



ANNEX to GB decision no 08/2020

ANNUAL WORK PLAN and BUDGET 2021 adopted by the S2R GB on 19 November 2020

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	LIST OF ACRONYMS4					
1.	INTR	ODUCTION	8			
1.	1	THE SHIFT2RAIL JOINT UNDERTAKING	8			
1.	2	Mission and Objectives	9			
1.	3	R&I PRIORITIES	10			
	- 131	Innovation Programme 1 (IP1): Cost-efficient and reliable trains	11			
	132	Innovation Programme 2 (IP2): Advanced traffic management and control systems	11			
	1 3 3	Innovation Programme 2 (IP2): Cost Efficient and Reliable High Canacity Infrastructure	12			
	130	Innovation Programme 4 (IPA): IT Solutions for attractive railway services	13			
	1 2 5	Innovation Programme 5 (IP5): Technologies for sustainable and attractive European rail	freight			
	1.5.5		Jiciyin			
	136	Cross-cutting themes and activities	14			
	137	/ IPx - System Architecture and Concentual Data Model (CDM)	15			
	1.5.7		15			
2.	WOF	K PLAN AND BUDGET 2021	16			
2.	1	EXECUTIVE SUMMARY	16			
2.	2	OPERATIONS	18			
	2.2.1	Objectives & indicators	18			
	2.2.2	Risks & mitigations	23			
	2.2.3	Scientific priorities & challenges	25			
	2.2.4	Operational activities planned in 2021	25			
	2.2.5	Call for proposals and/or Call for tenders - S2R JU members eligible only	25			
	2.2.6	Open call for proposals for non-JU members	25			
	2.2.7	Call planning	25			
	2.2.8	Call for tenders				
	2.2.9	Dissemination and information about projects results	27			
2.	3	CALL MANAGEMENT RULES	27			
2.	4	SUPPORT TO OPERATIONS	27			
	2.4.1	Communication and events	27			
	2.4.2	Procurement and contracts				
	2.4.3	IT and loaistics				
	2.4.4	S2R JU Programme Team – HR matters				
	245	Administrative hudget and finance	31			
	246	Data protection	31			
2	5	GOVERNANCE	31			
۷.	251	Governing Board	31			
	2.5.1	Everytive Director	22			
	2.5.2	Scientific Committee	22			
	2.5.5	States Penrosentatives Group				
2	2.J.4 c					
Ζ.	0 7 C 1	Financial procedures				
	2.0.1	r munchul μιστευμίες	34 24			
	2.0.2	Ex-unite unu ex-post controls	34 25			
	2.0.3	AUUILS	35			
	2.0.4	הוא ויועוועצוווצוונ	30			
3.	BUD	GET 2021	36			
3.	1	BUDGET INFORMATION	36			
3.	2	STAFF ESTABLISHMENT PLAN	44			

4. A	NNE	XES	45
4.1	A	NNEX III – Indicators and Scoreboard of KPIs	47
4	.1.1	TABLE I - Horizon 2020 Key Performance Indicators common to all JTI JUs	
4	.1.2	TABLE II - Indicators for monitoring H2020 Cross-Cutting Issues common to all JTI JUs	
4	.1.3	TABLE III - Key Performance Indicators specific for the S2R JU	
4	.1.4	TABLE IV – Initial estimation of Release 3.0 - of the Key Performance Indicators of the S	Shift2Rail
P	rogra	mme	
4.2	A	NNEX IV – LIST OF MEMBERS OF S2R JU OTHER THAN THE UNION	60

LIST OF ACRONYMS

Abbreviation	
AAR	Annual Activity Report
ABAC	Accrual Based Accounting
AI	Artificial Intelligence
ΑΤΟ	Automatic Train Operation
АТР	Automatic Train Protection
A&V	Auralisation and Visualisation
AWP	Annual Work Plan
BEMU	Battery Electric Multiple Unit
BIM	Building Information Modelling
СА	Commitment Appropriation
CAPEX	Capital Expenditure
СВА	Cost Benefit Analysis
СВМ	Condition-Based Maintenance
ССА	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
GA	Grant Agreement

Abbreviation	
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
ΙΚΑΑ	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
ITL	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
ОТМ	On Track Machine
ΡΑ	Payment Appropriation
РТО	Public Transport Operator
RAIM	Receiver Autonomous Integrity Monitoring
RCA	Reference Command Control and Signalling Architecture

Abbreviation	
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
РТС	Positive Train Control
PTI	Platform Train Interface
РТО	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
Rol	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
ТАР	Telematic Application for Passengers
TCMS	Train Control and Monitoring System
тс	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
URID	User Requirements Working Group

Abbreviation	
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 performed under the S2R programme 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.

