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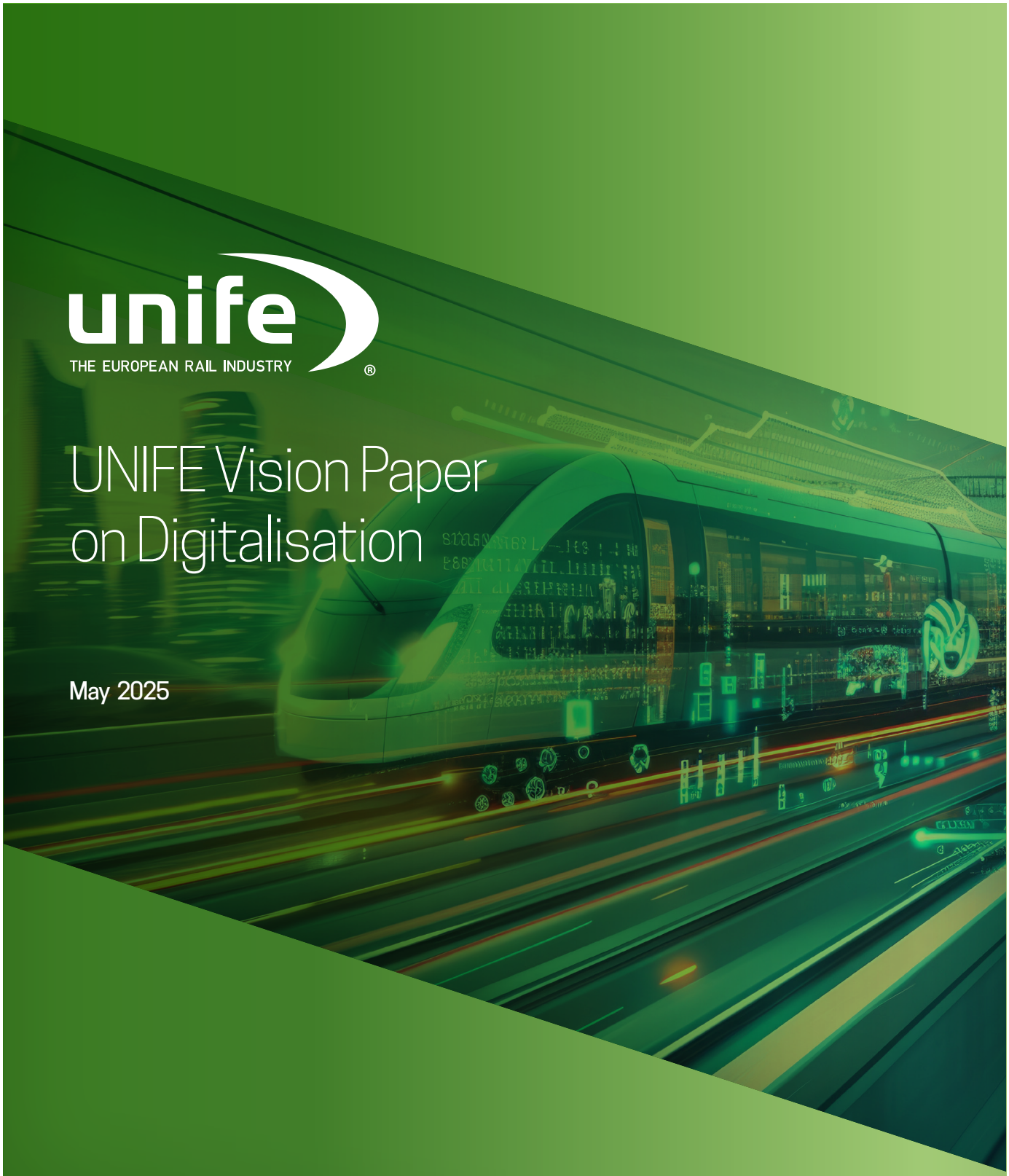
THE EUROPEAN RAIL INDUSTRY

UNIFE Vision Paper on Digitalisation



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UNIFE – The European Rail Supply Industry Association

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EXECUTIVE SUMMARY

The digitalisation of rail transport is essential for achieving the EU's sustainability, competitiveness, resilience, and security goals. While rail is the most sustainable transport mode, it faces challenges like inefficiencies, capacity constraints, and maintenance needs that digitalisation can address. The EU rail supply industry is committed to innovation, developing cutting-edge solutions to modernise rail infrastructure, services, networks, and rolling stock, while accommodating a growing demand for rail travel. Advanced technologies like artificial intelligence (AI), digital twins, and data-driven solutions will optimise energy use, improve performance, reduce costs, and future-proof rail infrastructure against climate risks.

EU policy and funding can play a pivotal role in accelerating and scaling the digital transition of the entire rail ecosystem, unlocking greater value from technological advancements and facilitating progress for the sector. Key initiatives, including the revision of EU Public Procurement Directives, the 2027-2034 Multiannual Financial Framework, and the implementation of the TEN-T regulation, present significant opportunities to promote the adoption of transformaTive rail technologies such as AI and digital twins, which are central todelivering on the EU's objectives for the 2024-2029 political cycle. In summary, UNIFE is proposing the following policy recommendations:

