, the physical infrastructure was moved to private cloud computing. During 2018, with the participation in the Inter-Agency Cloud Framework Contract led by EFSA in Parma, the S2R JU continued using the latest information technology of the cloud in order to maximize the systems uptime, resource availability and staff mobility.

During 2020, the JU led an assessment of the joint JUs' ICT shared services in view of the implementation of Microsoft O35 and its components, resulting in a *Data protection impact assessment* (DPIA) report that constitutes the basis for the mitigation actions to be put in place in terms of data protection, transfer of data and security. As a result, an inter-JU project action plan was adopted.

2.4.4 S2R JU Programme Team – HR matters

By 2021, the S2R JU shall be fully staffed with 24 staff members including 2 Seconded National Experts (SNEs). Where needed, the JU will make recourse to CAs or Interim Staff to cover long term absences, after consultation with the Commission Services

Further details are provided in Section 3 in the Staff Establishment Plan.

In addition to statutory staff Members and the SNE's already in place, the S2R JU will also resort to the European Commission's Bluebook trainees. The S2R JU HR function ensures continuous improvement of all HR processes and will continue to develop its internal guidelines, policies and its legal framework, paying particular attention to how EU Staff Regulations' Implementing Rules shall apply to the S2R JU particularities (in accordance with Article 110 of the EU Staff Regulations).

Annual appraisal and reclassification exercises will be set up by HR within the limits of the Staff Establishment Plan and the S2R JU Financial Rules, with the support of HR IT tool (SYSPER). Trainings for staff members will be further developed and social events will take place in order to reinforce the cohesion of the team.

2.4.5 Administrative budget and finance

The European Commission's Accrual Based Accounting system (ABAC) has been rolled out in the S2R JU in 2016 and is used for accounting purposes.

The S2R JU implements the new S2R JU financial rules adopted by the S2R JU Governing Board in 2020, which define powers and responsibility of the S2R JU Accounting Officer inter alia. They also make an explicit reference to the possibility that this function could be attributed to the Accounting Officer of the EC[28].

In this respect, the S2R JU Governing Board has also appointed the Accounting Officer of the EC as the Accounting Officer to the JU. This appointment is not expected to be revised in 2021. In addition, the S2R JU Governing Board examined at different stages the need for an internal audit capability, in addition to the Internal Audit Service of the Commission (the S2R JU Internal Auditor), and considered that the current processes and procedures provide reasonable assurance on the functioning of the organization.

2.4.6 Data protection

[28] Commission Delegated Regulation (EU) 2019/887 on the on the model financial regulation for public-private partnership bodies referred to in Article 71 of Regulation (EU, Euratom) 2018/1046 of the European Parliament and of the Council

As regards the processing of personal data, the S2R JU applies Regulation (EU) 2018/1725 of 23 October 2018[29] which entered into force on 11 December 2018.

The role of the Data Protection Officer (DPO) or some data protection tasks currently exercised by the S2R JU's Chief Legal Officer is expected to be externalized to an external contractor by the end of 2020 or beginning 2021. During 2021 the implementation of the new data protection regime will continue, *inter alia*, the S2R JU Data Protection Action plan and implementing rules on data protection, drafting new S2R JU privacy statements; reviewing data processing operations; updating the data protection central register; implementing the inter-JU project action plan for the migration to Office 365; and providing guidance to S2R JU staff.

2.5 Governance

The S2R JU is composed of two Executive bodies: the Governing Board and the Executive Director. In addition, there are two advisory bodies: the Scientific Committee and the States Representatives Group.

2.5.1 Governing Board

The S2R JU Governing Board has the overall responsibility for the strategic orientation and the operations of the S2R JU and supervises the implementation of its activities, in accordance with Article 8 of the S2R JU Statutes.

The S2R JU Governing Board was established after the 8 Founding Members of the S2R JU other than the Union listed in Annex II to the S2R Regulation, endorsed the S2R JU Statutes and once all founding members, including the Union, nominated their representatives and alternate representatives to the Board.

In accordance with Art. 6 of the S2R JU Statutes, once the process of selection of the Associated Members was completed in late 2015, the representatives of the Associated Members to the S2R JU Governing Board were selected, after nomination by the IP Steering Committees and appointment by the Board. Following this process, the final composition of the S2R JU Governing Board was reached beginning of 2016. The Governing Board is currently composed of two representatives from the Commission, one representative from each of the 8 founding members of the S2R JU other than the Union, and 10 representatives of associated members. The remaining Associated Members can attend the meeting of the S2R JU Governing Board as observers.

In line with the provisions of the S2R JU Statutes, a representative of the ERA and the chairperson or the vice-chairperson of the States Representatives Group will have the right to attend meetings of the S2R JU Governing Board as observers and take part in its deliberations, but with no voting rights. The chairperson of the Scientific Committee will be invited to attend meetings of the S2R JU Governing Board as an observer and take part in its deliberations, whenever issues falling within its remit are discussed, but has no voting rights.

In 2021, the S2R JU Governing Board is planning to hold three ordinary meetings.

The key activities are listed below:

[29] Regulation (EU) 2018/1725 of the European Parliament and of the Council of 23 October 2018 on the protection of natural persons with regard to the processing of personal data by the Union institutions, bodies, offices and agencies and on the free movement of such data, and repealing Regulation (EC) No 45/2001 and Decision No 1247/2002/EC

Key activities in 2021 – timetable	
Approve 2020 Annual Activity Report	Q1
Adopt the award decision in relation to the Call for the Proposals 2021	Q2
Discuss draft 2022 Annual Work Plan	Q4
Discuss draft budget 2022	Q4
Adopt the key documents for the S2R JU's operations in 2022: 2022 budget and staff establishment plan	Q4

2.5.2 Executive Director

According to Article 10 of the S2R JU Statutes, the Executive Director is the chief executive responsible for the day-to-day management of the S2R JU in accordance with the decisions of the Governing Board. The Executive Director is the legal representative of the S2R JU. The Executive Director is accountable to the Governing Board. He is supported by the S2R JU staff.

2.5.3 Scientific Committee

According to Article 13 of the S2R JU Statutes, the Scientific Committee is an advisory body to the S2R JU Governing Board. During the year 2021, two meeting of this body are planned.

The tentative key activities are listed below:

Key activities in 2021 – timetable	
15th Meeting of the SC. The SC would: – Provide advice on the results achieved in the previous years and the alignment with the MAAP.	Q2
16th Meeting of the SC. The SC would: – Provide advice on the scientific priorities to be addressed in the 2021 Annual Work Plan, including links with similar research activities carried out for example in Horizon 2020 and linking to Horizon Europe. – Provide advice to the S2R JU GB on the programme progress of the S2R JU and other strategic issues.	Q4

As implemented since 2019, the possibility will also exist in 2021 to contract Scientific Committee Members as experts in the review and monitoring of the S2R JU Projects.

2.5.4 States Representatives Group

Following the entry into force of the S2R JU Regulation, Members States and countries associated to the Horizon 2020 framework programme were asked to nominate their representatives to the States Representatives Group (SRG), in accordance with Article 14 of the S2R Statutes. To date, 33 countries have nominated representatives to the Group.

The States Representatives Group shall be involved in particular in the review of information and provision of opinions on the following matters:

- strategic orientation, the S2R Master Plan, and progress towards achievement of the S2R JU targets;
- the S2R JU Annual Work Plans;
- links to Horizon 2020/Horizon Europe and to other Union and Member State funding instruments, including the Connecting Europe Facility and the European Structural and Investment Funds;
- links to the Union rail transport legislation and the goal of achieving a Single European Railway Area;
- involvement of SMEs and relevant actors from outside the traditional rail sector.

The States Representatives Group also provides information to, and acts as an interface within the S2R JU on the following matters:

a) the status of relevant national or regional research and innovation programmes and identification of potential areas of cooperation, including deployment of relevant technologies to allow synergies and avoid overlaps;
b) specific measures taken at national or regional levels with regard to dissemination events, dedicated technical workshops and communication activities.

The States Representatives Group may issue, on its own initiative, recommendations or proposals to the S2R JU Governing Board on technical, managerial and financial matters as well as on annual work plans, in particular when those matters affect national or regional interests.

During the year 2021, two meetings of the States Representatives Group are planned (Q2 and Q4).