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 2017¹

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 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.

¹ Decision N° 6/2017 of 27 October 2017

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 Members² and nineteen Associated Members³ ('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 JU⁴.

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, thorugh 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 Plan⁵ 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;
- 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;

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 <u>http://ec.europa.eu/transport/modes/rail/doc/2015-03-31-decisionn4-2015-adoption-s2r-masterplan.pdf</u>

- 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 railfocused 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 cofunded by the S2R JU in accordance with its budget availabilities and in compliance with the Horizon 2020 Regulation⁶ and its Rules of Participation⁷. 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).

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).

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

http://ec.europa.eu/research/participants/data/ref/h2020/legal_basis/rules_participation/h2020-rulesparticipation_en.pdf

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 doorto-door mutlimodal 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 Paper⁸ in terms of developing rail freight; almost doubling the use of rail freight compared to 2005, achieving a shift of 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

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

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 Roadmap¹⁰. 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. prepare the transition to the next programming period, with particular reference to the L4R projects and the incoming System Pillar.

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.

During 2021, no new Call for Proposal is foreseen to be launched under the current MFF.

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

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 finalzied 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 partiticaption of virtual presence, depending on the overall situation of the Covid-19 pandemia. Envisaged events for 2021 include InnoTrans 2021 (20-23 September), the 7th Railway Forum (7-8 September) in Berlin, SIFER 2021 (26-28 October) in Lille, and the 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 demonstations 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 Indutry Members;
- 5. together with the European Commission and other stakeholders, promote and deliver support activities for a successful European Year of Rail, to rais 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 upodated 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.

		Specific Technological demonstration of		chara	acteristics			
IP	Research Area		Market	Testing time - YEAR start	Testing time - YEAR end	Country	TRL	Overall high level focus/objective
	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
		Wireless TCMS	Metro	2022	2022	ES	6/7	Incorporate wireless technologies to the train communication network solutions (i.e. train backbong concist network and train to ground
			Regional	2022	2023	DE	6	communication).
	TD1.2 Train Control &	Drive-by-data	Metro	2022	2022	ES	6/7	Provide a train-wide communication network for full TCMS support including the replacement of train
	Monit. System		Regional	2022	2022	TBD	6	lines, connecting safety functions up to SIL4 (incl. signalling).
	(TCMS)	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 &
			Regional	2022	2022	TBD	6	integrity requirements
	TD1.3 Carbody Shell	New materials in train carbody structures	High Speed	2022	2023	ES	6	the adjacent coaches and the running gear, together with the internal interfaces of the main representative equipment of the train (HVAC, etc.)
		Sensoring functionality	Urban/Subur ban	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
	TD1.4 Running Gear		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.
IP1		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
			Generic	2019	2021	DE	6/7	Innovative wheelset guiding based on proven hydraulic actuators minimizing active control
		Bogie Control	Generic	2022	2022	TBD	6/7	Active wheelset guidance system for reduction of
			High Speed	2019	2021	ES	6	Active suspension to improve passenger comfort and
		SIL 3/4 electronic solutions for Brake Control	Urban/Regio nal	2021	2022	TBD	7	vibration reductions 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.
	TD1 5 Brakes	Innovative Friction Pair		2021	2022	TBD	7	High power and eco-friendly friction pairing solution
	101.5 brakes	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	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
	Intelligent Access system	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
	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.