TOPIC	RECOMMENDATIONS
Multiannual Financial Framework (MFF) 2028 – 2034 and Connecting Europe Facility (p. 11)	Incorporate substantial funding for transformative technologies (DAC, FRMCS) and ensure continuity between ongoing and new initiatives. Reward best practices in digitalisation for the design, construction, and operation of rail infrastructure leading to improved, data-driven infrastructure outcomes.
Implementation of the revised TEN-T Regulation (p. 12)	Promote best practices and knowledge sharing on how data-driven technologies like AI and Digital Twins can accelerate the deployment of the TEN-T, improve planning (particularly for multimodal hubs and resilience against extreme weather events), and ensure overall compliance with the regulation.
Revision of the EU public procurement directives (p. 12)	Modernise procurement rules to promote digitalisation and sustainability, effectively using the Most Economically Advantageous Tender (MEAT) and non-price criteria, especially for digital technologies (Digital Twins, AI and connected data environments).
EU Competitiveness Compass and rail (p. 13)	Leverage policy initiatives such as the *EU High-Speed Rail Plan*, the *Sustainable Transport Investment Plan*, and the *EU Climate Adaptation Plan* to promote the adoption of advanced rail technologies and encourage the digital transition of the rail sector.
Implementation of Data Act – Impacts on Data Sharing (p. 13)	Expand the Rail Data Space providing a structured and secure ecosystem for managing, sharing, and utilizing data with appropriate commercial safeguards. This will support compliance with the EU Data Act and help unlock the full potential of data-driven technologies.
Implementation of Cyber Resilience Act (p. 14)	Ensure smooth implementation of the Cyber Resilience Act (CRA) in the rail sector by defining the scope more clearly, preventing cost escalation, and ensuring cybersecurity without disrupting sustainable transport and industry operations.

Image credit: CAF

DIGITALISATION OF RAIL: A KEY DRIVER FOR EU COMPETITIVENESS, RESILIENCE AND SUSTAINABILITY

Digitalisation is not only about "making digital" information already available in analogue format. More importantly, it involves uncovering and generating new digital information that was previously inaccessible or unnoticed. In these terms, digitalisation means creating insights, and therefore value, from raw data. In the rail sector, the power of generative AI algorithms combined with data related to the state of infrastructure, the operating conditions of electronic/electrical/mechanical components, environmental conditions, or user movement patterns can optimise energy consumption, performance and maintenance. This, in turn, reduces costs, intervention times and prevents disruptions.

As Europe confronts the pressing challenge of reducing carbon emissions and promoting sustainable transport solutions, rail emerges as a beacon of hope within the EU's transportation framework. Rail aligns with the broader *European Green Deal* and the *Fit for 55 package*, offering a promising future for sustainable transport. The *European Green Deal* establishes a crucial goal of reducing transport-related greenhouse gas emissions by 90% by 2050. **Rail transport remains the most sustainable mode of transport.**

The digitalisation of rail is therefore central for the EU to deliver on its carbon neutrality objective set for

2050, whilst enhancing the EU's resilience, security, and competitiveness objectives:

Strengthening European competitiveness

An efficient and digitised rail system ensures a well-functioning single market and a thriving EU economy. Advanced rail technologies can eliminate inefficiencies and enhance overall connectivity by facilitating the seamless movement of goods, services, and people across the EU. This promotes economic integration within the EU and strengthens supply chains, enhancing the EU's competitiveness in a fast-evolving and complex global market.

Advancing Europe's sustainability agenda

By digitalising rail, energy consumption is reduced, emissions are lowered, and the capacity of existing tracks is increased – allowing more trains to operate safely and smoothly. Digitalisation of rail travel enables quicker journeys over longer distances, which encourages a shift of both passengers and freight to rail, the most sustainable mode of transport. Additionally, digitalisation optimises energy consumption and resource management through proactive maintenance and improved risk preparedness. In the EU, although rail accounts for roughly 5% of intra-EU passenger transport and 11% of freight transport, it represents only 1.5% of the energy consumed by all transport activities and 0.4% of the transport sector's greenhouse gas emissions.[1]

