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techUK perspective

Putting data and innovation at the heart of Great British Railways transition

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Executive Summary

This report from techUK outlines several strategies that a newly formed Great British Railways (GBR) could adopt as it looks to embed data and digital technology into how our railways are planned and operated.

We have a generational opportunity to create a rail network that is low-carbon, cost efficient, reliable and customer focussed. Technology and data form a critical part of this ambition.

However, barriers to digital adoption remain. These include a fragmented data landscape, legacy systems which are not easily interoperable and a disjointed approach to technology adoption.

Addressing these issues will require partnership between the technology industry and Great British Railways. As the UK's technology trade association, we have begun signalling new approaches to solving some of these challenges. We hope this early thinking will start an ongoing conversation as we work together to revolutionise rail travel in Great Britain.

Summary of Recommendations:

1.	GBR should lead the creation of an industry eco-system to nurture innovation.
2.	GBR should ensure there remains a level playing field for Third Party Retailers to foster innovation in ticketing.
3.	GBR should build on the work of Network Rail in strengthening ties to the telecoms sector to improve connectivity.
4.	GBR should create a blueprint for stations to become digitally enabled "smart-spaces".
5.	GBR should lead in the creation of a single point of access for data sharing.
6.	GBR should work closely with the technology sector to develop the right solutions to optimise infrastructure and utilities.
7.	GBR should work with rail freight operators to build awareness of how technology can support the sector.

Introduction

The Williams-Shapps Plan for Rail stated that “rail needs to innovate and accelerate change if it is to remain relevant".[1] The plan recommended the establishment of Great British Railways (GBR) as the “guiding mind” for the industry which will own the infrastructure, receive the fare revenue, run and plan the network and set most fares and timetables.

The Great British Railways Transition Team (GBRTT) has been established to lead the formation of the new organisation. It has consulted closely on its plans to develop a long-term strategy for rail[2], the legislative changes needed to deliver reform[3] and on a new target for rail freight.[4]

Deeply woven into GBR’s thinking is a focus on data and technology to deliver a low-carbon, cost efficient, reliable and passenger-centric railway[5] and we believe that the rate of technological change over the next 30 years for transport cannot be underestimated in delivering those outcomes.

However, as the Rail Industry Association (RIA) highlighted recently, railway innovation is under-funded when compared to formal targets published by the Government in its recent Innovation Strategy, and under-supported, when compared to best practice.[6]

On a technical level, barriers to adoption and integration remain. We have attempted within this short report to tackle some of these issues head on. Through drawing upon wealth of industry and technology experience available within our membership, we have begun signalling better approaches and innovative solutions to support the next generation of British railways, its ecosystem and supply chain.

We do not intend to provide a fully comprehensive breakdown of every step GBR should undertake. Rather, we have taken GBR’s six strategic pillars for transformation and outlined some first principles for ensuring data and technology can become embedded following a simple situation, challenge, recommendation and evidence format.

We are positive about Great British Railways and what it can deliver for the technology sector and the UK more broadly. Through establishing stronger partnerships between GBR and the technology sector we believe the barriers to private sector investment in rail and innovation can be overcome.

1. The Customer Journey

GBR will be accountable for the end-to-end customer journey, from the decision to travel, the core train service, through to post journey.

This is an ambitious and welcome objective. However, there are technical and commercial challenges created by the integrations needing to take place across the value-chain to achieve the seamless experience which passengers expect.

In this section we have taken two key areas for passengers; ticketing and broadband connectivity; and set out recommendations for improving these processes using technology.

Ticketing

Situation: The Williams-Shapps Plan for Rail recommended that Train Operating Companies (TOCs) will lose their ability to retail tickets. Instead, a new simplified system will be established where GBR will be responsible for setting fares and timetables and will retail tickets through a new retail arm. Third Party Retailers (TPRs) will also continue to retail tickets. Achieving this level of centralisation creates technical and commercial challenges for GBR. It will need to unite a fractious, difficult to navigate landscape and ensure a competitive market to bring customers the best price and experience.

Challenge: GBR's retail arm will act as a gatekeeper to the entire rail retail environment. However, as true of other regulated retail markets, GBR will need to ensure that level playing field safeguards are in place to ensure a competitive and dynamic market. This includes ensuring product and feature parity between GBR and TPRs.

From a technical perspective, TOCs all currently utilise their own mobile and web applications which may be based on multiple development platforms and not easily interoperable. While steps have been made to reduce complexity through cloud technology platforms such as AWS and Azure, the prolific nature of application development means integration may be difficult and expensive if GBR is to achieve true centralisation.