The tentative key activities are listed below:

Key activities in 2021 – timetable	
14th Meeting of the SRG. The SRG would: – Provide advice on the draft 2022 Annual Work Plan. – Provide advice on the results achieved in the previous years and the alignment with the MAAP.	Q2
15th Meeting of the SRG. The SRG would: – Provide advice on the priorities to be addressed in the 2022 Annual Work Plan, including links with similar research activities carried out for example in Horizon 2020 – Provide advice to the S2R JU GB on the programme progress of the S2R JU and other strategic issues – Provide updated information and discuss initiatives on: regional and national research and innovation programmes to allow synergies; dissemination and communication activities; and deployment activities in relation to S2R JU.	Q4

As the new Chairperson and Vice-Chairperson of the SRG were elected as of 1st January 2019 for a period of two years, a new election will be organized end of 2020 for the new mandates starting as of 1st January 2021.

2.6 Internal Control framework

2.6.1 Financial procedures

In 2016, S2R JU adopted an ICT tool, ABAC Workflow, to support its financial procedures. At the same time, it adopted its Manual of Financial Procedures including the Financial Circuits applicable to the S2R JU. This Manual of Financial Procedures was further revised in a new version in 2017.

The Manual of Financial Procedures has been designed to guarantee a segregation of duties and to apply the four eyes principle in S2R JU financial transactions. It describes in detail the financial circuits the S2R JU implements per type of transactions and the roles and responsibilities of each actor involved. To a lesser extent, it also describes the basic principles on main procedures (grants & procurements).

During the past years, the processes and procedures have been further reinforced with the introduction of the S2R JU Cooperation Tool (including for in-kind contribution declarations and certifications), the Governance and Process Handbook, implementation of ICT tool ABAC Assets and different specific procedures that enhance the sound financial management in the implementation of the activities. During 2019, the S2R JU implemented the remaining elements of the Internal Control System which had been in place since 2016.

In 2020, in accordance with the revised S2R JU Financial Rules, the S2R JU started implementing a revised Internal Control Framework, following the adoption of the ED Decision on the Adoption of the Shift2Rail Joint Undertaking Internal Control Framework (ED-20-08). The impact of the new internal control framework on the S2R JU financial procedures continues to be assessed, and further adjustments may be introduced, also taken into account experience gained with the implementation of these processes and procedures. For the AAR 2020, the compliance and effectiveness of internal control will be assessed on the basis of the revised Framework.

2.6.2 Ex-ante and ex-post controls

The S2R JU follows the procedures for ex-ante and ex-post control established in its Financial Rules as well as guidelines applicable to Horizon 2020.

The S2R JU is aligning *with the Article 21 of the new S2R Financial Rules* providing that "Each operation shall be subject at least to an ex ante control based on a desk review of documents and on the available results of controls already carried out relating to the operational and financial aspects of the operation". The ex-ante controls are considered essential to prevent errors and to avoid the need for ex-post corrective actions. They take the form of checking contracts and grant agreements, initiating, checking and verifying invoices and cost claims and carrying out desk reviews (such as mid-term reviews carried out by external experts on S2R JU projects and other). In addition to the process' defined internally, the S2R JU is implementing the Horizon 2020 ex-ante control framework for its grants.

Ex-post controls are defined as the controls executed to verify financial and operational aspects of finalised budgetary transactions *in accordance with Article 22 of the S2R JU Financial Rules*. The main objectives of the ex-post controls are to ensure that the principles of legality, regularity and sound financial management (economy, efficiency and effectiveness) have been respected and to provide the basis for corrective and recovery activities, if necessary.

The S2R JU ex post controls of S2R JU projects include financial audits which are covered by the Horizon 2020 Audit Strategy and administrated by the Common Audit Service (CAS) of the Commission. In 2021, the S2R JU will report the outcome of the ex-post audits performed on the S2R JU specific sample on its validated cost claims. This reporting will include the error rates identified and applicable to the JUs population.

In addition, the S2R JU has introduced since 2018 an internal mechanism of ex-post controls on financial transactions related to administrative expenditure as another element in the control framework to provide assurance on the effective functioning of the system.

In 2021, the ex-post review on administrative expenditure will be organised on an annual basis.

2.6.3 Audits

In accordance with the Article 26 of the Financial Rules applicable to the S2R JU, the internal audit function shall be performed by the Commission's Internal Auditor.

The internal auditor shall advise the S2R JU on dealing with risks, by issuing independent opinions on the quality of management and control systems and by issuing recommendations for improving the conditions of implementation of operations and promoting sound financial management. Following a risk assessment performed at the JU during 2020, the Internal Auditor drew up the Strategic Internal Audit Plan for 2021-2023 which will be the basis for the internal audit work to be carried out as of 2021.

The financial audit of the S2R JU accounts is performed by an external audit firm that has been chosen under the Framework contract of DG Budget, on the basis of the joint tendering of the services by the EC, agencies and other JUs.

Each year, the European Court of Auditors shall prepare a specific annual report on the S2R JU in line with the requirements of Article 287(1) of the Treaty on the Functioning of the European Union. In preparing the report, the Court shall consider the audit work performed by the aforementioned independent external auditor and the action taken in response to his or her findings.

Regarding the ex-post audits on grants, the S2R JU is part of the Horizon 2020 common Audit Strategy. The strategy has been developed and implemented by the Common Audit Service of the Commission, as mentioned in the previous section.

2.6.4 Risk Management

During 2020, in accordance with the S2R JU Policy for Risk Management as defined in the Governance and Process Process Handbook, the S2R JU performed a risk assessment exercise to ensure that the internal control system in place provides the reasonable assurance to achieve the strategic objectives of its Programme, as established in the Master Plan and MAAP. This process reflects the implementation of the new Internal Control Framework during 2020.

The assessment and management of risks during 2021 will be based on the results of the exercise carried out during 2020 (cf. section 2.2.2).

3. BUDGET 2021[30]

[30] The Budget and Staff figures and tables do not reflect, at this stage, the impact of the Commission proposal to establish Joint Undertakings under Horizon Europe; the AWP will be amended at the later stage to take into account the impact of the new legal basis.

3.1 Budget information

The S2R JU 2021 Budget is subject to the adoption of the EU General Budget for 2021 and to the adoption of the S2R JU Governing Board. All figures may be updated during both of these adoption procedures.

The present Budget is proposed for the following reason:

Unused appropriations received from the Union for the JU running costs, already included in Title IV of the Budget 2021, amounts to EUR 3.2 million to cover years 2022 to 2024. This amount will be received during the same three years by the Members other than the Union.

In order to maximize the performance and impact of the JU, taking into consideration the above background information, it is proposed to the Governing Board to transfer the amount of the unused appropriations from the Union for the running costs of the JU for the amount of EUR 3.2 million to Title 3 for operational activities. This possibility is established in Article 16.2 of the Statutes of the S2R JU Regulation: "*If part of the contribution for administrative costs is not used, it may be made available to cover the operational costs of the S2R Joint Undertaking*".

In addition, in order to realise the delivery of the Technological Demonstrators on Doors and Interiors PIVOT2 agreed with the complementary project Carbodin, that the latter reduces its grant for the amount of EUR 0.2 million. Subsequently the S2R IP1 Steering Committee requested the JU to launch a tender procedure to procure the necessary services and products to complement the work for the two demonstrators in 2022. Consequently, a new Procurement procedure is added in the amended AWP2021 and the relevant budget appropriations adjusted.

And therefore to make use of the amount of EUR 3.4 million transferred to Title 3, in addition to the budget already planned for the operational activities (with a new total of EUR 6.6 million as described in the section 2.2.4 of the present document).

The Budget 2021 might be subject to adjustments considering the appropriations made available by the Union and to amendments to take into account any unexpected elements. Any possible Budget amendment will be subject to the S2R JU Governing Board approval on a proposal from the Executive Director.

Revenue

The S2R JU details three types of revenue in its Budget 2021:

- The contributions from the Union, including the EFTA contribution (reduced in this amended version at 2.66% instead of initially 2.7%);
- The contributions from the members other than the EU;
- The un-used appropriations from the previous years.

The revenue includes EUR 0.3 million relating to the Expert Review and Evaluators; this amount, although included in the S2R JU Budget, is managed by the REA Services. Unused amounts will be returned to the S2R JU.