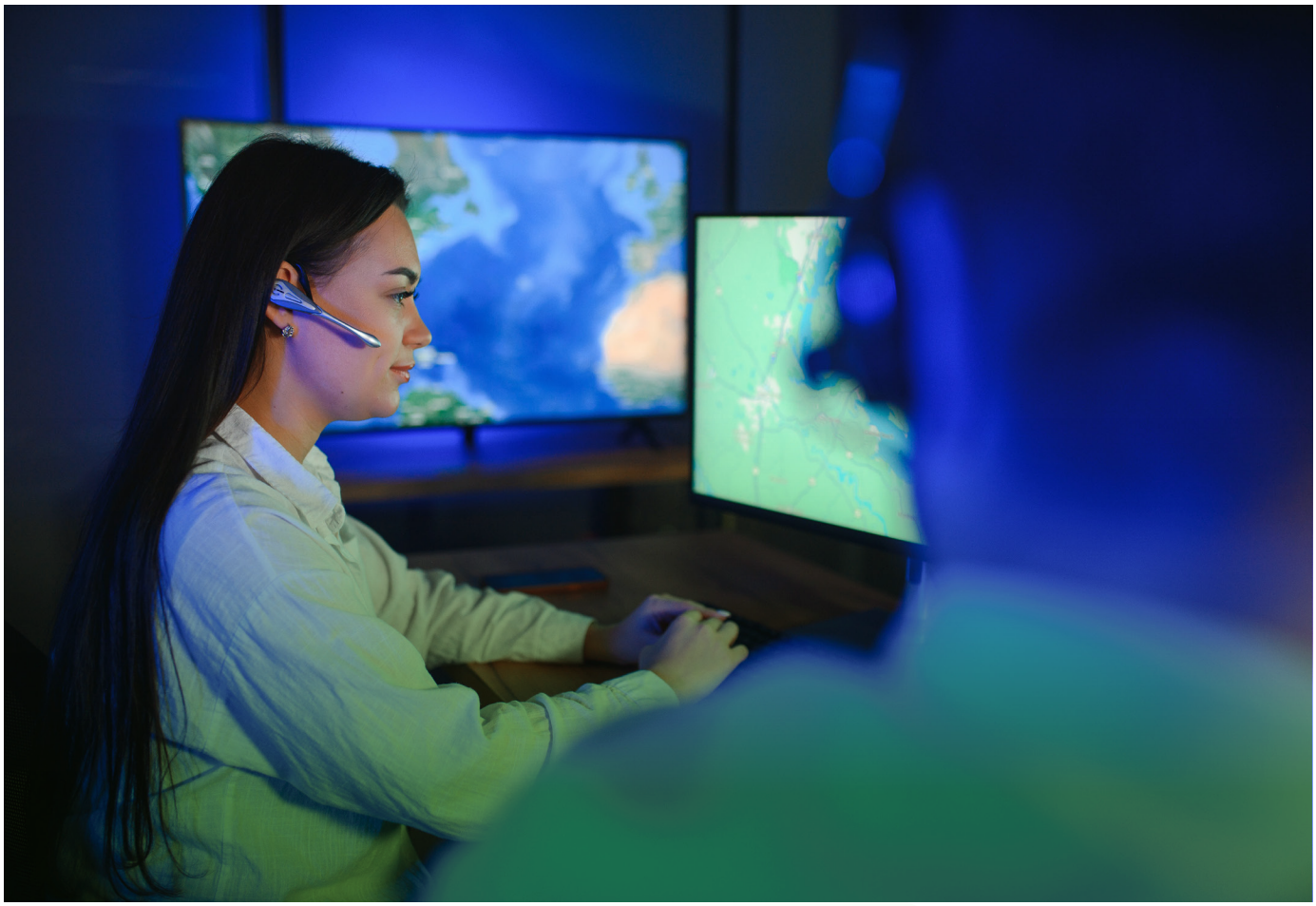
Enhancing Europe's resilience

Digitalisation of rail has the potential to significantly enhance the EU's resilience by future-proofing rail networks against external pressures such as extreme weather events and human disruptions. This ensures that transport systems remain reliable under adverse conditions, contributing to the EU's capacity to withstand external shocks. By leveraging technologies such as advanced analytics, simulations, predictive maintenance, and real-time data sharing, rail systems become more adaptable and better equipped to manage risks.

Safeguarding Europe's security

Advanced rail technologies also play a vital role in safeguarding Europe's security. They enhance passenger safety through sophisticated monitoring and safety systems whilst contributing to the broader protection of Europe's citizens in an increasingly complex and challenging geopolitical landscape. Digitalisation can help deliver on the EU's Military Mobility agenda by ensuring the efficient deployment of dual-use infrastructure whilst facilitating the quicker, seamless, and coordinated movement of military equipment across borders, strengthening the EU's strategic readiness and operational efficiency.

1
UNIFE, **On the move to a Net-Zero EU: The European Rail Supply Industry's priorities for 2024-2029**, March 2024.
European Environment Agency, **Shares of GHG emitted by different transport modes (%) in EU-27 total GHG emissions**, October 2024.
European Parliament, study requested by the TRAN Committee, **Perspectives for the rolling stock supply in the EU**, July 2023.



THE EU RAIL SUPPLY INDUSTRY AT THE FOREFRONT OF INNOVATION

The EU rail supply industry has been at the forefront of innovation, notably through the involvement in the Europe's Rail Joint Undertaking (EU-Rail JU), leveraging cutting-edge solutions to modernise rail infrastructure, services, networks, and rolling stock while accommodating a growing demand for rail travel. The EU institutions recognised the importance of the rail sector, and in 2020, they made it **the backbone of the** Sustainable and Smart Mobility Strategy. The Commission aims to increase rail freight traffic by 50% by 2030 and to double it by 2050. It also seeks to double high-speed rail passenger traffic by 2030 and triple it by 2050 while reducing reliance on aviation and road transport. However, the amount of tracks cannot simply be tripled. Instead, **the utilisation of the infrastructure must be significantly improved**. This is only feasible with robust infrastructure, reliable rolling stock, and highly efficient maintenance. Modern digital technology is the key enabler for such drastic utilisation increases.

DATA

Data is the foundation of the rail sector's digital transition, underpinning technologies like AI and digital twins, and enabling real-time analysis, predictive capabilities and smarter decision-making. Traditionally, the rail industry relied heavily on manual, paper-based and siloed processes for operations, maintenance, and

planning. However, data is revolutionising the sector as many rail assetsd – such as tracks, signalling systems, ticketing platforms, and trainsd – incorporate digital capabilities, delivering data-based insights.

Data is a powerful enabler of enhanced collaboration in the rail sector, breaking down silos between operators, infrastructure managers, and service providers. Technologies like connected data environments facilitate seamless data sharing, ensuring all stakeholders have access to accurate, up-to-date information and data-driven insights. This improves coordination across asset management, maintenance, and operations, leading to better decision-making, reduced delays, and increased efficiency. Ultimately, a data-driven approach fosters greater transparency, interoperability, and innovation, driving the sector towards a smarter and more connected future.

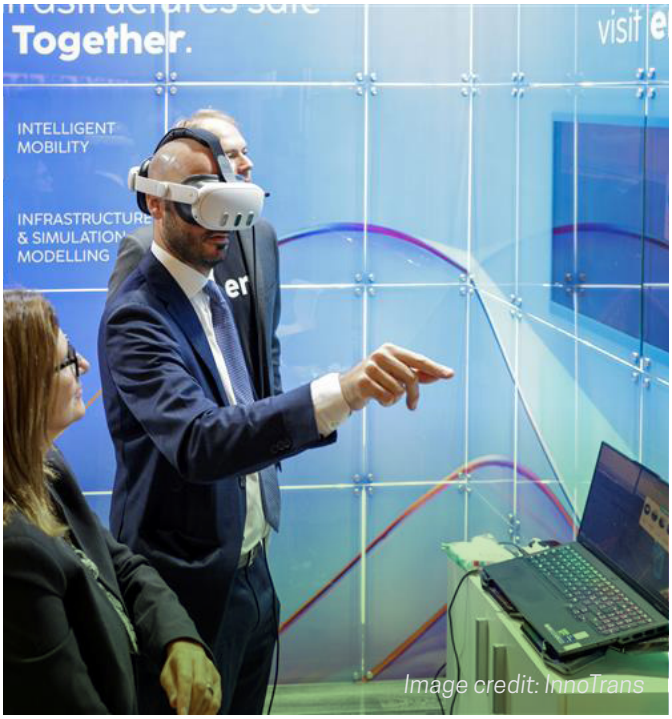


Image credit: InnoTrans

CASE STUDIES

European Rail Data Space – Standardised and secure data exchange to accelerate rail innovations

The rail sector generates vast amounts of digital data; yet scalable and secure data exchange remains a significant challenge. Siloed, a lack of common standards, and reluctance to share data hinder collaboration, limiting the potential for predictive maintenance, traffic optimisation and overall operational efficiency.