	TD2 1 Advanced	markets applications	Mainline/Hig h Speed	2021	2023	FR/DE tbc	6/7	The demonstrators will be used to validate aspects
-	Communication	markets applications	Urban/Subur ban	2021	2023	UK	6/7	documents (incl. support VoIP communication) and
	System	markets applications	Regional/Frei ght	2021	2023	IT	6/7	assess them in the context of related FRMCS specifications.
	TD2 2 Automatic	feasibility of GoA2 solution	Urban/High Speed/Regio nal	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.
	Train Operation	Demonstrate the feasibility of GoA3/4 solution on actual pilot train and line	Urban/High Speed/Region al/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.
		Higher Capacity	Urban/Subur ban	2021	2023	UK	6/7	Moving Block Demonstration for Urban / Suburban,
	TD2.3 Moving Block	Higher Capacity	High Speed Railways	2021	2023	DE, FR	6/7	capacity increase on existing infrastructure,
		Lower Cost	Low Traffic Railway	2021	2023	SE, IT	6/7	compared with traditional signalling, in lab environment
	TD2.4 Safe Train Positioning	functional block integrated into an ERTMS based solution	Regional/Frei ght	2021	2022	IT	6	Under review for successful Fail Safe Train positioning demonstration innovative solution
		positionning demo	All	2021	2022	DE, ES, FR	4/6	integrated with an ERTMS based system
	2 E On board	On-Board Train Integrity	Low density traffic lines	2022	2022	CZ	6/7	On-Board Train Integrity, wired on-board communication
	Train Integrity	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	т	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/Reg ional/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
		Connected Driver Advisory System		2021	2022	IT	6	Prototype that implements the computation of speed profile and driving modalities to feed a Connected Driver Advisory System (C-DAS)
	TD2.9 Traffic management system	Conflict Prediction System	Generic	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.
IP2		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
		Verification of Wireless Low Power Object Controller		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,)
	TD2.10 Smart radio-connected all-in-all wayside	Verification of SWOC network for managing WOs demonstrator	Generic	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.
	objects	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

	TD3.1 Enhanced Switch & Crossing	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.
	System Demonstrator	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	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
	Generation Switch & Crossing	Low N&V Tramway Crossing	Urban/Subur ban	2021	2023	TBD	6/7	Test overall performance of a girder rail swing nose crossing in service for the reduction of N&V
	System Demonstrator	Materials and Components	Conoria	2019	2023	UK, SE, FR	4/7	Next generation S&C materials and components tests (<i>i.e.</i> adjustable fastening systems)
		Asphalt Track	Generic	2021	2023	UK	6/7	A site trial for demonstration to assess future assessment of asphalt performance.
		Transition zone		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
	TD3 3 Ontimised	Fastening system		2019	2023	SE	5/6	Test of a new design of fastenings system
	Track System	Innovative use of materials	Generic	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
IP3	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
		Tunnel improvements	Generic	2020	2023	FR, UK	7	Reduce track and tunnel closure by offsite manufacturing and increase quality
	TD3.5 Proactive			2020	2023	AT	7	Predict calcite clogging over time
	Bridge and Tunnel			2021	2023	TBD	6	Technology to enlarge tunnel gauge.
	Assessment,		Urban/Subur ban	2020	2023	DE	6	Efficient monitoring of noise emission and installation of passive noise dampers.
				2020	2023	UK	7	Extend bridge service life by lowering fatigue
	Demonstrator	Bridge improvements	Generic	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	Strategic long-term		2021	2022	PT, UK	6	Test of a strategical decision support tool based on the tactical planning tool
	Demonstrators Asset	Tactical and Operational short term	Generic	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
	Management (TD3.6, TD3.7, TD3.8)	Metro/ Tram Asset Management	Urban/Subur ban	2021	2022	IT	7	Demonstrator focusing on minimising maintenance costs, optimising the use of resources while maximising network
			1					

	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.
IP4		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.