Recommendation: GBR will need to ensure that there is a level playing field for TPRs to foster innovation in ticketing.

Safeguards, clearly defined within GBR's licence and legislation, will be essential for ensuring that all retailers are treated on an equal and non-discriminatory basis under a commitment to competition in the rail retail market.

From a technology viewpoint, interoperability will play a huge part in how the railway can attract new customers. We believe that a common integration platform for application development will lead to simplification and a more competitive environment. An integrated system will also enable the greater uptake of digital ticketing, unlocking the benefits of mobile technology, disruption notification alerts and other innovative features being developed by TPRs to improve customer experience and satisfaction.

Evidence: The Netherlands has a strong tradition of integrated ticketing for public transport. In 1980, it was the first country to have a national ticketing and fare system for local and regional public transport. It was the first country to adopt nationwide ticketing, with more than 17,500 station validators, 6,000 gates and 450 ticket vending machines.[7]

The implementation of contactless ticketing across the TfL Network, originally achieved with the Oyster payment card, and later improved to accept retail credit and debit cards is another good example. Contactless technology was not new, nor was it a rail-specific development, but the change to the passenger experience was radically different. The underlying RFID technology has been in use for many years in applications outside rail.[8]

Broadband connectivity

Situation: It is essential to ensure the appropriate connectivity on rail journeys for passengers and staff. Currently, users can access the internet directly via their mobile phones or can connect to Wi-Fi networks provided by train operators. These Wi-Fi links are normally served by connections to mobile masts. This means that train-based access to the internet is entirely dependent on the availability of terrestrial mobile coverage, often leading to intermittent connectivity which falls short of expectations.

Challenge: Broadband on trains is a major selling point in support of rail travel and considerable effort has been made to improve it. Nevertheless, basic problems remain, namely that trains routinely travel through sparsely populated areas with limited terrestrial coverage. Installing new infrastructure to improve this can also be costly.

Recommendation: GBR should build on the work of Network Rail in strengthening ties to the telecoms sector through embracing a partnership and outcomes-led approach.

The solutions adopted need to provide service into the hard to reach and high usage locations to ensure a highly reliable end-to-end mobile connection throughout the passenger journey.

This is going to be essential to enable passengers and staff to access the wide range of digital apps and centralised servers that the new vision for the customer journey requires. This means solving mobile connectivity in mainly the tunnels and underground locations where signal (including Wi-Fi) is currently lost together and ensuring high-capacity systems in the busiest stations. Solving this requires joined-up approach across shared infrastructure to drive the best and most competitive solutions.

Evidence: techUK member Cellnex UK is working with Network Rail to improve cellular and mobile data coverage on the London to Brighton line. Through the installation of new infrastructure such as towers and fibre cabling for Mobile Network Operators, full connectivity will be delivered on the 51-mile stretch, improving the experience of 300,000 passengers a day at its busiest.[9]

techUK member CGI is leading a consortium of businesses including iComera, All.Space, 5G3i and rail operators Network Rail, ScotRail and Northern Trains to the use of satellite communications (satcoms) to achieve greater connectivity and solve the issue of terrestrial gaps in service.[10]

In London, techUK member BAI Communications has agreed a 20-year partnership with Transport for London to deliver connectivity across the tube network. To date, over 400km of dark fibre has been laid, already delivering 4G coverage to the Jubilee Line and is due to expand to the wider network in the coming year.[11] This has been supported by fellow techUK member Capita's data network infrastructure.

teckUK member Freshwave has also supported HS1 in deploying a 5G Mobile Private Network in St Pancras station to investigate how the use of 5G can improve efficiency in operations and maintenance, and improve the customer experience.[12]

2. Station and Retail

GBR will take over all asset management including stations and depots. It will be responsible for improving the experience within stations to encourage passengers to stay for longer and improve the viability of its retail offer.

Situation: As we recover from the pandemic and life begins to return to our cities and their businesses, there is a need to innovate in attracting people back to city spaces and to promote rail travel as an enjoyable, relaxing passenger experience. Currently, urban stations are often seen as an unwelcoming, sterile, transactional environment, which passengers view as somewhere to get through quickly simply to get on a train. This fails to maximise the value of the station as a retail asset and attract business investment in the station environment.

