UNIFE Position Paper on Digitalisation of Railways

1. Objectives of the Position Paper

The objective of this paper, developed by the UNIFE Digital Platform, is to clarify the position of the rail supply industry with respect to the rail digital transformation and to set the priorities and targets for the short and long term, as basis for further engagements with the EU institutions and the other rail stakeholders.

2. UNIFE and the Digital Railways

Based in Brussels since 1992, UNIFE is the association representing the European rail supply industry at the EU and international level. UNIFE gathers over 85 direct company Members – from numerous SMEs to major industrial champions from all over Europe – active in the engineering, design and manufacture of rolling stock (i.e. trains, metros, trams, freight wagons) as well as rail signalling and infrastructure equipment. UNIFE also brings together national rail industry associations from no less than 14 European States.

To promote the rail industry expertise in digitalisation and better respond to the current digital challenges, UNIFE set-up a digitalisation platform at the end of 2015 bringing together a large number of UNIFE members.

3. Challenges of the European Rail sector

Seizing on the opportunity for a huge modal shift to rail, the rail sector adapts continuously to new market demands by focusing on the customer experience, new operating plans and its technology requirements. To remain competitive and meet the challenge projected by the European Commission of rail being the backbone of transport in Europe, the whole European rail sector combines its efforts towards the goal of being closer to end users' expectations of rail services. To attract new customers, rail capitalises on its strengths: its absolute commitment to safety, its global leadership in high speed line services, its traffic management systems technology and telematics. As a main facilitator of mobility and a fundamental part of the transport system, rail also offers reliable and efficient services for the benefit of multi-modal and seamless door-to-door journeys.

However, the rail sector faces huge challenges. New competitors coming from Asia shake historical European leadership, and the rail industry must improve its competitiveness continuously. Competitive modes of transport (e.g. low cost airlines or buses) are becoming a credible alternative to main-lines transport. Furthermore, the increasing success of new business models (e.g. Uber, BlablaCar) is changing the roles and the positions of the stakeholders in the mobility landscape. And the needs of the citizens are also drastically changing, with commuting mobile apps, real-time information which become part of the everyday life and which conduct the passengers to ask for the same level of services for their end-to-end journey.

The digital transformation is affecting the way the transport sector deals with user information, payments, integration and automation. Well-established in metro systems, automation is now explored in cars, buses and trucks. Big Data, Internet of Things, Industry 4.0. and robotics, as well as smart infrastructure are all contributing to rapid changes.

We can identify at least six disruptive trends that the transport sector will have to master:
- The transport networks will become integrated and intelligent and they will be able to sense load and demand, adjust capacity, measure performance, monitor and identify the maintenance needs of the physical assets;
- Transport of goods and passengers will become more user-centred. This will affect the planning and operation of the transport systems, which will have to respond to users' choices, priorities, data flows. The real-time information about the transport networks will become personal. New mobility services will create new markets and multi-modal journeys will become more integrated. This will require change in existing business models, data access and availability. The interface with customers will be key in making travel/transport of goods more convenient and flexible, as well as personal;
- Automation and safety will benefit from the increased capacity to anticipate risks. Automation will impact significantly infrastructure capacity. Road safety could increase significantly thus challenging the railway sector even more;
- Pricing and payments will be transformed thanks to the rapid changes in the financial sector, with digitalisation of tickets and payments becoming the norm;
- New private transport sector entrants will use different peer-to-peer models, digital and mobile technology, and take benefit of low costs and the availability of open data to scale regionally and globally. New services and applications will continue to emerge fast based on new data-driven business models;
- Cyber-security issues will become one of the main challenges stemming from this digital transformation, as the intensive usage of digital data and communication links will increase the cyber-vulnerability of the systems.

For the rail sector, this digital transformation is at the same time a threat and an opportunity. It can be seen as a threat because it transforms the roles and the business models. From a rigid value chain linking suppliers, integrators and end-users, the sector is evolving towards dynamic networks with added-value, joining suppliers, integrators, technological platforms, mobility service provider, clients in permanent interaction.

But the potential benefits are as huge as the challenges. For instance, a study by Roland Berger estimates that the rolling stock maintenance costs as a major portion of operation costs or rail companies could be potentially lowered by 20% if digitization is properly understood and implemented.[1] And it will become an opportunity only if the rail sector is able to transform itself: answering better to the end user needs, letting apart the silo modes, becoming more agile, and

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[1] Roland Berger. On the digital track: Leveraging digitization in rolling stock maintenance, June 2016. http://www.rolandberger.com/media/pdf/Roland_Berger_TAB_RailMaintenance_20160624.pdf

using fully (and sharing) all the data generated by the transport operations, coming from the fixed assets, the transport offer (real time circulation) or the demand (passengers).