Expenditure

The amount included in the 2021 Budget takes into account the overall ceiling established in the S2R JU Regulation on the total amount of the S2R JU Running Costs until 2024.

Staff Expenditure (Title 1)

Title 1 includes the following Chapters:

- The full cost of staff in Active Employment for Temporary Agent Staff (110) and Contractual Agents, Interim Staff, trainees and SNEs (111);
- Mission Costs (13);
- Training (15);
- Other Staff Expenditure (19), such as medical service, recruitment, mobility costs and other social expenses.

The estimated expenditure under Title 1 amounts to EUR 2,609,000 and represents 70% of the total administrative budget. A majority of this amount covers the Salaries & allowances of the S2R JU staff.

Administrative Expenditure (Title 2)

The S2R JU details its staff expenditure into following Chapters to cover the costs of:

- Rental of buildings and associated costs (20)
  Amongst which: Rents; Provisions for other charges in relation to housing
- IT Expenditure and technical facilities (21)
  Amongst which: Hardware purchases; Software development & purchases; Day-to-day maintenance
- Movable property and associated costs (22)
  Amongst which: The purchase / maintenance of office equipment and furniture
- Current Administrative Expenditure (23)
  Amongst which: Stationery and office supplies; Petty expenditure; Documentation and library expenditure, subscriptions; Translation, interpretation
- Postage and telecommunications (24)
  Amongst which: postage, telephone, internet and mobile communication expenses
- Administrative Board Expenditure (25)
  Amongst which: Governing Boards, SRG meetings, SC meetings and other meeting expenditure
- Administrative support services (26)
  Amongst which: Experts other than ones related to evaluations and project reviews under operational budget, Beneficiary portal.
- PR and Events (27)
  Amongst which: All communication costs of the JU, design and printing or promotional items, organising and attendance of events, website
- Other Infrastructure and operating Expenditure (29)
  Amongst which; auditing, studies, ABAC fees and other service fees to support the JU infrastructure

Operational expenditure (Title 3)

This chapter includes all operational expenditure of the S2R JU necessary to implement the R&I activities described in the present document.

As already indicated with regard to the Revenues, this chapter also includes EUR 0.3 million relating to the Expert Reviews and Evaluators which is managed by the REA Services.

Un-used Appropriations not required in current year (Title 4)

Budget year 2020 was the last year for the S2R JU to collect the Commitment Appropriations available under the Horizon 2020 funding scheme from the Union. The Commitment Appropriations required to run the S2R JU in 2021 and after are placed under Title 4 to be available for re-activation in future budget years.

Shift2Rail Joint Undertaking Budget 2021A1

STATEMENT OF REVENUE

Title / Chapter	Heading	2019 Budget Executed CA	2019 Budget Executed PA	% of Budget 2021 CA	% of Budget 2021 PA	2020 Budget as finally adopted CA	2020 Budget as finally adopted PA	2021 Budget CA	2021 Budget PA	2021A1 Budget CA	2021A1 Budget PA	CA Variance 2021 / 2021 A1 EUR	CA Variance 2021 / 2021 A1 %	PA Variance 2021 / 2021 A1 EUR	PA Variance 2021 / 2021 A1 %
9	REVENUE														
9 0	CONTRIBUTIONS														
	CONTRIBUTION FROM THE EUROPEAN UNION	79,982,327	62,866,928		151%	81,839,584	75,997,838	-	41,628,016	-	41,611,803	-		(16,213)	0.0%
9 0 0	*Administrative Budget*	*1,661,627*	*1,661,627*	*-*	*134%*	*5,317,621*	*1,056,000*	*-*	*1,237,777*	*-*	*1,237,295*	*-*		*(482)*	*0.0%*
9 0 1	*Operational Budget*	*78,320,700*	*61,205,301*	*-*	*152%*	*76,521,963*	*74,941,838*	*-*	*40,390,239*	*-*	*40,374,508*	*-*		*(15,731)*	*0.0%*
	CONTRIBUTION FROM MEMBERS OTHER THAN THE EU	1,661,627	1,661,627	134%	134%	1,706,000	1,056,000	1,237,777	1,237,777	1,237,295	1,237,295	- 482	0.0%	(482)	0.0%
9 0 2	*Administrative Budget*	*1,661,627*	*1,661,627*	*134%*	*134%*	*1,706,000*	*1,056,000*	*1,237,777*	*1,237,777*	*1,237,295*	*1,237,295*	*- 482*	*0.0%*	*(482)*	*0.0%*
9 3	UN-USED APPROPRIATIONS PREVIOUS YEARS*	1,121,332	16,728,472	12%	65%	6,165,278	3,234,948	8,913,463	25,725,253	9,128,387	25,725,253	214,924	2.4%	0	0.0%
9 3 0	*Un-used appropriations previous years Administrative*	*688,899*	*1,033,626*	*12%*	*58%*	*552,201*	*672,379*	*5,603,033*	*1,775,741*	*5,603,033*	*1,775,741*	*-*	*0.0%*	*0*	*0.0%*
9 3 1	*Un-used appropriations previous years Operational*	*432,433*	*15,694,846*	*12%*	*66%*	*5,613,077*	*2,562,570*	*3,310,429*	*23,949,512*	*3,525,353*	*23,949,512*	*214,924*	*6.5%*	*0*	*0.0%*
TOTAL REVENUE		82,765,286	81,257,027	798%	118%	89,710,862	80,288,786	10,151,240	68,591,047	10,365,682	68,574,351	214,442	2.1%	(16,696)	0.0%

STATEMENT OF EXPENDITURE

Title		2019 Budget Executed				2020 Budget as finally adopted		2021 Budget		2021A1 Budget		CA Variance 2021 / 2021 A1		PA Variance 2021 / 2021 A1	
Chapter	Heading	CA	PA			CA	PA	CA	PA	CA	PA	EUR	%	EUR	%
1	**STAFF EXPENDITURE**														
11	STAFF IN ACTIVE EMPLOYMENT	1,985,186	2,007,887	87%	88%	2,180,149	2,162,342	2,289,000	2,289,000	2,289,000	2,289,000	-	*0.0%*	*0*	*0.0%*
1 1 0	*Temporary Agents*	*703,858*	*703,858*	*91%*	*91%*	*728,079*	*729,000*	*777,000*	*777,000*	*777,000*	*777,000*	-	*0.0%*	*0*	*0.0%*
1 1 1	*Contract Agents, Interim Staff, trainees and SNEs*	*1,281,328*	*1,304,030*	*85%*	*86%*	*1,452,071*	*1,433,342*	*1,512,000*	*1,512,000*	*1,512,000*	*1,512,000*	-	*0.0%*	*0*	*0.0%*
13	MISSION COSTS	105,000	98,154	117%	109%	25,009	30,585	90,000	90,000	90,000	90,000	-	***0.0%***	*0*	***0.0%***
15	TRAINING	4,000	23,769	20%	119%	24,485	15,073	20,000	20,000	20,000	20,000	-	***0.0%***	*0*	***0.0%***
19	OTHER STAFF EXPENDITURE	182,814	206,307	87%	98%	197,529	219,172	210,000	210,000	210,000	210,000	-	***0.0%***	*0*	***0.0%***
TITLE 1 TOTAL		**2,277,000**	**2,336,117**	**87%**	**90%**	**2,427,172**	**2,427,172**	**2,609,000**	**2,609,000**	**2,609,000**	**2,609,000**	**-**	***0.0%***	**-**	***0.0%***
2	**ADMINISTRATIVE EXPENDITURE**														
20	RENTAL OF BUILDINGS AND ASSOCIATED COSTS	308,480	311,020	92%	93%	316,438	320,000	335,000	335,000	335,000	335,000	-	*0.0%*	*0*	*0.0%*
21	IT EXPENDITURE AND TECHNICAL FACILITIES	175,500	230,803	117%	154%	207,938	239,000	150,000	150,000	150,000	150,000	-	*0.0%*	*0*	*0.0%*
22	MOVABLE PROPERTY AND ASSOCIATED COSTS	1,050	1,047	11%	10%	-	-	10,000	10,000	10,000	10,000	-	*0.0%*	*0*	*0.0%*
23	CURRENT ADMINISTRATIVE EXPENDITURE	17,422	17,929	116%	120%	31,241	39,000	15,000	15,000	15,000	15,000	-	*0.0%*	*0*	*0.0%*
24	POSTAGE AND TELECOMMUNICATIONS	14,000	10,564	93%	70%	27,000	30,000	15,000	15,000	15,000	15,000	-	*0.0%*	*0*	*0.0%*
25	ADMINISTRATIVE BOARD EXPENDITURE	41,286	40,760	83%	82%	22,000	15,000	50,000	50,000	50,000	50,000	-	*0.0%*	*0*	*0.0%*
26	ADMINISTRATIVE SUPPORT SERVICES	32,630	13,226	65%	26%	69,689	44,000	50,000	50,000	50,000	50,000	-	*0.0%*	*0*	*0.0%*
27	PR AND EVENTS	528,386	482,687	176%	161%	319,104	278,410	300,000	300,000	300,000	300,000	-	*0.0%*	*0*	*0.0%*
29	OTHER INFRASTRUCTURE AND OPERATING EXPENDITURE	96,878	128,399	65%	86%	154,000	182,000	150,000	150,000	150,000	150,000	-	*0.0%*	*0*	*0.0%*
TITLE 2 TOTAL		**1,215,632**	**1,236,436**	**113%**	**115%**	**1,147,410**	**1,147,410**	**1,075,000**	**1,075,000**	**1,075,000**	**1,075,000**	**-**	***0.0%***	***0***	***0.0%***
TOTAL ADMINISTRATIVE EXPENDITURE (Title 1 and Title 2)		**3,492,632**	**3,572,554**	**95%**	**97%**	**3,574,582**	**3,574,582**	**3,684,000**	**3,684,000**	**3,684,000**	**3,684,000**	**-**	***0.0%***	***0***	***0.0%***