Since 2022, a consortium of 12 European rail sector companies has been developing the European Rail Data Space (ERDS) to enable secure, standardised, and trustworthy data exchange. In 2025, the initiative enters its next phase, establishing the ERDS in the open market alongside the EU co-funded research project. By providing a scalable data-sharing ecosystem where data providers retain full control, the ERDS fosters large-scale collaboration, accelerates digital transformation, and strengthens Europe's rail network for the future.

Data-driven Transformation of Paris' Gare du Nord Railway Station

Paris' Gare du Nord, Europe's oldest and busiest train station, underwent a €600 million renovation to triple the station's size and capacityd – from 35,000 to 124,000 square metersd – ahead of the 2024 Olympic Games. To optimise the design, the contractors leveraged advanced data-based simulations of pedestrian movement, helping architects and engineers eliminate bottlenecks and ensure seamless passenger flow. By testing different scenarios and comparing options, the data-driven approach shaped the station's final layout, reducing unnecessary spaces, cutting energy costs, and enhancing access to sustainable rail transport. The redesign accommodates a diverse mix of passengers, including international and national travellers, suburban commuters, metro users, tourists, and individuals with mobility needs, ensuring smooth and efficient transit for all.

ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) has the potential to enhance nearly every aspect of rail transport by harnessing vast amounts of data and transforming it into actionable insights that improve efficiency, safety, and decision-making.

One of AI's most significant contributions is its ability to anticipate and prevent issues before they disrupt rail networks. Through predictive maintenance, AI can continuously analyse the condition of tracks, bridges, and signalling systems, allowing operators to detect and address faults before they escalate into costly failures. This proactive approach enhances reliability and extends the lifespan of critical rail assets. AI also optimises traffic management, dynamically adjusting train schedules, routes, and speeds to reduce congestion and improve punctuality.

Beyond operations, AI is transforming how railway infrastructure is designed and built. Engineers increasingly rely on AI-powered tools to streamline complex construction projects, enhance planning, optimise resource allocation, and minimise delays. AI-driven automation improves both safety and precision on construction sites, ensuring that projects are delivered more efficiently. Meanwhile, computer vision and sensor technology advancements bolster network safety, enabling automated inspections, obstacle detection, and real-time track monitoring.

AI's impact is set to expand as the rail sector continues to evolve. Its applications are expanding beyond traditional operations, with new use cases emerging daily. Whether in infrastructure management, traffic optimisation, construction planning, or passenger services, AI is becoming an indispensable tool in shaping the future of rail transport.

CASE STUDIES

Future-Proofing a Historic Railway Bridge with AI

The Minnesota Department of Transportation launched a major renovation of the Robert Street Bridge in St. Paul – an iconic landmark known for its vertical rail lift – to extend its lifespan for another 50 years. The project's contractor digitised inspection data and created a 3D model of the bridge, which facilitated virtual and AI-driven inspections. The project resulted in the delivery of a comprehensive digital twin of the bridge to the local transport administration, providing future contractors with detailed insights into its structural condition. By using AI and a digital approach, 70% of inspection information was collected before visiting the bridge, reducing time spent on site by 20% and yielding EUR +85,000 in savings. The project sets a benchmark for how AI-driven technologies – still less widely adopted in Europe compared to other regions – can play a crucial role in future-proofing and enhancing the resilience of the continent's rail network.

AI-driven Analytics to Optimise Maintenance and System Availability of Milan Metro

As part of the Shift2Rail project IN2SMART2, Milan's Line 5 – a driverless light metro equipped with distance-to-go signalling – has been recently upgraded with advanced decision-support methods and anomaly detection algorithms. These improvements rely on collecting diagnostic data from multiple sources to enhance system availability and performance.

In particular, the implementation of AI machine learning models fed by Track Circuit parameters allows to accurately predict the insurgence of anomalies that can lead to disruption of service and in general discomfort for the passenger. This application is currently used to optimise the scheduling of maintenance activities, with remarkable benefits for the operator's workflow and direct and quantified savings in the management of the assets.

DIGITAL TWINS

A Digital Twin is a virtual model of a physical asset (e.g. train, component, railway infrastructure, etc.) that replicates its real-world counterpart for monitoring, analysis, and optimisation purposes.

Supported by technologies such as Artificial Intelligence, Reality Modelling, and 3D visualisation, Digital Twins have the potential to transform numerous aspects of the rail sector, from infrastructure management to rolling stock production and design, station management, passenger experience, and communications systems. Continuously fed with a broad range of engineering, operational, and geospatial data, Digital Twins allow for the visualisation of rail assets and networks in context, enabling various analyses and simulations, yielding data-driven in sights, and enhancing decision-making.