4. The key role of the European Rail Supply industry in digitalisation

The diffusion of IT and enabling technologies in the rail industry is still at an early stage and sometimes slower than in other transport sectors. However, the European rail supply industry plays already a key role to develop digital railways. UNIFE Members heavily contribute to digitalising the sector, bringing on the market expertise on the field, technologies of excellence and innovation in the digital domain. Railway sector was among the first to implement digital technologies, as exemplified by the automated metros in many European cities, or ERTMS/ETCS for the main line.

The existing use of the digital technologies is already covering many aspects:

- Contribution to the Railway performance
  - Signaling solutions, with ERTMS/ETCS, and CBTC for urban rail;
  - Traffic management systems to increase the capacity and make a better use of the network;
  - Energy management solutions which is a high political priority;
  - Digital based maintenance, with monitoring and diagnosing tools (incl. Development of sensors, asset management);
  - Cyber-security, a needed complement of digitalization;
  - Physical security, and specifically Video system, including software image recognition, situational awareness;
  - Communication solutions, including onboard safety related (TCMS);
  - Use of Internet of Things;
  - Big data applications, including business analytics.
- Improvement of end customer's satisfaction
  - Infotainment (internet on board);
  - (Real time) passenger information solutions, new apps, new HMI;
  - Seamless access to all travel services;
  - e-ticketing and/or various rights to travel;
  - Digital tracking/tracing applications (for freight and passengers).
- Internal digital transformation of the Railway manufacturing industry
  - Industry 4.0 with automation of production, of the supply chain and collaborative workplaces;
  - Digital based design and/or production (Simulation, Collaborative design), virtualization.

Moreover, additional developments will come from the Shift2Rail initiative. Indeed, Shift2Rail is based on a work programme composed of five Innovation Programmes (IPs) and six cross-cutting work areas aiming at increasing the railway capacity and reliability and reducing the life-cycle cost of the system. Digital transformation is not identified as such as an objective within

Shift2Rail. However, several Shift2Rail Technology Demonstrators will contribute to the digitalisation of the railway:

- IP1 – Cost Efficient and Reliable Trains: IP1 will push the digitalisation of the relevant subsystems and equipment of the train (traction, running gear, TCMS, brakes, Doors), which will produce new data useful for the improvement of several aspects of performance (energy, maintenance, operation...). Extended communications capabilities, both internal and external to the train, will be developed using new technologies such as wireless. Additionally, safety critical functions currently based on conventional technologies (brakes, safety loops...) will be transferred to digital platforms;

- IP2 – Advanced Traffic Management and Control Systems: IP2 focuses on innovative technologies, systems and applications in the field of telecommunication, train separation, supervision, engineering, automation and security, aiming at maintaining ERTMS as a solution for railway signalling and control systems across the world. Most of the IP2 outputs (e.g. Adaptable Communication, Moving Block, Fail Safe Train positioning, Cyber Security…) will contribute to the digitalisation of the railway system. In addition, the Integrated Mobility Management developed in Cross Cutting Activities will extend the functionalities of the Traffic Management System developed in IP2;

- IP3 – Cost Efficient and Reliable Infrastructure: IP3 focuses on innovative technologies, systems and applications in the field of infrastructure and energy, aiming notably at improving track performance, management of maintenance activities (e.g. predictive maintenance) and energy efficiency. Most of the IP3 outputs (e.g. Next Generation Switches & Crossings, Next Generation Track System, Dynamic Railway Information Management System, Railway Integrated Measuring and Monitoring System, Smart Metering for railway distributed energy resource management system…) will contribute to the digitalisation of the railway system;

- IP4 – IT Solutions for Attractive Railway Services: IP4 focuses on innovative technologies, systems and application in the field of IT. IP4 will propose more innovative, attractive and end-users oriented rail services and a general framework for multimodal transport. Most of the IP4 outputs (e.g. Ticketing, Travel Companion, Trip Tracker…) will contribute to the digitalisation of the railway system;

- IP5 - Technologies for Sustainable and Attractive European Rail Freight: thanks to new digital features, IP5 will boost the productivity and the punctuality of the freight transport. IP5 will develop innovative methods to automate the coupling of the trains and to propose more resilient time-table planning. IP5 will also improve condition monitoring for predictive maintenance.