STATEMENT OF EXPENDITURE

Title / Chapter	Heading	2019 Budget Executed CA	2019 Budget Executed PA			2020 Budget as finally adopted CA	2020 Budget as finally adopted PA	2021 Budget		2021A1 Budget		CA Variance 2021 / 2021 A1 EUR	CA Variance 2021 / 2021 A1 %	PA Variance 2021 / 2021 A1 EUR	PA Variance 2021 / 2021 A1 %
3	**OPERATIONA EXPENDITURE**														
30	OPERATIONAL EXPENDITURE	76,704,777	66,309,554	1157%	103%	80,506,114	72,203,958	3,260,000	64,339,751	6,631,735	64,324,020	*3,371,735*	103%	*(15,731)*	- 0
TITLE 3 TOTAL		**76,704,777**	**66,309,554**	**1157%**	**103%**	**80,506,114**	**72,203,958**	**3,260,000**	**64,339,751**	**6,631,735**	**64,324,020**	**3,371,735**	**103%**	- **15,731**	
4	**UNUSED APPROPRIATIONS NOT REQUIRED IN CURRENT YEAR**														
40	ADMINISTRATIVE BUDGET	519,521	784,326	#DIV/0!	138%	5,301,240	509,797	3,156,811	567,296	-	566,331	- *3,156,811*	*(100.0%)*	*(964)*	*(0.2%)*
41	OPERATIONAL BUDGET	2,048,356	10,590,594		1,49<10>%	328,926	4,000,450	50,429	0	49,947	0	-	-	-	-
TITLE 4 TOTAL		**2,567,877**	**11,374,920**	**5141%**	**2009%**	**5,630,166**	**4,510,247**	**3,207,240**	**567,296**	**49,947**	**566,331**	- *3,157,293*	*(98.4%)*	*(964)*	*(0.2%)*
TOTAL EXPENDITURE		**82,765,286**	**81,257,027**	**798%**	**118%**	**89,710,862**	**80,288,786**	**10,151,240**	**68,591,047**	**10,365,682**	**68,574,351**	**214,442**	*2.1%*	- **16,696**	*(0.2%)*

Contributions overview

CONTRIBUTIONS OVERVIEW	2019	2020	2021
CONTRIBUTIONS FROM THE UNION (incl EFTA)	79,982,327	81,839,584	0
Title 1 and Title 2 (financial)	1,661,627	5,317,621	0
Title 3 (financial)	78,320,700	76,521,963	0
CONTRIBUTIONS FROM MEMBERS OTHER THAN THE UNION	74,894,203	70,056,896	1,237,295
Title 1 and Title 2 (financial)	1,661,627	1,706,000	1,237,295
Title 3 (in-kind)	73,232,576	68,350,896	0
TOTAL CONTRIBUTIONS	154,876,530	151,896,480	1,237,295

Schedule of Payments in 2021

	Commitment Appropriations		Payment Appropriations	
	RAL from earlier years	Budget 2021	Budget 2021	Estimated Budget 2022 and after
2015 Work Plan Operational	270,840		270,840	0
2016 Work Plan Operational	14,377		14,377	0
2017 Work Plan Operational	10,264,820		6,314,884	3,949,936
2018 Work Plan Operational	27,334,656		25,534,930	1,799,726
2019 Work Plan Operational	40,778,495		28,344,492	12,434,003
2020 Work Plan Operational	45,523,391		2,205,015	43,318,376
2021 Work Plan Administrative	-	3,684,000	3,684,000	0
2021 Work Plan Operational		6,631,735	1,639,483	4,992,252
Total	**124,186,578**	**10,315,735**	**68,008,019**	**66,494,294**

3.2 Staff Establishment Plan

Establishment plan posts

Temporary posts

Establishment plan posts								
Function group and grade	2019				2020		2021	
	Authorised Budget		Filled as of 31/12/2019		Authorised Budget		Authorised Budget	
	Permanent posts	Temporary posts	Permanent posts	Temporary posts	Permanent posts	Temporary posts	Permanent posts	Temporary posts
AD 16								
AD 15								
AD 14		1		1		1		1
AD 13								
AD 12								
AD 11								
AD 10								2
AD 9		2		2		2		
AD 8		1		1		1		1
AD 7		1		1		1		1
AD 6								
AD 5								
AD TOTAL	0	5	0	5	0	5	0	5
AST 1-11								
AST TOTAL	0	0	0	0	0	0	0	0
AST/SC 1-6								
AST/SC TOTAL	0	0	0	0	0	0	0	0
TOTAL		5		5		5		5
GRAND TOTAL	5		5		5		5	

Contract Agents

Contract agents	Authorised 2019	Recruited as of 31/12/2019	Authorised 2020	Authorised 2021
Function Group IV	12	13	13	13
Function Group III	3	3	3	3
Function Group II	1	1	1	1
Function Group I				
TOTAL	16	17	17	17

Seconded National Experts

Seconded National Experts	Authorised 2019	Recruited as of 31/12/2019	Authorised 2020	Authorised 2021
TOTAL	3	3	3	2

4. ANNEXES

4.1 ANNEX I – 2021 CALL FOR PROPOSALS – TOPIC DESCRIPTIONS

S2R-IP5-01-2021: "Digital Automated Coupler innovation for the European Delivery Programme"

SPECIFIC CHALLENGE:

Within the scope and objectives of IP5, rail freight is expected to take advantage of digitalization and automation of technological solutions and processes, to improve the performance of operations and offer competitive and sustainable services to the clients in a logistic value chain approach. This meets the expectations and targets defined in the European Commission Sustainable and Smart Mobility Strategy[31] of 9 December 2020: inter alia, increase rail freight of 50% by 2030 and double by 2050.

IP5 Programme has been working to deliver a demonstrator for a Digital Automatic Coupler (DAC) that, in addition to the automatic coupling, integrates digital communications and energy.

The DAC eliminates manual interventions and, by transmitting data and power through the freight train consist, offers a backbone opening to fill operational gaps that have undermined the competitiveness of rail freight in the last 20 years. The DAC, one of the key enablers of the rail freight transformation, is expected to revolutionise the sector's competitiveness by increasing productivity of operations and the capacity of the EU rail network. The DAC is expected to address rail freight shortcomings with specific services, e. g. cargo monitoring for logistics or wagon condition and performance information, reducing trains' preparation time, increasing efficiency operations in shunting yards, providing a long due answer to potential rail freight clients. The DAC is part of a series of enablers that will deliver the digital rail freight, including ATO, digital break tests, etc.