Challenge: Transforming the station experience requires consideration of many interrelated aspects including avoidance of travel disruption, integrated digital services (e.g., location-based retail/marketing alerts, personalised travel guidance, etc), passenger safety, high-capacity data connectivity, security and privacy, ease-of-use and accessibility, and automation of operational maintenance.

Recommendation: GBR should consider stations as digitally enabled "smart-spaces".

The creation of a common blueprint for stations can be used to facilitate shared information flow and collaboration between all actors in the station environment and the passenger. This solution could provide a more pleasant, sustainable, and profitable station environment. For example, utilising digital twins technology for future stations could make these part of the metaverse, enabling new dimensions for engaging passengers within stations and driving an attractive virtual economy. High capacity, high reliability mobile and Wi-Fi infrastructure needs to be provided. However, the creation of new data streams, especially those pertaining to passengers, introduces significant new challenges regarding the information and cyber security of that data and the privacy of the public who generate it. A carefully considered cyber security and privacy approach is therefore critical.

Evidence: In Reading, techUK member Atkins is working with Network Rail to create a digital twin of Reading station that will improve its energy performance by up to 20%. The roll out of sensors will provide real-time data on the station's energy usage, revealing where energy is being overused and could be reduced. Data collected by the sensors will also provide insights on passenger numbers and help to understand station-user behaviour.[13]

Ipsotek, an Atos company and techUK member, is also pioneering the use of artificial intelligence-based video analytics to enhance station safety and security, creating smart spaces that drive operational efficiency and decision-making improving passenger experience.

3. Data and Digital

Data and digital services are intended to run at the core of GBR, permeating multiple elements of service provision and delivery.

Situation: The rail industry needs to become part of the evolving connected data-driven transport and smart city ecosystem. For example, rail is expected to become a key part in the growth in Mobility-as-a-Service offerings (MaaS). However, the industry currently lacks a single view of data across its various functional, services and engineering units, let alone the wider ecosystem and supplier base. This is exacerbated by a lack of data sharing frameworks both commercially and technically, resulting in "orphan" industries working in isolation from one other in the same ecosystem.

Challenge: As many rail information systems have grown organically over time, the data required is likely to be in multiple existing legacy systems, in diverse, non-standard formats. Attempting to re-engineer the data landscape to build a centralised data model from the ground up may be problematic and extend time to commercialisation. Data sharing is also often marred by lack of clear guidelines including unclear ownership, IP barriers and lack of a single coherent vision. This leads to difficulties in maintaining data quality standards, the need to maintain legal and data sharing terms, an inconsistent approach to managing IP and a lack of a single custodian for the rail data ecosystem.

With rapid digitalisation across sectors, legacy systems will likely be left behind in terms of skills and investment. This will stifle innovation and lock the rail community into incumbent suppliers.

Recommendation: GBR should lead in the creation of a single point of access for data sharing supported by a robust governance framework enabling cross-functional collaboration.

The current approach of developing a Rail Data Marketplace, an API layer over existing datasets, does not remove barriers to unlocking new value as the data inputs are of varying quality.

We need a new approach to cataloguing, ingesting and synchronising data from legacy systems into a common data architecture via suitable data pipelines. This will enable the efficient delivery of projects with a data sharing element or with data as a primary focus, through a consolidated platform intended to save time and money.

Benefits include a reduction in technical and back office (e.g., legal) overheads and improving the financial sustainability of the railways. There is also potential for revenue to be generated from data initiatives to further strengthen financial standing. Finally, putting data from passenger and freight end-users at the centre of decision making will enable GBR to deliver on its ambition of becoming a truly customer-centric railway.

More broadly, the proliferation of MaaS is also something we can expect to continue to develop overtime, fuelled by the need for carbon reduction and as passenger demands for a seamless journey experience across multiple modes of transport increase. The development of a common technology strategy for a cloud-based system of data management, alongside an open data architecture and standard APIs will be key to enabling MaaS and bringing the railway closer to other transport modes.

Evidence: Transport for London's (TfL) creation of the TfL API has nourished significant innovation, delivering improved experiences for passengers and stimulating a dynamic industry. Businesses such as Waze, Twitter, Google, Apple, Citymapper, as well as many academics and professional developers partner with TfL and use this data to create new commercial and non-commercial customer-facing products and services. A report published by Deloitte in 2017 found that the release of open data by TfL is generating annual economic benefits and savings of up to £130m for travellers, London and TfL itself.[14]

In addition, techUK member Capita's data network infrastructure enables London Underground to continue running, from stations to back-office functions. The system allows TfL to manage, monitor, and provide preventative maintenance, allowing the Tube to run smoothly. The service was recently enhanced to include Wi-Fi connectivity in stations and on the Jubilee Line, the first cellular and mobile network of its kind in the UK.[15]

4. Infrastructure and Utilities

GBR will be responsible for maintaining and upgrading physical infrastructure and ensuring efficient utility management.