Beyond this status, the rail supply industry is committed to extend this effort, aiming to develop technological and organisational arrangements maximising capacity and reliability:

- More real-time resilient, adaptive and available railway system components, leading to a highly performant system which is a prerequisite for the development of track capacity and network performances; business continuity, optimised by IT based real-time traffic management, maximising capacity, conserving energy and minimising inconvenience to the

passenger and the freight user; optimised recovery solutions and reduction of in-service failure;

- IT innovations foster highly adaptive and (semi)automated railway operation and technical support, including vehicle and infrastructure, as for operation that for condition monitoring and maintenance, thereby enhancing system resilience, including facing cyber-attacks from different origins, reliability and cost efficiency and improving customer service;
- Digitalisation and IT innovation technologies will lead for the railways, IM's, RU's and suppliers to a major culture change in order to operate the railway, to maintain a safe, secure and available traffic, to promote continued improvement of every aspect of the passenger's trip and of the freight shipper's experience along the supply chain.

UNIFE strongly believes that the digital transformation will benefit the end-users and the complete sector and will make railways more attractive and competitive: the rail supply industry is keen to contribute to achieve common objectives for the railway sector as whole.

5. European initiatives and political context

Legislation and regulation at the EU level should be supporting the digital transformation of the transport sector, while also providing the necessary safeguards. The Digital Single Market is one of the 10 European Commission political priorities, as stated in the EC Communication "A Digital Single Market Strategy for Europe", published on 6 May 2015. The "e-Transport" chapter of the Communication rightly stresses: "digitalisation and better integration of existing tools can significantly improve transport and traffic management and open up a wide range of opportunities". As Violeta Bulc, European Commissioner for Transport, outlined in her speech in the European Parliament on 23 May 2016, digitalisation is one of six content drivers of her mandate, along with decarbonisation, globalisation, people-focused solutions, innovation and investment - "all with a strong motivation to seize growth opportunities and generate conditions for high value jobs, including new ones."[2]

UNIFE fully agrees with the Commission that deployment of ITS technologies in the transport sector has the potential to create new growth, more efficient transport networks, more efficient logistics and better use of the existing infrastructure. UNIFE has been actively engaged and contributing to the work of DG MOVE for the definition of a new EU Strategy for a "Digital Single European Railway Area". UNIFE will also continue to work with the European Commission as a Member of the Digital Transport and Logistics Forum (launched on 1st July 2015) that aims to foster a more efficient exchange of information in freight transport and logistics.

In view of the different existing initiatives for fostering the dialogue between the railway sector and the Commission (such as PRIME or RU Dialogue) which all have subgroups on digitalisation, **UNIFE calls on the Commission to establish an overarching platform on digitalisation that would incorporate all sector stakeholders, including European rail supply industry.**

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[2] Speech by Transport Commissioner Violeta Bulc on her vision for investment in Transport, Brussels, European Parliament, 23 May 2016

6. UNIFE priorities and recommendations

In order to better responding to a need for greater cooperation within industry, the UNIFE Digital Platform has identified the following priorities:

6.1 Improving end-user's experience

One of the UNIFE priorities for end-user experience is the improvement of information exchange for the benefit of end-users (passengers, forwarders, shippers, retailers, ticket vendors…) by **implementing TAF/TAP TSI** according to standardized messaging generated by Infrastructure Managers and/or Railway Undertakings. Standard messaging is provided by means of a common interface with defined attributes. Starting from this "raw" TAF/TAP TSI format, the market can develop digital services and user-friendly applications installed on smart devices, laptops, etc.

The objective is to improve the availability, accessibility and accuracy of such information and to propose it in real time. In addition, the interconnection of TAP/TAF TSI with standards coming from other transport modes must be further developed in order to foster multi-modal real time information and services, as it is proposed in Shift2Rail IP4.

6.2 Enhancing the security of the rail system

In UNIFE point of view, the rail system must maintain a high reliability/safety and operational continuity standards, and focus on a better resilience against cyber-attacks:

- Improve Information Security Requirements, adding Authenticity, Verifiability and Non-Repudiation to classic CIA (confidentiality, integrity, availability);
- Increase System Integrity (statically for equipment/networks, dynamically for data and control dataflow) used within all fields of railway industry;
- Establish zone models based approaches with boundaries/gateways for segmentation of critical data and control data flow from non-critical ones for all of railway industry;
- Establish monitoring and event detection methods and technology based on gateways and frameworks to become aware of potential attacks.