	TD5.1 Fleet	Automatic coupling		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
	Automation	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	СН	6/7	Freight ATO (GoA2) use cases on ETCS Level 2 track in the open network, using ATO modules of IP2.
IP5	TD5.2 Digital Transport Management	Improved terminals	Freight	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	Core market wagon	-	2022	2023	SK	7	Modular, logistics-capable and cost-efficient, low weight, high-payload and aerodynamically optimised freight wagons
	Freight Wagon Concepts	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 int 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 Indicators¹¹ common to all JTI JUs;
- Indicators for monitoring Horizon 2020 Cross-Cutting Issues¹² 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 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 demonstrations, resulting in non-completion of	 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 + regular updated with EURID WG +

such activity in the project concerned.	 follow up of regulatory environment change management approach (EDPB) continous risk management and risk response (e.g. regular Covid risk assessment at project level)
Coupling Reporting Period with the technical	 continuous assessment of deliverables
assessment of the project progress of the work	decoupled from the Periodic Techncial
and associated deliverables leads to inefficient	Reporting sufficiently wide and qualified expertise
and ineffective implementation of the action.	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 perfrom 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

As pointed out above, no call for proposals is planned to be launched during 2021.

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

As pointed out above, no call for proposals is planned to be launched during 2021.

2.2.6 Open call for proposals for non-JU members

As pointed out above, no call for proposals is planned to be launched during 2021.

2.2.7 Call planning

Not applicable, cf. above.

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	Indicative scope	Maximum
	tender		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 activites, 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 or launch or an ad hoc procurement procedure for a framework contract with an amount ot be defined)

Number	Subject of tender	Indicative scope	Maximum budget* FUR
Total			2,750,000

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 be always 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: InnoTrans 2021 (April) SIFER 2021 (26-28 March) in Lille, the 2021 Global Public Transport Summit (6-9 June) in Melbourne, and the 7th Railway Forum (7-8 September) in Berlin. 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

As pointed out above, no call for proposals is included in the AWP 2021.

Nevetrtheless, for information purposes, to be noted that 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 participation¹³.

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.

¹³ <u>http://ec.europa.eu/research/participants/data/ref/h2020/legal_basis/rules_participation/h2020-rules-participation_en.pdf</u>

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.
 - $\circ~$ 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 interinstitutional 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 contracts¹⁴, implement existing FWC and select individual exteral experts based on a Call for expression of interest (CEI).

Indicative Title	Indicative expenditure	Type of procedure	Indicative			
	(EUR)		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	50,000	Ad-hocsupportcontracts, notfor callevaluationnorreview,based on a CEI	1Q, 2Q, 3Q and 4Q 2021			
Basic Office Furniture	<15,000	Specific Contracts/order forms implementing a FWC	1Q, 2Q, 3Q and 4Q 2021			
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 Negociated procedure for middle or low value contract	1Q, 2Q, 3Q and 4Q 2021			
Team Building and Training	20,000	Negociated 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	1Q, 2Q, 3Q and 4Q 2021			

¹⁴ 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
		FWC	

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 EC¹⁵.

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

As regards the processing of personal data, the S2R JU applies Regulation (EU) 2018/1725 of 23 October 2018¹⁶ 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.

¹⁵ 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

¹⁶ 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

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:

Key activities in 2021 – timetable	
Approve 2020 Annual Activity Report	Q1
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	Q4
and staff establishment plan	

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	
15 th Meeting of the SC. The SC would:	Q2
 Provide advice on the results achieved in the previous years and the alignment with the MAAP. 	
16 th Meeting of the SC. The SC would:	Q4
 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.	

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

14 th Meeting of the SRG. The SRG would:	Q2
 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.	
15 th Meeting of the SRG. The SRG would:	Q4
- 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.	

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

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 based on the initial amounts submitted to the Commission Services in view of the preparation of the Union Draft Budget 2021, duly updated taking into account the final budget availabilities. It 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;
- The contributions from the members other than the EU;
- The un-used appropriations from the previous years.

The revenue includes EUR 0.25 million relating to the Expert 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 till 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 0.7 million relating to the Expert 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 2021