Regarding infrastructure, Digital Twins can greatly enhance the design, construction, and operation of rail networks. In rail asset management, for example, Digital Twins facilitate predictive maintenance by enabling digital asset inspections and allowing operators to identify faults before they result in costly failures, thereby improving the reliability and lifespan of existing assets. This is particularly crucial in the context of climate change, as Digital Twins can assist in future-proofing rail infrastructure by simulating and anticipating the impacts of extreme weather events. In network management, they enable operators to simulate different operational scenarios, optimising train schedules, capacity planning, and traffic flows to alleviate congestion and enhance service punctuality. At rail stations, Digital Twins aid in managing passenger movements, stream lining operations, and improving crowd control, ultimately refining the travel experience. Furthermore, they play a vital role in optimising communication systems and ensuring seamless coordination between trains, signalling, and control centres, thus enhancing safety and operational efficiency.

The development and adoption of Digital Twins are expanding within the rail sector, with major Trans-European Transport Network (TEN-T) projects, such as Rail Baltica, already leveraging these technologies.

CASE STUDIES

Digitising Bergen's Light-Rail Network Extension

The City of Bergen, Norway, contracted an engineering consultancy to deliver a 9-kilometre extension of Bergen's light-rail network, which includes adjacent roads, bicycle lanes, pedestrian zones, and supporting bridge structures. Engineers utilised a Digital Twin to ensure the efficient rollout of the project. The Digital Twin facilitated the creation and coordination of over 450 designs and 3D representations in a multidisciplinary model of the rail project. It connected the 18 organisations involved in the project, allowing them to collaborate and share data in real time. The Digital Twin contributed to a 15% reduction in design time, and construction errors decreased by 25%. The technologies were estimated to save the engineering consultancy EUR 1.5 million annually on projects of similar scale.

Delivering Cross-Border Rail with Digital Twins: Rail Baltica

As part of the Rail Baltica project, which connects Estonia, Latvia, and Lithuania by rail, one of the contracted engineering consultancy used a Digital Twin to design a 389-kilometre section of the new network. The Digital Twin allowed engineers to effectively manage the extensive size, scope, and complexity of the project, which included the design of 44 railway viaducts, 50 road viaducts, and 15 bridges, specifically through advanced visualisations and 3D modelling. The Digital Twin enabled over 150 professionals to collaborate from more than 6 countries and across various civil disciplines, including bridges, drainage, noise barriers, and utilities. Automated features increased engineers' productivity and allowed them to focus on the most value-adding tasks.

FRMCS

The Future Railway Mobile Communication System (FRMCS) is a priority technology for the future railway system. The need for FRMCS implementation arises not only from the impending obsolescence of the Global System for Mobile Communications – Railway (GSM-R) and its associated challenges from 2030 onwards but also due to the significant opportunities FRMCS will provide to enable and support the digitalisation of railways. FRMCS is a crucial component of the European Rail Traffic Management System (ERTMS), which aims to increase capacity, enhance digitalisation, and boost the competitiveness of passenger and freight rail transport within the European Union. It will also facilitate new applications such as Automatic Train Operation (ATO), data and video services, and, more generally, essential services requiring telecom quality, flexibility, and capacity, which are core elements of future competitive, sustainable transport.

Further digitalisation and automation in rail are keys to achieving the European Union's Green Deal objectives and the European Commission's Sustainable and Smart Mobility Strategy. The Commission's dual objectives of carbon neutrality and leadership in digitalisation will serve as a dominant driver for the deployment of FRMCS across the European railway network. Implementing 5G FRMCS will unlock the potential for a wide range of new applications that contribute to optimised train operations and ultimately enhance services for rail passengers and freight customers. The European rail supply industry is committed to making FRMCS a success and ensuring the transitions to FRMCS is as smooth as possible.

CASE STUDIES

5GRAIL project

Successfully concluded in 2023, the 5GRAIL project validated the first FRMCS specifications by developing and testing prototypes for the system's ecosystem, encompassing both trackside infrastructure and onboard usage, as well as under laboratory and real track conditions.

MORANE-2 project

Officially launched at the end of 2024, this 34-month project will test FRMCS technology in real conditions across Europe's busiest rail lines and foster market-ready specifications to be incorporated into the future revision of the Control Command and Signalling Technical Specifications for Interoperability (CCS TSI). Prototypes will undergo comprehensive testing in three European laboratories and in real track conditions, including both conventional and high-speed lines. The MORANE-2 project represents a crucial step towards achieving market-ready specifications and subsequently support the first deployable FRMCS commercial solutions being an essential component of the future European Rail Traffic Management System (ERTMS).

CYBERSECURITY

Cybersecurity plays a critical role in the European railway sector by safeguarding the integrity, availability, and safety of both operational technology and passenger information systems. As railways become increasingly digital and interconnected, robust cybersecurity measures are essential to protect against cyber threats that could disrupt services, compromise safety, or lead to data breaches.

Modern railway systems integrate a wide range of interconnected technologies, from HVAC (heating, ventilation and air-conditioning) systems, brakes, doors, and sanitary systems to critical signalling infrastructure. While enhancing efficiency and passenger comfort, this connectivity also broadens the attack surface for potential cyber threats. Any vulnerability in these systems can have serious safety and operational consequences. Suppliers in the railway industry play a pivotal role in ensuring the cybersecurity of these components, contributing to the overall safety and resilience of the network. Their commitment to securing these technologies is vital in safeguarding both citizens and goods, reinforcing the need for strong collaboration across the supply chain to protect Europe's critical rail infrastructure.

CASE STUDIES

Standardised Cybersecurity Framework

Compliance with legislative frameworks is achieved through certification like ISO 27000 and IEC 62443. This compliance approach provides a baseline for a mutually ccepted level of cybersecurity. However, the rapid rate of development in the field and new legislation such as the NIS2 and CRA frequently raise the requirements for this baseline. Beyond compliance, several European entities active in the supply chain industry have implemented standardised technical cybersecurity frameworks, including secure remote access with encryption, multi-factor authentication, and real-time monitoring to detect and prevent cyber threats. This scalable solution benefits the European railway industry by ensuring regulatory compliance, reducing maintenance costs, strengthening resilience, and creating a secure, interconnected rail network.