Rail research and innovation will continue beyond the current DAC Type 4 towards a Type 5 (automatic decoupling) as a scalable solution.

The intrinsic nature of the DAC requires to opt for one European solution to be deployed on the full network; already such approach carries challenges, opportunities and risks. Nevertheless, any alternatives to one European solution would simply accelerate the decline of rail freight.

In this context, the Governing Board of the Shift2Rail Joint Undertaking fully endorsed the European DAC (Digital Automatic Coupler) Delivery Programme on 22 July 2020. Built upon the outcomes achieved in Shift2Rail's freight related R&I activities (Innovation Programme 5), and the acknowledged achievements of the sector, the European DAC Delivery Programme[32] (EDDP) is a unique opportunity for the sector to collectively drive the process bridging R&I towards the deployment of the European DAC, enabled by S2R.

The EDDP's objectives encompass the technological assessments of the available solutions, testing and demos, definition of migration plans, definition of standards' proposals, assessing the interfaces

[31] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0789
[32] https://shift2rail.org/european-dac-delivery-programme/

with other programmes, business cases, and communication and dissemination, aiming to bridge R&I towards the future deployment of the European DAC. In particular, it includes:

- the selection of an open, functional, operationally tested, safe and sustainable European DAC model ready for industrialisation and deployment;
- the delivery of a final open design of the selected model, based on use-case considerations in 2021, and its interoperability and safety requirements which could be incorporated into the TSI, Green Deal & Digitalization Package 2022;
- subject to the results of the ongoing business case analysis, the identification of migration and business plans compatible across Europe as well as the necessary resources to match them.

SCOPE

Proposals are called to address the aforementioned challenges, starting with ensuring the management of the European DAC delivery programme and a wide geographical stakeholders involvement, in strict liaison with the Shift2Rail JU.

Project proposals, expected to cover indicatively a period of 18 months, should also address all the following work streams:

Work-stream 1: DAC technical specifications for enhanced system prototype of the energy and communication system

The project proposals should address the need for further development of DAC electrical/communication specifications, their translation into CEN/CENELEC standards' and ERA relevant TSIs' proposals. including the adaptation of the sector operational rules for the European DAC. Hence, this work-stream shall deliver the necessary specifications that enable the introduction of a European DAC within the current EU regulatory framework (TSIs) alongside the necessary industrial process and testing definition needed to achieve interoperability constituent (IC) categorization as per Directive 2008/57/EC.

Harmonised electrical and communication systems is a pre-condition for the future intelligent freight wagons/trains, should be taken into account in the DAC specifications for a reliable European DAC system. This activity should ensure translation of the user requirements into a system architecture and the assessment of their impacts on the architecture and technical parameters for the wagon/locomotive system.

The system architecture should be agreed with the S2R JU, in particular looking at the activities undertaken by the S2R project Linx4Rail as well as expected in its future evolution[33]. The architecture shall match reliability standards and take into account the hardware requirements to support upwards compatibility to future freight automation use cases.

In order to support the overall DAC system, the proposal may consider to address the communications and power Proof of Concept, at laboratory level, for theoretical evaluation by the S2R JU, at TRL4. The

[33] https://ec.europa.eu/transparency/regdoc/rep/1/2021/EN/COM-2021-87-F1-EN-MAIN-PART-1.PDF

Proof of Concept may cover basis of estimation for costs and ROI of the definitive chosen technologies, included the functions: brake test, train integrity, ECP.

In order to ensure the adequate management of these complex activities, the project proposals may include the necessary programme management aspects in relation to WP1 of the EDDP[34].

Work-stream 2: European DAC migration concepts and planning

In order to ensure the necessary input within WP3 of the EDDP[35], the project proposals should cover, in relation to the European DAC, the identification and feasibility assessment of potential alternative for the migration scenarios and related timeframes in the European rail network, identification of critical operational processes in train formation and customer logistics and required maintenance/retrofit capacities (including workforce). With regard to rolling stock fleets and their European DAC-preparedness the project proposals needs to assess the retrofit boundary conditions in function of the indicative migration scenarios. Minimum requirements to ensure migration feasibility shall be defined.

In a second more exhaustive step, the most suitable selected migration scenario should be detailed, covering an overall time plan with individual steps to take for traffic/asset related conversion priorities, transitional concepts for different traffic segments and regions. Stakeholders' traffic flow data need to be analysed to support the action definition. In addition, potential adaptation effort for the stakeholders' operational IT-systems should be assessed.

Considering the risks of conflict of interest that can be associated to such stream of work, the project proposals shall provide the necessary framework to ensure an independent recommendation on migration scenarios.

Work-stream 3: Attractiveness and skills related measures for accompanying the migration

This work-stream addresses the change of job requirements in an automated environment specifically related to the European DAC introduction. The objective is to analyse how staff work changes in balance of evident benefits (more attractive and better ergonomic working conditions, less physical long-term issues, avoidance of risky tasks, etc.) and new challenges (solo work, men-machine-interaction, handling of both old and new technology during the migration phase, build-up of necessary competence, etc.). Current and future work tasks and risk profiles should be mapped. New required skills should be analysed and needs for education, re-training of staff and e.g. ergonomic optimisation should be assessed.

This work is expected to contribute to the WP4[36] of the EDDP; the project proposals shall take stock of the work already conducted by S2R on Human Capital[37] and coordinate its activities with the project Skill Training Alliance For the Future European Rail system (STAFFER) [38], to avoid duplications and looking for synergies.

[34] https://projects.shift2rail.org/s2r_ip5_n.aspx?p=EU-DAC#wp1
[35] https://projects.shift2rail.org/s2r_ip5_n.aspx?p=EU-DAC#wp3
[36] https://projects.shift2rail.org/s2r_ip5_n.aspx?p=EU-DAC#wp4
[37] https://shift2rail.org/publications/human-capital-report-series/
[38] Contact details: staffer.coordination@unige.it

As a horizontal measure, the effects on rail network capacity (including ETCS Level 3 and train integrity functionality) and the environmental impact of the potential overall shift to rail (green deal impact) enabled by DAC should be assessed, also taking into account existing results from within the S2R JU.

The project proposals should focus on dissemination oriented activities that shall be realized via the channels and in coordination with the S2R JU; no activities that are considered to be a duplication, such as websites, newsletters, etc., will be considered eligible for funding and may result in the reduction of the grant.

EXPECTED IMPACT

The action shall result in contributing to achieve the objectives of the European DAC Delivery Programme, in particular to bridge the research and innovation within IP5 and the future deployment of the European DAC. Hence, the action is expected to be substantial in accelerating the adoption of a European DAC solution together with the constituent supporting elements that will contribute to materialize a major transformation of the rail freight sector, to improve operations, services and performance, to attract new clients, to create new skills and competences for staff and improve safety and, finally, to set the basis for Digital Rail Freight.

Type of Action: Coordination and Support Action (CSA)

Expected Duration: 18 – 24 months indicatively

Budget: EUR 1.6 million

Notice for S2R JU Members

This call for proposal is open to all eligible entities in accordance with the Rules of Participation of H2020. With regard to any Shift2Rail JU Founding or Associated member (including the constituent entities of members in the form of consortia or groupings, or affiliated entities either to the Shift2Rail JU members or to the constituent entities of members in the form of consortia or groupings), if it becomes a direct beneficiary of the grant, with an EU contribution, the Member in question shall comply with the provision of the respective Membership Agreement, in terms of in kind contributions to be provided against the funding expected to be received.

S2R-CCA-01-2021: R&I impact and benefits to make rail attractive for stakeholders

SPECIFIC CHALLENGE

The recently launched EU Sustainable and Smart Mobility Strategy[39] lays the foundation for how the EU transport system can achieve its green and digital transformation and become more resilient to future crises and accessible to all. Within this context the European Commission proposed the creation of a new Joint Undertaking[40] within the rail transport sector, Europe's Rail, that should define a Master Plan able to capture the priority research and innovation activities, and overall system architecture and harmonised operational approach, required to support the Single European Railway Area and the objectives of the EU Sustainable and Smart Mobility Strategy, to be benefit of the final users.

The starting point is the output of the different R&I activities Shift2Rail conducted and is conducting that will constitute the building blocks for the future. The specific challenge ahead is to ensure that the technological and operational innovations resulting from the work of S2R and its future successor respond to a clear societal case and produce benefits to the final users in the scope of the sustainable and smart multi-modal door to door services and integrated logistic value chain.