Title		2019 Budge	et Executed	% of Budg	et 2021	2020 B	Budget	2021 E	Budget	CA Variance 202	0/2021	PA Variance 202	0/2021
Chapter	Heading	CA	PA	CA	PA	CA	PA	CA	PA	EUR	%	EUR	%
)	REVENUE												
90	CONTRIBUTIONS												
	CONTRIBUTION FROM THE EUROPEAN UNION	79.982.327	62.866.928		151%	81.839.584	75.997.838	-	41.628.016	(81.839.584)	(100,0%)	(34.369.822)	(45,2%)
900	Administrative Budget	1.661.627	1.661.627	-	134%	5.317.621	1.056.000	-	1.237.777	(5.317.621)	(100,0%)	181.777	17,2%
901	Operational Budget	78.320.700	61.205.301	-	152%	76.521.963	74.941.838	-	40.390.239	(76.521.963)	(100,0%)	(34.551.599)	(46,1%)
	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	(468.223)	(27,4%)	181.777	17,2%
902	Administrative Budget	1.661.627	1.661.627	134%	134%	1.706.000	1.056.000	1.237.777	1.237.777	(468.223)	(27,4%)	181.777	17,2%
3	UN-USED APPROPRIATIONS PREVIOUS YEARS*	1.121.332	16.728.472	13%	65%	6.131.377	3.201.048	8.913.463	25.725.253	2.782.086	45,4%	22.524.205	703,7%
930	Un-used appropriations previous years Administrative	688.899	1.033.626	12%	58%	519.521	639.699	5.603.033	1.775.741	5.083.512	978,5%	1.136.042	177,6%
931	Un-used appropriations previous years Operational	432.433	15.694.846	13%	66%	5.611.856	2.561.349	3.310.429	23.949.512	(2.301.427)	(41,0%)	21.388.163	835,0%
OTAL REV	VENUE	82.765.286	81.257.027	815%	118%	89.676.961	80.254.886	10.151.240	68.591.047	(79.525.721)	(88,7%)	(11.663.839)	(14,5%)

STATEMENT OF REVENUE

STATEME	TATEMENT OF EXPENDITURE												
Title		2019 Budge	et Executed			2020 F	Budget	2021 F	Budget	CA Variance 202	20/2021	PA Variance 202	0/2021
Chapter	Heading	CA	PA	Í		CA	PA	CA	PA	EUR	%	EUR	%
1	STAFF EXPENDITURE												
11	STAFF IN ACTIVE EMPLOYMENT	1.985.186	2.007.887	87%	88%	2.180.000	2.180.000	2.289.000	2.289.000	109.000	5,0%	109.000	5,0%
110	Temporary Agents	703.858	703.858	91%	91%	740.000	740.000	777.000	777.000	37.000	5,0%	37.000	5,0%
111	Contract Agents, Interim Staff, trainees and SNEs	1.281.328	1.304.030	85%	86%	1.440.000	1.440.000	1.512.000	1.512.000	72.000	5,0%	72.000	5,0%
13	MISSION COSTS	105.000	98.154	117%	109%	80.000	80.000	90.000	90.000	10.000	12,5%	10.000	12,5%
15	TRAINING	4.000	23.769	20%	119%	20.000	20.000	20.000	20.000	0	0,0%	0	0,0%
19	OTHER STAFF EXPENDITURE	182.814	206.307	87%	98%	197.000	197.000	210.000	210.000	13.000	6,6%	13.000	6,6%
TITLE 1 TO	JTAL	2.277.000	2.336.117	87%	90%	2.477.000	2.477.000	2.609.000	2.609.000	132.000	5,3%	132.000	5,3%
2	ADMINISTRATIVE EXPENDITURE												
20	RENTAL OF BUILDINGS AND ASSOCIATED COSTS	308.480	311.020	92%	93%	330.000	330.000	335.000	335.000	5.000	1,5%	5.000	1,5%
21	IT EXPENDITURE AND TECHNICAL FACILITIES	175.500	230.803	117%	154%	145.000	145.000	150.000	150.000	5.000	3,4%	5.000	3,4%
22	MOVABLE PROPERTY AND ASSOCIATED COSTS	1.050	1.047	11%	10%	15.000	15.000	10.000	10.000	(5.000)	(33,3%)	(5.000)	(33,3%)
23	CURRENT ADMINISTRATIVE EXPENDITURE	17.422	17.929	116%	120%	20.000	20.000	15.000	15.000	(5.000)	(25,0%)	(5.000)	(25,0%)
24	POSTAGE AND TELECOMMUNICATIONS	14.000	10.564	93%	70%	20.000	20.000	15.000	15.000	(5.000)	(25,0%)	(5.000)	(25,0%)
25	ADMINISTRATIVE BOARD EXPENDITURE	41.286	40.760	83%	82%	50.000	50.000	50.000	50.000	0	0,0%	0	0,0%
26	ADMINISTRATIVE SUPPORT SERVICES	32.630	13.226	65%	26%	85.000	85.000	50.000	50.000	(35.000)	(41,2%)	(35.000)	(41,2%)
27	PR AND EVENTS	528.386	482.687	176%	161%	300.000	300.000	300.000	300.000	0	0,0%	0	0,0%
29	OTHER INFRASTRUCTURE AND OPERATING EXPENDITURE	96.878	128.399	65%	86%	100.000	100.000	150.000	150.000	50.000	50,0%	50.000	50,0%
TITLE 2 TO	JTAL	1.215.632	1.236.436	113%	115%	1.065.000	1.065.000	1.075.000	1.075.000	10.000	0,9%	10.000	0,9%
TOTAL A	OMINISTRATIVE EXPENDITURE (Title 1 and Title 2)	3.492.632	3.572.554	95%	97%	3.542.000	3.542.000	3.684.000	3.684.000	142.000	4,0%	142.000	4,0%