These objectives must cope with operational and safety aspects as well as authorisation activities.

In order to achieve this, UNIFE has identified a list of possible actions and cooperation with the other sector stakeholders:

- Foster the common understanding of Cyber Security threats and derived countermeasures to create feasible approaches with a good chance for interoperability; develop information and exchange networks of Cyber Security experts on supplier and operator sides at international level, including a view on methods, processes and best practices; enhanced collaboration among Vendors, Industries, Institutions and Governments (and e.g., with National CERTs), for greater interoperability and information sharing;

- Explore the need for specific Regulations and International Standards/Policies at EU level for Signalling Critical Infrastructures (similar to what already happens with e.g. Energy);
- Railway operators are considered by the EC as Operator of Essential Services. It is the interest of the Railway industry to cooperate with EC initiatives:
  - ENISA (European Union Agency for Network and Information Security) on technologies and methodologies;
  - Exchange on incidents on the CSIRT network (Computer Security Incident Response Team);
  - Cooperation with standardisation and regulation bodies, namely: EUAR, Cenelec.

6.3 Better use of the existing infrastructure

The two main objectives in this field are ERTMS and Predictive Maintenance.

ERTMS, the European Rail Traffic Management System, remains one of the key priorities for UNIFE, which continues to advocate for an increased availability of funds for supporting the deployment of ERTMS in Europe. The midterm review of the Multiannual Financial Framework should be used as an opportunity to increase the grant amounts available for this purpose in the Connecting Europe Facility (CEF).

On the technical side, 2016 marked a turning point for the roll-out of this digital technology. The European Commission adopted in May 2016 the second release of the Baseline 3 (ETCS) specifications and at the same time the rail sector agreed to a period of stability: in practice, stakeholders, together with the European Union Agency for Railways, agreed not to issue any further formal release of the ERTMS specifications until at least 2022.

In parallel, the sector issued an "ERTMS Long Term Strategy" adopted by the Member States in February 2016. This strategy aims at detailing the different additional features which are, from a business perspective, needed by the railway undertakings and infrastructure managers in order to boost capacity, reduce maintenance cost, reduce energy consumption and further optimise traffic management. These additional features, referred to as "game changers", are as follows:

"Game Changer"	Justification
ETCS Level 3	Increase of capacity and/or reduction of trackside life cycle costs due to the removal/decrease of train detection systems to be installed;
Automatic Train Operation (ATO)	Reduction of energy consumption and/or increase in capacity due to optimal train speed setting and/or more robustness in operation;

Next Generation Communication System(s)	Obsolescence management and potential reduction in costs due to non-dedicated railway radio communication technology/network model and/or potential use of capacity increase due to increased spectrum efficiency;
Satellite positioning	Potential reduction in deployment and maintenance of balises and improved performance due to more accurate odometry;

These "game changers" will play an important role for the future of ERTMS. Shift2Rail (via Innovation Programme 2) will also play an important role in ensuring the coordinated development of these new features.

The second key objective is the predictive railway maintenance which is currently characterised as follows:

- A huge number of monitoring and measuring information systems are currently available in the EU railways, designed as independent tools, each of them dealing with individual and isolated areas of the maintenance process thus making difficult the fusion of information and the optimal exploitation of big data analysis;
- Typically, applied maintenance is still periodic preventive maintenance based on good practices established a long time ago, simply integrated by targeted interventions when faults appear. Useful information for prognostic is often never used and hence the development of the predictive capability has been on a more moderate level;
- Stakeholders' environment is becoming more and more complex due to the increasing amount of parties - often with conflicting priorities - involved in infrastructure operation and maintenance;
- Research and innovation results are showing that maintenance performances are linked to many heterogeneous parameters, most of them not yet taken into account in the maintenance process.

From all the above, it is clear that a step change in asset management has to be delivered through innovative technologies, new economic models, and enhanced standards in the rail sector meeting the best practice set out in ISO55000 "International Standards for Asset Management".