Towards a rail standard for the cybersecurity of complex systems

Cybersecurity standards are empowering the rail industry to better protect against cyber threats. The widely adopted IEC 62443 already provides a comprehensive framework for securing industrial automation and control systems, including rail networks, devices, and operations centres. Despite its coverage, IEC 62443 lacks a proven track record for mixed distributed systems – an essential characteristic of railway systems – which is where the CENELEC technical standard, TS 50701, comes in to address the gaps. TS 50701 laid the foundation towards the first railway cybersecurity international standard IEC 63452, which will ensure a unified cybersecurity management in railway systems, tailored to the sector's specific operational environment, building on top of the IEC 62443 series.

Further support to building a clear and comprehensive cybersecurity framework comes from the work of Europe's Rail Joint Undertaking (EU-Rail) System Pillar, which published its Cybersecurity Specification V1.0 in early 2025. Comprised of four main specification documents for the design of secure components, programs, communications and services, these guidelines emphasize the sector's commitment to build a robust framework ensuring the cyber-resilience of Europe's rail system. The specification could act as a common basis for the sector to reduce operator-specific security requirements to a minimum.

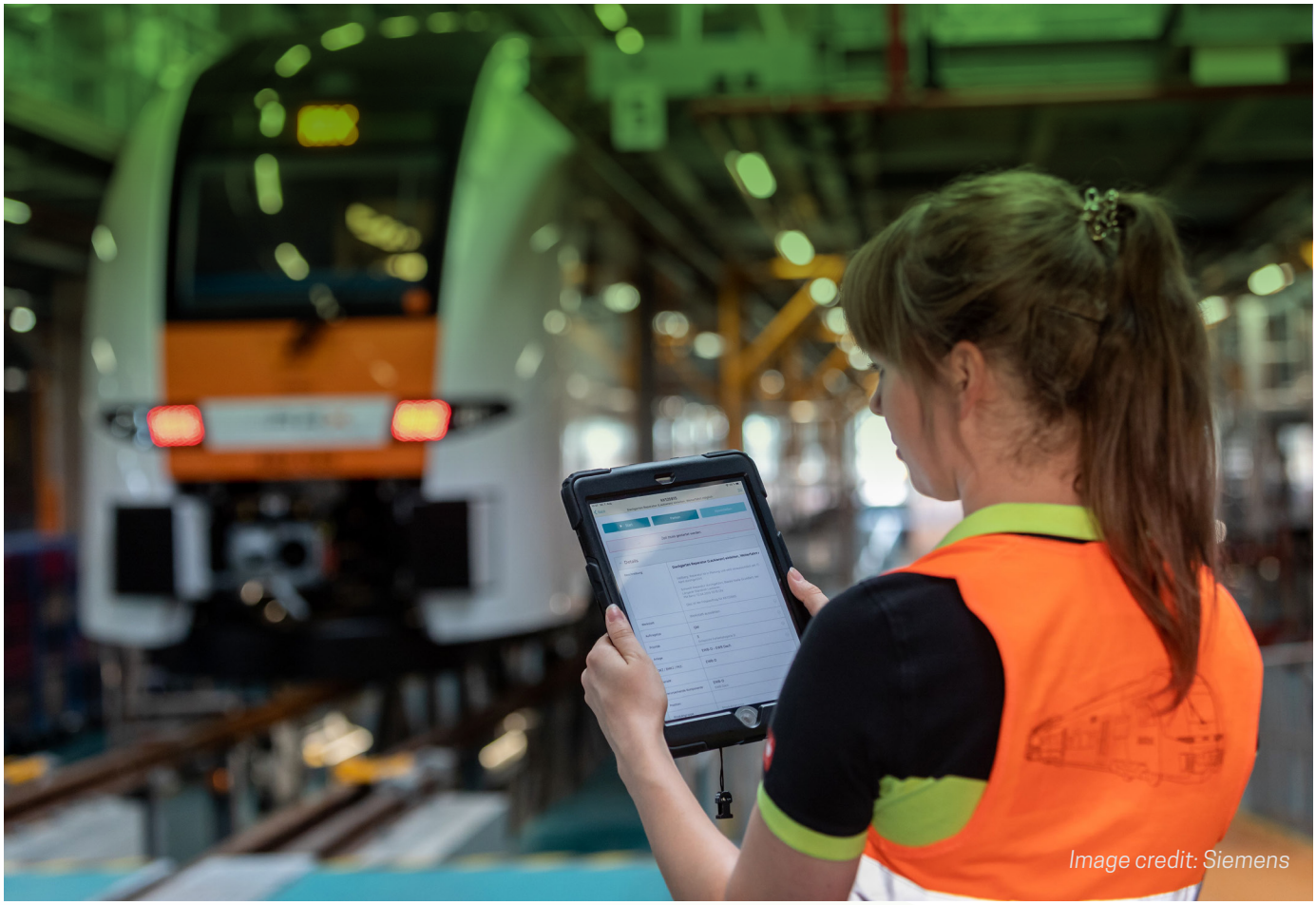


Image credit: Siemens

DRIVING THE DIGITAL TRANSITION OF THE RAIL SECTOR: THE ROLE OF EU POLICY

The rail supply industry continues to show a strong commitment to innovation, ensuring Europe's rail networks' long-term efficiency, resilience, and safety. However, despite these efforts, the digital transition of the entire rail ecosystem remains inconsistent and fragmented throughout the EU. This can be attributed to various factors, including a lack of awareness about existing technologies and limited incentives for adopting digital rail solutions.

Given this, **UNIFE believes that EU policy plays a crucial role in driving the digital transition of the entire rail ecosystem, unlocking greater value from advanced technological developments, and facilitating progress for the sector.** Fostering the digitalisation of the rail sector will have a substantial positive impact on the EU's ability to deliver on its objectives of competitiveness, resilience, security and sustainability.