STATEM	IENT OF EXPENDITURE												
Title		2019 Budge	t Executed			2020 Budget		2021 Budget		CA Variance 2020/2021		PA Variance 2020/2021	
Chapter	Heading	CA	PA			CA	PA			EUR	%	EUR	%
3	OPERATIONA EXPENDITURE												
30	OPERATIONAL EXPENDITURE	76.704.777	66.309.554	2353%	103%	80.833.819	76.203.187	3.260.000	64.339.751	(77.573.819)	(96,0%)	(11.863.436)	(15,6%)
TITLE 3	TOTAL	76.704.777	66.309.554	2353%	103%	80.833.819	76.203.187	3.260.000	64.339.751	(77.573.819)	(96,0%)	(11.863.436)	(15,6%)
4	UNUSED APPROPRIATIONS NOT REQUIRED IN CU	RRENT YEAR											
40	ADMINISTRATIVE BUDGET	519.521	784.326	16%	138%	5.301.142	509.699	3.156.811	567.296	(2.144.331)	(40,5%)	57.597	11,3%
41	OPERATIONAL BUDGET	2.048.356	10.590.594		1,49<10>%			50.429	0	50.429	0,0%	0	0,0%
TITLE 4	TOTAL	2.567.877	11.374.920	80%	2005%	5.301.142	509.699	3.207.240	567.296	(2.093.902)	(39,5%)	57.597	11,3%
											-		
TOTAL	EXPENDITURE	82.765.286	81.257.027	815%	118%	89.676.961	80.254.886	10.151.240	68.591.047	(79.525.721)	(88,7%)	(11.663.839)	(14,5%)

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	1.237.777
Title 1 and Title 2 (financial)	1.661.627	1.706.000	1.237.777
Title 3 (in-kind)	73.232.576	68.350.896	0
TOTAL CONTRIBUTIONS	154.876.530	151.896.480	1.237.777

CONTRIBUTIONS OVERVIEW	2018	2019	2020
CONTRIBUTIONS FROM THE UNION (incl EFTA)	79,227,979	79,982,327	81,839,584
Title 1 and Title 2 (financial)	1,661,839	1,661,627	5,317,621
Title 3 (financial)	77,566,140	78,320,700	76,521,963
CONTRIBUTIONS FROM MEMBERS OTHER THAN THE UNION	52,478,408	96,577,524	73,939,913
Title 1 and Title 2 (financial)	1,661,839	1,661,627	1,706,000
Title 3 (in-kind)	50,816,569	94,915,897	72,233,913
TOTAL CONTRIBUTIONS	131,706,387	176,559,851	155,779,497

Schedule of Payments in 2021

	Commitment A	Appropriations	Payment Ap	propriations	
	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	3.156.811	3.684.000	3.684.000	3.156.811	
2021 Work Plan Operational		3.310.429	1.655.215	1.655.215	
Total	127.343.389	6.994.429	68.023.751	66.314.067	