To this end, the following interlinked steps are necessary:
- Design and develop practical software solutions to achieve a seamless interface with existing maintenance-related information between the different railway stakeholders;
- The digitalisation and integration of the different sources of information shared between stakeholders (data producers and data users) shall be the basis for the exploitation of the increased possibilities of analysing big data sets for the nowcasting and forecasting of assets' condition and diagnosis towards risk-based predictive maintenance;
- Remove the drawbacks of current decision-making procedures by

o Adopting an integrated system fully exploiting information and knowledge extracted from available data;

o Moving from reactive and preventive maintenance to predictive maintenance based on nowcasting and forecasting of asset condition and diagnosis;

o Advancing to risk-based decision-making, considering risks as parameters to be controlled and influenced.

In order to guarantee an efficient management of the information dealt with, and a good exploitation of the data available, the railway sector needs a harmonised framework and appropriate mechanism supporting the digitalisation of information and knowledge exchange.

6.4 Better accessing and using data

Access to data (for passengers, operations, asset, etc.) is a key point to develop further the railway sector.

Ownership, access and usage of data must be clarified between all actors of the sector. As pointed out in the EC Communication "Digitising European Industry: Reaping the full benefits of a Digital Single Market" (19 April 2016), "ownership and use of data generated in an industrial context are major areas of concern" for the Commission (while personal data protection is ensured by the General Data Protection Regulation, together with the ePrivacy Directive).

There is a need to find a sector agreement and adequate rules for data sharing that is necessary to allow railway sector to grow; all stakeholders should work together with this objective. The Commission should undertake a leading role in this process under the forthcoming 'Free flow of data' initiative that will address the issue of ownership, interoperability, usability and access to data in situations such as business-to-business, business to consumer, machine generated and machine-to-machine data. As outlined in the EC Communication "A Digital Single Market Strategy for Europe", the Commission wants to encourage access to public data to help drive innovation.

Recommendation/action: one of the key objectives of the railway sector platform on digitalization proposed above should be having a consolidated view on data ownership and find a sector agreement on data sharing that would establish a good business model, ensuring a win-win situation for all stakeholders (e.g. a framework agreement).

7. Next Steps

UNIFE believes that to reach the digitalisation of the railway sector in Europe a cooperative approach by all stakeholders is essential: agree on common priorities, fix common and individual objectives, establish a sector roadmap and a shared deployment plan are the only way to achieve the digital transformation that the sector needs.

In order to achieve that, UNIFE is willing to establish a permanent dialogue with the sector stakeholders and decision makers; this includes the other sector associations such as EIM, CER, UIC, UITP, etc. and the European institutions, in particular the European Railway Agency and the relevant Directorates-General of the European Commission. In the short term, UNIFE would like to engage in close cooperation with other rail stakeholders on two particular topics:

- Cyber Security threats;
- Access to data that would allow to achieve greater efficiency.

UNIFE also expect the EU institutions to be a strong supporter for the digitalisation of the railways, following the fact that digitalisation of transport is one of the top priorities of European Commissioner for Transport Violeta Bulc's mandate. Legislation and regulation at the EU level should be supporting the digital transformation of the transport sector, while also providing the necessary safeguards. UNIFE is therefore requesting the European Commission to build a clear road map on digitalisation.

UNIFE also calls for the EU institution to support the establishment of a sector platform for digitalisation (as requested in section 5), that would allow the discussion of vital points such as:

- Objectives and priority;
- Establish roadmap and a shared deployment plan;
- Have a consolidated view on data ownership and find a sector agreement on data sharing (as requested in section 6);
- Clarify the sector view and needs in terms of: standardisation, research, regulations.

While the CEF has provided a significant financial support to the digitalisation of the railways through the deployment of the ERTMS in Europe, after the first two CEF Transport calls there is currently no grants foreseen in the current financial period. In this context, the midterm review of the Multiannual Financial Framework should be used as an opportunity to increase the resources for the CEF grants available for the deployment of ERTMS.

Other EU funding and financing instruments, including the European Structural and Investment Funds, the European Fund for Strategic Investments (EFSI), as well as the European Investment Bank's lending facilities, should be mobilised in support of the digitalisation of the railway sector.

UNIFE also calls the EU on allocating more EU funding for railway research focused on digitalisation in the future Research Framework Programme (after Horizon 2020) and to ensure that Shift2Rail will be followed by a second Rail Joint Undertaking (e.g. SHIFT2Rail n°2) which will address the railway digitalisation priorities not covered by Shift2Rail or others European research projects.

For further questions, please contact

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