In this context, UNIFE puts forward the following recommendations to accelerate the digital transition of rail in the EU:

Multiannual Financial Framework (MFF) 2028-2034 and Connecting Europe Facility

The Connecting Europe Facility (CEF) should incorporate a dedicated budget line for ERTMS to accelerate both trackside and onboard deployment, and substantial

funding to gradually integrate transformative technologies into the rail system, such as DAC (Digital Automatic Coupling) and FRMCS (Future Railway Mobile Communication System). It is essential to highlight that, under the current CEF Digital programme, support for 5G deployment and future synergies with FRMCS is, although limited, already available along transport corridors, including rail. Therefore, continuity must be assured between these ongoing projects and new initiatives. It is also important to ensure that cloud data storage solutions compliant to European regulations are available on the market (e.g. disaster recovery outside EU servers).

The selection process for CEF projects should reward best practices in digitalisation related to the design, construction, and operation of rail infrastructure. Digital and data-driven solutions can significantly mitigate risks associated with European funding allocated to rail infrastructure, such as reducing time and cost overruns, enhancing transparency in project monitoring, and facilitating ex-post evaluation. Consequently, best practices in digitalisation should be promoted, for instance, by establishing specific criteria, reward mechanisms, or advantageous conditions for proposals that demonstrate optimal use of digital tools, including connected data environments and Digital Twins, to enhance planning, decision-making, and lifecycle management, ultimately leading to improved, data-driven infrastructure outcomes.

Implementation of the revised TEN-T regulation

While the revised TEN-T regulation recognises the crucial role of technology in ensuring the efficient roll-out of the network until 2050, in particular for the deployment of ERTMS on the network by 2040, the regulation does not provide further guidance on how digitalisation can support its implementation. Therefore, it is essential to promote best practices and knowledge sharing among Member States regarding how data-driven technologies like AI and Digital Twins can facilitate accelerated deployment and compliance with the regulation. EU policymakers can also assist Member States in understanding how digitalisation can enable a "whole system" view of European rail networks, allowing for improved planning across borders (e.g. coordination along transport corridors, better planning for multimodal hubs in urban areas, and enhanced resilience against extreme weather events).

Revision of the EU Directives on Public Procurement

The upcoming revision of the EU Public Procurement Directives presents a once-in-a-decade opportunity to maximise the lifespan and sustainability of rail components, such as rail infrastructure and rolling stock, through digitalisation.

The Most Economically Advantageous Tender (MEAT) principle understood as Best-Price Quality Ratio (BPQR) is rarely used in rail procurement and price-driven tenders largely remain the prevailing trend in the rail sector. In Germany for example, 92% of the public tenders in the rail sector were awarded solely based on the lowest initial price between 2013-2020[2]. While some Member States have made great efforts to amend public procurement rules at the national level, particularly through measures encouraging digital technologies, the landscape across Europe remains fragmented and complex. This deters private investment in rail infrastructure and delays execution, especially for cross-border projects. Furthermore, this leads to enterprises vying for low-price solutions, which tends to decrease quality, and prevents innovation instead of encouraging it, as economic operators try to avoid development costs. This contradicts the strategic policy-driven objectives of the directives.

Modernising public procurement rules at the EU level could harness digitalisation at scale and significantly accelerate the rail sector's transition. This could be achieved through a much stronger emphasis on

2 Report Modern public tendering (MEAT): Cornerstone for the rail mobility revolution, VDB, 2023..

qualitative/non-price criteria, notably relating to digitalisation (e.g. valuing environmental or resilience outcomes facilitated by digital technology), along with greater incentives for employing rail technologies such as Digital Twins, AI, and connected data environments. This approach, strongly supported by the European Rail Supply Industry, would in fact highly benefit the railway operating community and end users.

To achieve this, contracting entities shall base the award of contracts on the most economically advantageous tender (MEAT), using a cost-effectiveness approach with a total cost of ownership (TCO), including the best price-quality ratio. This should be assessed on the basis of criteria, including qualitative, environmental and/or social aspects, which in the digital software space could include European preference in subject matter areas deemed "high risk" or sensitive from a critical infrastructure perspective as per relevant EU legislation (e.g. AI Act, NIS2 Directive). In this respect, strengthened provisions in the future public procurement framework, as well as guidance and training of public bodies by the European Commission, would be needed to adequately support and accompany the shift of the procurement mindset.

Competitiveness Compass and Rail

UNIFE welcomes the publication of the *Competitiveness Compass* in January 2025. As part of the measures announced, UNIFE believes that the forthcoming *EU High-Speed Rail Plan*, the *Sustainable Transport Investment Plan*, and the *EU Climate Adaptation Plan* should encourage the digital transition of the rail sector and the adoption of advanced rail technologies, as a means to enhance EU competitiveness, resilience, and security. More specifically, the EU High-Speed Rail Plan should recognise the role of digitalisation in accelerating and mitigating the risks associated with the deployment of high-speed rail infrastructure in Europe, whilst improving return on investment and maximising the lifespan of the infrastructure. In parallel, the Climate Adaptation Plan should promote the adoption of AI-driven innovation and advanced asset analytics to enhance the monitoring, operation, maintenance, and overall safety of Europe's rail infrastructure in the context of climate change. This is particularly critical for bridges, for example, which are many decades old and increasingly vulnerable to structural risks.

Implementation of Data Act – Impacts on Data Sharing

As previously outlined, data is the cornerstone of all digitalisation initiatives. It holds immense value for those who can act on it appropriately. However, data availability remains limited, and generating the necessary ata, such as with additional sensors, is costly and entails ongoing expenses due to the required data handling. To enhance

the quantity of relevant data available, the railway supply industry must develop robust business models based on the generation and extraction of data.