SCOPE

Project proposals are called to address the aforementioned challenge, in particular starting with an investigation of the material already available on the Shift2Rail website[41].

Project proposals should perform a top-down analysis by defining the most important stakeholders for both the passenger and the freight transport and their main conditions for seamless and optimised journeys/logistic with railways as the backbone.

This analysis will have to be matched against the outcome of S2R and expected impact of Europe's Rail R&I, and also to determine the obstacles and key success factors of the railway system to attract more freight and passenger customers as part of an multi-modal transport and mobility network.

The project proposals shall demonstrate the benefits of using the new rail transport capabilities for the final users, passengers or freight customers. These new capabilities derive from the successful conclusion of the R&I actions and their future implementation in the rail network, improving rail operations and assets and unlocking innovative sustainable multi-modal door to door services.

The proposal shall also assess the impact of the existing, ongoing and future R&I activities in the rail sector supported by S2R and its successor on the societal challenges with a specific focus on sustainability, digital, manufacturing and urban mobility.

[39] COM(2020) 789 final
[40] https://shift2rail.org/shift2rail-successor/
[41] https://shift2rail.org/

Concerning the future R&I activities, the available documents, such as the ERRAC Strategic Research and Innovation Agenda[42], the proposal of the European Commission to establish the European Partnerships of 23 February 2021[43], provide an outlook of the sector ambition to transform the railway system in such way that rail "*in combination with other public transport, integrating aviation and shipping as needed, [becomes] the backbone of Europe's mobility and the logistic chain*".

Complementarity

As specified in section 2.3.1 of AWP 2021, in order to facilitate the contribution to the achievement of S2R objectives, the options regarding 'complementary grants' of the S2R Model Grant Agreement and the provisions therein, including with regard to additional access rights to background and results for the purposes of the complementary grant(s), will be enabled in the corresponding S2R Grant Agreements.

The action stemming from this topic will also be complementary to activities carried out with-in the following project:

- IMPACT-2 (GA 777513)

SPECIFIC CONDITIONS FOR PARTICIPATION

In accordance with Art. 9(3)(d) of the HORIZON 2020 Rules for Participation, in this specific topic the minimum condition shall be the participation of one legal entity established in a Member State or Associated Country. The reason of this approach is justified by the technically specific nature of the expected activity that would not require a significant amount of investigation and cooperation.

EXPECTED IMPACT

The action shall result in

- contributing to align the R&I activities with the user needs,
- quantifying the users benefits by establishing the future sustainable multi-modal door to door services,
- qualitative assessment and trends of the R&I work on the societal challenges described above,
- contribute as far as possible to any future realignment of the rail R&I priorities and scope.

Expected Duration: 12 months indicatively

Type of Action: Research an Innovation Action (RIA)

Budget: EUR 0.17 million

[42] https://errac.org/wp-content/uploads/2020/12/RAIL-Strategic-Research-and-Innovation-Agenda-2020-_FINAL_dec2020.pdf

[43] https://ec.europa.eu/transparency/regdoc/rep/1/2021/EN/COM-2021-87-F1-EN-MAIN-PART-1.PDF

Notice for S2R JU Members

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4.2 ANNEX II – Indicators and Scoreboard of KPIs

4.2.1 TABLE I - Horizon 2020 Key Performance Indicators[44] common to all JTI JUs

	Correspondence to general Annex 1	Key Performance Indicator	Definition/Responding to question	Type of data required	Data to be provided by	Baseline at the start of H2020 (latest available)	Target at the end of H2020	Automated
INDUSTRIAL LEADERSHIP	12	SME - Share of participating SMEs introducing innovations new to the company or the market (covering the period of the project plus three years);	Based on Community Innovation Survey (?). Number and % of participating SMEs that have introduced innovations to the company or to the market;	Number of SMEs that have introduced innovations;	H2020 beneficiaries through project reporting	n.a. [new approach under H2020]	50%	Yes
	13	SME - Growth and job creation in participating SMEs	Turnover of company, number of employees	Turnover of company, number of employees;	H2020 beneficiaries through project reporting	n.a. [new approach under H2020]	to be developed based on FP7 ex-post evaluation and /or first H2020 project results	Yes
SOCIETAL CHALENGES	14	Publications in peer-reviewed high impact journals in the area of the JTI	The percentage of papers published in the top 10% impact ranked journals by subject category.	Publications from relevant funded projects (DOI: Digital Object Identifiers); Journal impact benchmark (ranking) data to be collected by commercially available bibliometric databases.	H2020 beneficiaries through project reporting; Responsible Directorate/Service (via access to appropriate bibliometric databases)	n.a. [new approach under H2020]	[On average, 20 publications per €10 million funding (for	Yes

[44] (based on Annex II to Council Decision 2013/743/EU)

	Correspondence to general Annex 1	Key Performance Indicator	Definition/Responding to question	Type of data required	Data to be provided by	Baseline at the start of H2020 (latest available)	Target at the end of H2020	Automated
							all societal challenges)]	
	15	Patent applications and patents awarded in the area of the JTI	Number of patent applications by theme; Number of awarded patents by theme	Patent application number	H2020 beneficiaries through project reporting; Responsible Directorate/Service (via worldwide search engines such as ESPACENET, WOPI)	n.a. [new approach under H2020]	On average, 2 per €10 million funding (2014 - 2020) RTD A6	Yes
	16	Number of prototypes testing activities and clinical trials[45]	Number of prototypes, testing (feasibility/demo) activities, clinical trials	Reports on prototypes, and testing activities, clinical trials	H2020 beneficiaries through project reporting	n.a. [new approach under H2020]	[To be developed on the basis of first Horizon 2020 results]	Yes
	17	Number of joint public-private publications in projects	Number and share of joint public-private publications out of all relevant publications.	Properly flagged publications data (DOI) from relevant funded projects	H2020 beneficiaries through project reporting; Responsible Directorate/Service (via DOI and manual data input-flags)	n.a. [new approach under H2020]	[To be developed on the basis of first Horizon 2020 results]	Yes
	18*	New products, processes, and methods launched into the market	Number of projects with new innovative products, processes, instruments, methods, technologies	Project count and drop down list allowing to choose the type processes, products, instruments, methods, technologies	H2020 beneficiaries through project reporting	n.a. [new approach under H2020]	[To be developed on the basis of first Horizon 2020 results]	Yes

[45] Clinical trials are IMI specific

	Correspondence to general Annex 1	Key Performance Indicator	Definition/Responding to question	Type of data required	Data to be provided by	Baseline at the start of H2020 (latest available)	Target at the end of H2020	Automated
EVALUATION	NA	Time to inform (average time in days) all applicants of the outcome of the evaluation of their application from the final date for submission of completed proposals	To provide applicants with high quality and timely evaluation results and feedback after each evaluation step by implementing and monitoring a high scientific level peer reviewed process	Number of days (average)	Joint Undertaking	FP7 latest know results		Yes
	NA	Time to inform (average time in days) successful applicants of the outcome of the evaluation of their application from the final date for submission of completed proposals		Number of days (average)	Joint Undertaking	FP7 latest know results		Yes
	NA	Redress after evaluations	To provide applicants with high quality and timely evaluation results and feedback after each evaluation step by implementing and monitoring a high scientific level peer reviewed process	Number of redresses requested	Joint Undertaking	FP7 latest know results		
GRANTS	NA	Time to grant measured (average) from call deadline to signature of grants	To minimise the duration of the granting process aiming at ensuring a prompt implementation of the Grant Agreements through a simple and transparent grant preparation process	Cumulatively in days Average under H2020 (days) TTG < 270 days (as %of GAs signed)	Joint Undertaking (automatized)	n.a. [new approach under H2020]		Yes
	NA	Time for signing grant agreements from the date of informing successful applicants (average values)		Average under H2020 (days)	Joint Undertaking	n.a. [new approach under H2020]		Yes