3.2 Staff Establishment Plan

Establishment plan posts

Temporary posts

Establishment pla	n posts							
dn		20	19		20	20	20	21
tion gro d grade	Authorise	ed Budget	Filled as of 31/12/2019		Authorise	ed Budget	Authorised Budget	
Funct an	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	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 III – Indicators and Scoreboard of KPIs

4.1.1 TABLE I - Horizon 2020 Key Performance Indicators¹⁷ 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	Automate d
ADERSHIP	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. [<u>new</u> <u>approach</u> under H2020]	50%	Yes
INDUSTRIAL LE	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. [<u>new</u> <u>approach</u> 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	H2020 beneficiaries through project reporting; Responsible Directorate/Service (via access to appropriate bibliometric databases)	n.a. [<u>new</u> <u>approach</u> under H2020]	[On average, 20 publications per €10 million funding (for all societal	Yes

¹⁷ (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	Automate d
			bibliometric databases.			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. [<u>new</u> <u>approach</u> under H2020]	On average, 2 per €10 million funding (2014 - 2020) RTD A6	Yes
16	Number of prototypes testing activities and clinical trials ¹⁸	Number of prototypes, testing (feasibility/demo) activities, clinical trials	Reports on prototypes, and testing activities, clinical trials	H2020 beneficiaries through project reporting	n.a. [<u>new</u> <u>approach</u> 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. [<u>new</u> <u>approach</u> under H2020]	<u>[To be</u> <u>developed on</u> <u>the basis of</u> <u>first Horizon</u> <u>2020 results]</u>	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

¹⁸ 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	Automate d
	NA	Time to inform (average time in days) <u>all applicants</u> 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
EVALUATION	NA	Time to inform (average time in days) <u>successful applicants</u> 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	Automate d
SLI	NA	Error rate		% of common representative error; % residual error	CAS	n.a. [new approach under H2020]		Yes
AUD	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 ¹⁹	Joint Undertaking	n.a. [new approach under H2020]		

 $^{^{\}rm 19}$ 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	Automate d
FFICIENCY	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
JU E	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.

4.1.2 TABLE II - Indicators for monitoring H2020 Cross-Cutting Issues²⁰ common to all JTI JUs

spondence le general nnex 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	
Corre in th A	100000						Automated
2		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
	participation	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	Widening the	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

²⁰ (based on Annex III to Council Decision 2013/743/EU)

spondence e general mex 2	Cross- cutting	Definition/Responding to question	Type of data required	Data to be provided by	Data to be provided in/to	Direct contribution to ERA	
Corre in the Aı	15500						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		6.1 Percentage of women participants in H2020 projects	Gender of participants in H2020 projects	H2020 Beneficiaries through project reporting		YES	Yes
	der	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
	Gend	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	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
	International	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

spondence è general mex 2	Cross- cutting	Definition/Responding to question	Type of data required	Data to be provided by	Data to be provided in/to	Direct contribution to ERA	
Corres in the An	issue						Automated
9	y to market ²¹	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
	ing from discover	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	Bridg	Scale of impact of projects (High Technology Readiness Level)	Number of projects addressing TRL ²² between(4-6, 5-7)?	Joint Undertaking	JU AAR RTD Monitoring Report		
11	r 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
	Private secto	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		Yes

²¹ This indicator (9.2) is initially intended to monitor the Digital Agenda (its applicability could be only partial) ²² TRL: Technology Readiness Level

respondence 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	
Coi in							Automated
					Report		
12		12.1 EU financial contribution for PPP (Art 187)	EU contribution to PPP (Art 187)	Responsible Directorate/Service	JU AAR RTD Monitoring Report		Yes
	Funding for PPPs	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	Participatio n patterns of independent	14.2 Proposal evaluators by country	Nationality of proposal evaluators	Responsible Directorate /Service/Joint Undertaking in charge with the management of			

spondence te general nnex 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	
Corre in th A	100 40						Automated
				proposal evaluation			
		14.3 Proposal evaluators by organisations' type of activity	Type of activity of evaluators' organisations	Responsible Directorate /Service/Joint Undertaking in charge with the management of proposal evaluation		YES	
NA	Participation of RTOs and Universities	Participation of RTO ²³ 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) ²⁴	Responsible Directorate /Service/Joint Undertaking	JU AAR RTD Monitoring Report		

Notes:

*H2020 applicants - all those who submitted H2020 proposals

 ²³ RTO: Research and Technology Organisation
 ²⁴ Data relates to pre-granting ethics review. This time span runs in parallel to granting process.