The European Union has developed a "European Strategy for Data" to promote innovation around data services and products and enhance Europe's position as a world leader in the digital economy. Several legislative acts, like the Data Governance Act and the most recent EU Data Act (in force since February 2024) have been drafted to support "data-driven innovation" by increasing the capacity of businesses to make use of information derived from data analytics to develop improved products and services. In particular, the EU Data Act provides legal clarity regarding the access to and use of data, ensuring fairness in the allocation of the value of data among all actors in the data economy. The impact of the obligation for manufacturers of connected products to implement access to users' data "by default" (applicable from September 2026) poses technical, business and strategic challenges.

The new data-sharing legal terms set forth in the EU Data Act change the status-quo, lowering previous market barriers that may allow new entrants in the marketplace. Secondary legislation is currently being drafted and is expected to further clarify some key aspects of such regulation when it comes into its implementation in the railway context, considering that most of the railway products and related services fall in scope of this regulation.

In this regard, UNIFE welcomes the launch of an initiative in CENELEC TC9X (Sub-Group 34/SG3 – Impact of the Data Act). Furthermore, it would be imperative for the legislation to support viable rail data business models, ensuring commercial safeguards and covering inevitable data generation costs.

Implementation of Cyber Resilience Act

UNIFE welcomes the introduction of the *Cyber Resilience Act* (CRA) and its aim to enhance the overall level of cybersecurity for products with digital elements. Compliance with the CRA and the Network and Information Systems Directive (NIS2) ensures legal adherence and bolsters resilience against evolving cyber risks, ultimately securing the trust of passengers and stakeholders across the sector. When implementing the CRA, it is essential to **consider the complexities of sectors such as the railway industry to guarantee an appropriate level of cybersecurity.** This should be accomplished through a coherent approach that enables the industry to operate smoothly while minimising economic impacts and avoiding disruptions that could hinder sustainable transport and industry.

UNIFE proposes specific suggestions for a smooth implementation of the CRA in the rail sector, such as defining products in complex sectors to prevent a sharp cost increase. The current scope is very broad and should be better specified; according to this definition, most rail products, including systems, fall within the scope. If every component of every product is required to be compliant (self- and third-party assessment), this could potentially lead to a significant escalation of costs (increasing total costs by approximately 100%).

Another suggestion is to clarify the duration of the support period, as most railway products are designed to be in use for 30 years or more. This may cause disruptions in global supply chains and have a tremendous impact at various levels if not managed carefully on a case-by-case basis. Moreover, the definition of substantial modifications should be clarified. For example, it could specify that a significant modification includes:

a) any change impacting the product's risk assessment or
b) any modification in configuration affecting its originally intended operational use.

Manufacturers should specify in their product documentation which modifications are reasonably foreseeable as substantial.

CONCLUSIONS

The digitalisation of rail transport is crucial for achieving the EU's sustainability, competitiveness, resilience, and security goals. By addressing inefficiencies, capacity constraints, and maintenance needs, digitalisation can significantly enhance the rail sector. **The EU rail supply industry is committed to innovation,** developing advanced technologies like AI, digital twins, and data-driven solutions **to optimise energy use, improve performance, reduce costs, and future-proof rail infrastructure against climate risks.**

EU policy and funding play a pivotal role in accelerating the digital transition of the rail ecosystem. Key initiatives, such as the revision of EU Public Procurement Directives, the Multiannual Financial Framework, and the implementation of the TEN-T regulation, present significant opportunities to promote transformative rail technologies. **UNIFE proposes several policy recommendations to support this transition, including substantial funding for transformative technologies, rewarding best practices in digitalisation, and modernising procurement rules to promote sustainability.**

Digitalisation is not only about converting analogue information to digital format but also involves generating new insights from raw data. In the rail sector, **AI algorithms combined with data can optimise energy consumption, performance, and maintenance, reducing costs and preventing disruptions.** The digitalisation of rail is central to achieving the EU's carbon neutrality objective by 2050.

Advanced rail technologies can eliminate inefficiencies, enhance connectivity, and promote economic integration within the EU, strengthening supply chains and competitiveness. Digitalisation reduces energy consumption, lowers emissions, and increases track capacity, encouraging a shift to rail transport. It also enhances resilience by future-proofing rail networks against external pressures and safeguarding passenger safety through sophisticated monitoring systems.

The EU rail supply industry is at the forefront of innovation, leveraging cutting-edge solutions to modernise rail infrastructure and accommodate growing demand for rail travel. Data is the foundation of the rail sector's digital transition, enabling real-time analysis, predictive capabilities, and smarter decision-making. Technologies like connected data environments facilitate seamless data sharing, improving coordination and efficiency.

In conclusion, the **digitalisation of rail transport is essential for achieving the EU's sustainability, competitiveness, resilience, and security goals.** By leveraging advanced technologies and supportive EU policies, the rail sector can significantly enhance its performance, reduce costs, and contribute to a sustainable future. This is why UNIFE is proposing the recommendations outlined in the executive summary for the EU to accelerate the digital transition of the rail sector during the 2024-2029 legislative cycle, as a lever to achieving the EU's goals.

ABOUT UNIFE

UNIFE, the European Rail Supply Industry Association, operating in Brussels since 1992, represents over 120 European train builders and rail equipment suppliers, involved in designing, manufacturing, maintaining and refurbishing rail systems, subsystems and related equipment. UNIFE also brings together national rail industry associations from 12 European countries.

With the EU's goal of carbon neutrality by 2050, decarbonizing transport is urgent, and the rail sector offers significant potential for achieving this. The industry, generating €45.8 billion in sales and providing 650,000 jobs, continues to thrive despite challenges, with annual growth of 2.7% and a projected global market volume of €240.8 billion by 2027[3]. Europe remains the largest rail market, crucial for the industry's success.

3 2024 UNIFE World Rail Market Study, forecast 2024 to 2029

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