	Correspondence to general Annex 1	Key Performance Indicator	Definition/Responding to question	Type of data required	Data to be provided by	Baseline at the start of H2020 (latest available)	Target at the end of H2020	Automated
AUDITS	NA	Error rate		% of common representative error; % residual error	CAS	n.a. [new approach under H2020]		Yes
	NA	Implementation of ex-post audit results		Number of cases implemented; in total €million; ´of cases implemented/total cases	CAS	n.a. [new approach under H2020]		Yes
PAYMENTS	NA	Time to pay (% made on time) -pre-financing - interim payment -final payment	To optimize the payments circuits, both operational and administrative, including payments to experts	Average number of days for Grants pre-financing, interim payments and final payments; Average number of days for administrative payments; Number of experts appointed	Joint Undertaking	FP7 latest know results	-pre-financing (30 days) - interim payment (90 days) -final payment ((90days)	Yes
HR	NA	Vacancy rate (%)		% of post filled in, composition of the JU staff [46]	Joint Undertaking	n.a. [new approach under H2020]		
JU EFFICIENCY	NA	Budget implementation/execution: 1. % CA to total budget 2. % PA to total budget	realistic yearly budget proposal, possibility to monitor and report on its execution, both in commitment (CA) and payments (PA), in line with sound financial management principle	% of CA and PA	Joint Undertaking		100% in CA and PA	Yes

[46] Additional indicators can be proposed/discussed with R.1 and/or DG HR

	Correspondence to general Annex 1	Key Performance Indicator	Definition/Responding to question	Type of data required	Data to be provided by	Baseline at the start of H2020 (latest available)	Target at the end of H2020	Automated
	NA	Administrative Budget: Number and % of total of late payments	realistic yearly budget proposal, possibility to monitor and report on its execution in line with sound financial management principle	Number of delayed payments % of delayed payments (of the total)	Joint Undertaking			Yes

NOTES:

18* This indicator is not a legally compulsory one, but it covers several additional specific indicators requested for more societal challenges by the services in charge.

4.2.2 TABLE II - Indicators for monitoring H2020 Cross-Cutting Issues[47] common to all JTI JUs

Correspondence in the general Annex 2	Cross-cutting issue	Definition/Responding to question	Type of data required	Data to be provided by	Data to be provided in/to	Direct contribution to ERA	Automated
2	Widening the participation	2.1 Total number of participations by EU-28 Member State	Nationality of H2020 applicants & beneficiaries (number of)	H2020 applicants & beneficiaries at the submission and grant agreement signature stage	JU AAR RTD Monitoring Report	YES	Yes
		2.2 Total amount of EU financial contribution by EU-28 Member State (EUR millions)	Nationality of H2020 beneficiaries and corresponding EU financial contribution	H2020 beneficiaries at grant agreement signature stage	JU AAR RTD Monitoring Report	YES	Yes
NA		Total number of participations by Associated Countries	Nationality of H2020 applicants & beneficiaries (number of)	H2020 applicants & beneficiaries at the submission and grant agreement signature stage	JU AAR RTD Monitoring Report	YES	Yes
NA		Total amount of EU financial contribution by Candidate Country (EUR millions)	Nationality of H2020 beneficiaries and corresponding EU financial contribution	H2020 beneficiaries at grant agreement signature stage	JU AAR RTD Monitoring Report	YES	Yes

[47] (based on Annex III to Council Decision 2013/743/EU)

Correspondence in the general Annex 2	Cross-cutting issue	Definition/Responding to question	Type of data required	Data to be provided by	Data to be provided in/to	Direct contribution to ERA	Automated
3	SMEs participation	3.1 Share of EU financial contribution going to SMEs (Enabling & industrial tech and Part III of Horizon 2020)	Number of H2020 beneficiaries flagged as SME; % of EU contribution going to beneficiaries flagged as SME	H2020 beneficiaries at grant agreement signature stage	JU AAR RTD Monitoring Report		Yes
6	Gender	6.1 Percentage of women participants in H2020 projects	Gender of participants in H2020 projects	H2020 Beneficiaries through project reporting		YES	Yes
		6.2 Percentage of women project coordinators in H2020	Gender of MSC fellows, ERC principle investigators and scientific coordinators in other H2020 activities	H2020 beneficiaries at the grant agreement signature stage		YES	Yes
		6.3 Percentage of women in EC advisory groups, expert groups, evaluation panels, individual experts, etc.	Gender of memberships in advisory groups, panels, etc.	Compiled by Responsible Directorate/ Service /Joint Undertaking based on existing administrative data made available by the CSC		YES	
7	International cooperation	7.1 Share of third-country participants in Horizon 2020	Nationality of H2020 beneficiaries	H2020 beneficiaries at the grant agreement signature stage	JU AAR RTD Monitoring Report	YES	Yes
		7.2 Percentage of EU financial contribution attributed to third country participants	Nationality of H2020 beneficiaries and corresponding EU financial contribution	H2020 beneficiaries at the grant agreement signature stage	JU AAR RTD Monitoring Report	YES	Yes

Correspondence in the general Annex 2	Cross-cutting issue	Definition/Responding to question	Type of data required	Data to be provided by	Data to be provided in/to	Direct contribution to ERA	Automated
9	Bridging from discovery to market [48]	9.1 Share of projects and EU financial contribution allocated to Innovation Actions (IAs)	Number of IA projects	Project Office – at GA signature stage he/she will be required to flag on SYGMA. Responsible Directorate/Service (WP coordinator)/Joint Undertaking - via tool CCM2	JU AAR RTD Monitoring Report		Yes
		9.2 Within the innovation actions, share of EU financial contribution focussed on demonstration and first-of-a-kind activities	Topics properly flagged in the WP; follow-up at grant level	Responsible Directorate/Service (WP coordinator)/Joint Undertaking - via tool CCM2	JU AAR RTD Monitoring Report		Yes
NA		Scale of impact of projects (High Technology Readiness Level)	Number of projects addressing TRL[49] between…(4-6, 5-7)?	Joint Undertaking	JU AAR RTD Monitoring Report		
11	Private sector participation	11.1 Percentage of H2020 beneficiaries from the private for profit sector	Number of and % of the total H2020 beneficiaries classified by type of activity and legal status	H2020 beneficiaries at grant agreement signature stage	JU AAR RTD Monitoring Report		Yes
		11.2 Share of EU financial contribution going to private for profit entities (Enabling & industrial tech and Part III of Horizon 2020)	H2020 beneficiaries classified by type of activity; corresponding EU contribution	H2020 beneficiaries at grant agreement signature stage	JU AAR RTD Monitoring Report		Yes

[48] This indicator (9.2) is initially intended to monitor the Digital Agenda (its applicability could be only partial)

[49] TRL: Technology Readiness Level

Correspondence in the general Annex 2	Cross-cutting issue	Definition/Responding to question	Type of data required	Data to be provided by	Data to be provided in/to	Direct contribution to ERA	Automated
12	Funding for PPPs	12.1 EU financial contribution for PPP (Art 187)	EU contribution to PPP (Art 187)	Responsible Directorate/Service	JU AAR RTD Monitoring Report		Yes
		12.2 PPPs leverage: total amount of funds leveraged through Art. 187 initiatives, including additional activities, divided by the EU contribution	Total funding made by private actors involved in PPPs - in-kind contribution already committed by private members in project selected for funding - additional activities (i.e. research expenditures/investment of industry in the sector, compared to previous year)	Joint Undertaking Services	JU AAR RTD Monitoring Report		
13	Communication and dissemination	13.3 Dissemination and outreach activities other than peer-reviewed publications - [Conferences, workshops, press releases, publications, flyers, exhibitions, trainings, social media, web-sites, communication campaigns (e.g. radio, TV)]	A drop down list allows to choose the type of dissemination activity. Number of events, funding amount and number of persons reached thanks to the dissemination activities	H2020 Beneficiaries through project reporting	JU AAR RTD Monitoring Report	YES	Yes
14	Participation patterns of independent experts	14.2 Proposal evaluators by country	Nationality of proposal evaluators	Responsible Directorate /Service/Joint Undertaking in charge with the management of proposal evaluation			
		14.3 Proposal evaluators by organisations' type of activity	Type of activity of evaluators' organisations	Responsible Directorate /Service/Joint Undertaking in charge		YES	

Correspondence in the general Annex 2	Cross-cutting issue	Definition/Responding to question	Type of data required	Data to be provided by	Data to be provided in/to	Direct contribution to ERA	Automated
				with the management of proposal evaluation			
NA	Participation of RTOs and Universities	Participation of RTO[50]s and Universities in PPPs (Art 187 initiatives)	Number of participations of RTOs to funded projects and % of the total Number of participations of Universities to funded projects and % of the total % of budget allocated to RTOs and to Universities	H2020 beneficiaries at the grant agreement signature stage	JU AAR RTD Monitoring Report	YES	Yes
NA	Ethics	The objective is ensuring that research projects funded are compliant with provisions on ethics efficiently	% of proposals not granted because non-compliance with ethical rules/proposals invited do grant (target 0%); time to ethics clearance 5target 45 days)[51]	Responsible Directorate /Service/Joint Undertaking	JU AAR RTD Monitoring Report		

Notes:

*H2020 applicants - all those who submitted H2020 proposals

*H2020 beneficiaries - all those who have signed a H2020 Grant Agreement

*Responsible Directorate - DG RTD Directorates and R&I DGs family in charge with management of H2020 activities *Services - Executive Agencies and other external bodies in charge with H2020 activities

*Project officer - is in charge of managing H2020 projects in Responsible Directorate/Service including Executive Agencies

[50] RTO: Research and Technology Organisation

[51] Data relates to pre-granting ethics review. This time span runs in parallel to granting process.