*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 Executive Agencies and other external bodies in charge with H2020 activities

*Services -

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

4.1.3 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-	Reduce the negative externalities linked to railway transport	JU	"State-of-the-art" 2014	> 3 - 10 dBA	No

#	Key Performance Indicator	Objective	Data to be provided by	Baseline at the start of H2020	Target at the end of H2020	Automated
	the-art" 2014					
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- scale demonstration activities	JU	tbd in the Multi-Annual Action Plan		Yes
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

4.1.4 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	7	P	unctuali	ty	
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

4.2 ANNEX IV – List of Members of S2R JU other than the Union

NAME OF MEMBER	CONSTITUENT ENTITIES OF CONSORTIA	COUNTRY
	AERNNOVA AEROSPACE S.A.U.	ES
AERFITEC Consortium	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
	Contraffic GmbH	DE
	Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)	DE
Consortium (CEW)	Waggonbau Niesky GmbH	DE
	<i>Centro de Estudios e Investigaciones Técnicas (CEIT)</i>	ES
	Verband der Bahnindustrie in Deutschland (VDB)	DE
Construcciones y Auxiliar de Ferroo	carriles	ES
Deutsche Bahn AG		DE
CS Group		FR
	Infraestruturas de Portugal, S.A.	РТ
Furencen Reil Operating	BLS AG	СН
community Consortium (FUROC)	СР	РТ
	Finnish Transport Agency	FI
	ÖBB-Infrastruktur AG	AT

NAME OF MEMBER CONSTITUENT ENTITIES OF CONSORTIA		COUNTRY
	Polskie Koleje Państwowe S.A. (PKP)	PL
	PRORAIL B.V.	NL
	Schweizerische Bundesbahnen (SBB)	СН
	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	ì	AT
Knorr-Bremse Systems für Schiene	nfahrzeuge GmbH	DE
MER MEC S.p.A		П
Network Rail Infrastructure Limite	d	UK
Siemens Aktiengesellschaft		DE
	Strukton Rail BV	NL
	ACCIONA INFRAESTRUCTURAS SA	ES
Smart DeMain (SDM) consortium	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
	Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)	DE
Smart Rail Control (SmartRaCon) consortium	Centro de Estudios e Investigaciones Técnicas (CEIT)	ES
	FONDATION DE COOPERATION SCIENTIFIQUE RAILENIUM	FR

NAME OF MEMBER	CONSTITUENT ENTITIES OF CONSORTIA	COUNTRY
	Nottingham Scientific Ltd	UK
Société Nationale des Chemins de	Fer Français Mobilités (SNCF Mobilités)	FR
	FONDATION DE COOPERATION SCIENTIFIQUE RAILENIUM	FR
	UNIVERSIDADE DO PORTO	РТ
	TATASTEEL	FR
	UNIVERSIDAD DEL PAIS VASCO	ES
Swiltrackon concortium	UNIVERSIDADE DO MINHO	РТ
Swi fracken consortium	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
	Kompetenzzentrum - Das virtuelle Fahrzeug, Forschungsgesellschaft mbH (Virtual Vehicle)	AT
	FCP Firtsch, Chiari & Partner ZT GmbH	AT
	Getzner Werkstoffe GmbH	AT
Virtual Vehicle Austria	Kirchdorfer Fertigteilholding GmbH	AT
consortium+ (VVAC+)	Plasser&Theurer GmbH	AT
	voestalpine Schienen GmbH	AT
	voestalpine VAE GmbH	AT
	Wiener Linien GmbH & Co KG	AT
	AVL List GmbH	AT

NAME OF MEMBER	CONSTITUENT ENTITIES OF CONSORTIA	COUNTRY
	PJM Messtechnik GmbH	AT
	TATRAVAGONKA a.s.	SK
	AC2T research GmbH	AT
	Materials Center Leoben Forschung GmbH	AT