4.2.3 TABLE III - Key Performance Indicators specific for the S2R JU

#	Key Performance Indicator	Objective	Data to be provided by	Baseline at the start of H2020	Target at the end of H2020	Automated
S2R						
1	% reduction in the costs of developing, maintaining, operating and renewing infrastructure and rolling stock and increase energy efficiency compared to "State-of-the-art"	Reduce the life-cycle cost of the railway transport system	JU	"State-of-the-art" 2014	> 50 %	No
2	% increase the capacity of railway segments to meet increased demand for passenger and freight railway services compared to "State-of-the-art" 2014	Enhance the capacity of the railway transport system	JU	"State-of-the-art" 2014	100%	No
3	% decrease in unreliability and late arrivals compared to "State-of-the-art" 2014	Increase in the quality of rail services	JU	"State-of-the-art" 2014	> 50%	No
4	Reduce noise emissions and vibrations linked to rolling stock and respectively infrastructure compared to "State-of-the-art" 2014	Reduce the negative externalities linked to railway transport	JU	"State-of-the-art" 2014	> 3 - 10 dBA	No
5	Addressing open points in TSIs, compared to "State-of-the-art" 2014	Enhance interoperability of the railway system	JU	"State-of-the-art" 2014		No
6	Number of Integrated Technology Demonstrators (ITDs) and System Platform demonstrations	Improve market uptake of innovative railway solutions through large-	JU	tbd in the Multi-Annual Action Plan		Yes

#	Key Performance Indicator	Objective	Data to be provided by	Baseline at the start of H2020	Target at the end of H2020	Automated
		scale demonstration activities				
7	Share of the fund allocated to the different Innovation Programmes and to cross-cutting themes	Ensure that funding covers the railway system as a whole	JU	n.a.	> 80%	No
8	Percentage of topics resulting in signature of GA	Ensure a sufficiently high call topics success rate	JU	n.a.	> 90%	Yes
9	% of resources consumption versus plan (members only)	WP execution by members – resources	JU	n.a.	> 80%	Yes
10	% of deliverables available versus plan (members only)	WP execution by members – deliverables	JU	n.a.	> 80%	Yes

4.2.4 TABLE IV – Initial estimation of Release 3.0 - of the Key Performance Indicators of the Shift2Rail Programme

To be updated at the GB meeting, following the KPI presentation of Release 3

SPD	LCC			Capacity			Punctuality		
Target	-50%			+100%			+50%		
High speed	-14%	-15%	-18%	61%	69%	74%	26%	29%	19%
Regional	-20%	-21%	-24%	49%	57%	49%	46%	51%	15%
Urban	-17%	-16%	-18%	27%	23%	28%	n / a		
Freight	-38%	-39%	-40%	114%	42-114%	91%	72%	78%	71%

release 2.0

release 1.0

4.3 ANNEX III – List of Members of S2R JU other than the Union

NAME OF MEMBER	CONSTITUENT ENTITIES OF CONSORTIA	COUNTRY
AERFITEC Consortium	*AERNNOVA AEROSPACE S.A.U.*	ES
	FIDAMC	ES
	FUNDACION TECNALIA RESEARCH & INNOVATION	ES
ALSTOM Transport SA		FR
Amadeus IT Group SA		ES
Hitachi Rail STS S.p.A.		IT
AZD Praha s.r.o.		CZ
Bombardier Transportation GmbH		DE
Competitive Freight Wagon Consortium (CFW)	*Contraffic GmbH*	DE
	Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)	DE
	Waggonbau Niesky GmbH	DE
	Centro de Estudios e Investigaciones Técnicas (CEIT)	ES
	Verband der Bahnindustrie in Deutschland (VDB)	DE
Construcciones y Auxiliar de Ferrocarriles		ES
Deutsche Bahn AG		DE
CS Group		FR
EUropean Rail Operating community Consortium (EUROC)	*Infraestruturas de Portugal, S.A.*	PT
	BLS AG	CH
	CP	PT
	Finnish Transport Agency	FI
	ÖBB-Infrastruktur AG	AT
	Polskie Koleje Państwowe S.A. (PKP)	PL

NAME OF MEMBER	CONSTITUENT ENTITIES OF CONSORTIA	COUNTRY
	PRORAIL B.V.	NL
	Schweizerische Bundesbahnen (SBB)	CH
	Slovenske zeleznice (SZ)	SI
	Türkiye Cumhuriyeti Devlet Demiryollari (TCDD)	TR
Faiveley Transport		FR
HaCon Ingenieurgesellschaft mbH		DE
INDRA SISTEMAS S.A.		ES
Kontron Transportation Austria AG		AT
Knorr-Bremse Systems für Schienenfahrzeuge GmbH		DE
MER MEC S.p.A		IT
Network Rail Infrastructure Limited		UK
Siemens Aktiengesellschaft		DE
Smart DeMain (SDM) consortium	*Strukton Rail BV*	NL
	ACCIONA INFRAESTRUCTURAS SA	ES
	Deutsches Zenttrum für Luft-und Raumfahrt e.V. (DLR)	DE
	Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.	DE
	Centro de Estudios de Materiales y Control de Obra S.A	ES
Smart Rail Control (SmartRaCon) consortium	*Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)*	DE
	Centro de Estudios e Investigaciones Técnicas (CEIT)	ES
	FONDATION DE COOPERATION SCIENTIFIQUE RAILENIUM	FR
	Nottingham Scientific Ltd	UK
Société Nationale des Chemins de Fer Français Mobilités (SNCF Mobilités)		FR
Swi'Tracken consortium	*FONDATION DE COOPERATION SCIENTIFIQUE RAILENIUM*	FR
	UNIVERSIDADE DO PORTO	PT
	TATASTEEL	FR
	UNIVERSIDAD DEL PAIS VASCO	ES

NAME OF MEMBER	CONSTITUENT ENTITIES OF CONSORTIA	COUNTRY
	UNIVERSIDADE DO MINHO	PT
	VOSSLOH-COGIFER	FR
	INSTITUT FÜR ZUKUNFTSSTUDIEN UND TECHNOLOGIEBEWERTUNG	DE
	EGIS RAIL	FR
	GROUPE EUROTUNNEL SA	FR
	TRONICO ALCEN	FR
Patentes Talgo S.L.U.		ES
THALES		FR
Trafikverket		SE
Virtual Vehicle Austria consortium+ (VVAC+)	*Kompetenzzentrum - Das virtuelle Fahrzeug, Forschungsgesellschaft mbH (Virtual Vehicle)*	AT
	FCP Firtsch, Chiari & Partner ZT GmbH	AT
	Getzner Werkstoffe GmbH	AT
	Kirchdorfer Fertigteilholding GmbH	AT
	Plasser&Theurer GmbH	AT
	voestalpine Schienen GmbH	AT
	voestalpine VAE GmbH	AT
	Wiener Linien GmbH & Co KG	AT
	AVL List GmbH	AT
	PJM Messtechnik GmbH	AT
	TATRAVAGONKA a.s.	SK
	AC2T research GmbH	AT
	Materials Center Leoben Forschung GmbH	AT