Situation: Technologies to improve infrastructure maintenance and performance are rapidly evolving in many industries, applying modelling, artificial intelligence and machine learning to drive operational and strategic decision making. There is a significant opportunity for the application of digital twins and immersive technologies for rail, however, their application is currently fragmented.

This also prevents the integration of data from other external sources (e.g., highways and air travel) and supply sectors (e.g., utilities) that will be critical if GBR is to take responsibility for the end-to-end passenger experience.

Challenge: While there are several vendor solutions addressing concerns in rail infrastructure and utilities, their development is somewhat uncoordinated and there is no agreed common reference architecture supporting their integration.

Recommendation: GBR should work with industry closely to analyse the challenges it wishes to tackle before defining technology solutions.

This understanding combined with selecting the right operational processes and defining the expected decision-making outcomes is essential when rolling-out innovation.

Deriving the insights necessary to reduce cost, improving passenger experience and supporting the decarbonisation of the railway will also require close co-operation between industry providers to create a standardised approach to the underlying information architecture.

Evidence: Atos is engaged with Network Rail in the development of digital twins and other immersive environments to enable powerful innovative learning pathways aligned to the adoption of new technologies (e.g. ETCS L3), as well as driving a reduction in cost of physical training assets.

Atos is also delivering the Phase 1 options selection for Network Rail's proposed future synthetic environment, that seeks to address the major challenge of replacing aging UK signalling infrastructure by improving design efficiency and reducing the cost of future signalling systems through the application of an immersive, integrated automated design, simulation, visualisation, and test environment.[16]

5. Freight and Logistics

GBR will have a duty to promote rail freight, setting a growth target for the sector, and showcase its economic, environmental, and social benefits.

Situation: Currently, there are no Darwin data feeds[17] for rail freight trains as there are for passenger services. The availability of data is, however, critical when increasing rail freight volumes to ensure better coordination between freight and passenger services and maximise efficiency.

Challenge: We must improve data and technology coordination for rail freight. Global freight systems and supply chains are linked to frequent service disruptions. For example, in March 2021 a container ship blocked the Suez Canal in Egypt. As a key freight corridor, this blockage created a ripple effect across the entire freight system, resulting in goods on the other side of the world finding themselves in a standstill (economists and insurers calculated that the blockage reduced annual trade growth by 0.2 to 0.4%). The lasting impact of COVID-19 has caused multiple disruptions and expense in the transportation of goods with costs ultimately passed on to the end-consumer.

Recommendation: GBR should work with rail freight operators to build awareness of how technology can support the sector and lead in the creation of an open data standard.

This would modernise the sector while facilitating integration with the railways and the logistics sector more broadly, including last mile couriers. This improved communication would allow stakeholders to conduct analyses to have better predictions of goods' availability across rail freight terminals, making it easier for road haulage companies dealing with their own labour and equipment shortages to be responsive to real world conditions.

Evidence: The global freight sector is rapidly embracing an "ecosystem" approach; collaborative arrangements that enable companies to coordinate efforts to satisfy customer needs underpinned by data sharing. A study conducted by techUK member IBM published in 2021 found that 88% of businesses in the global shipping and supply industry expected ecosystems to grow and 52% of experts view ecosystems as a way of improving interoperability.[18] A separate report published by the thinktank The Coalition of Reimagined Mobility in 2022 found that if freight data was shared in near real time, it could eliminate 2.6 billion barrels of oil per year from global supply chains and lead to 6% cost savings per ton-kilometre.[19]

6. Funding and Financing

GBR is tasked with delivering financial sustainability for the sector and considering ways it could support greater efficiency. There is a strong case for an increased focus in the delivery of new technologies as a basis for driving efficiencies and improving cost performance throughout the sector.

Situation: Innovative technology for rail remains difficult to implement and the rail industry lags other sectors of the economy and even other transport systems in deploying technology that drives cost reductions and efficiencies. Rail and strategic connectivity are also too often considered in isolation in businesses cases and investment decisions, not linked to holistic solutions which can drive multiple benefits across the wider transport network.

Challenge: GBR needs to support a clear path to market for innovation. Currently, rollout is often prevented by policy, procurement, cultural or industry issues which are beyond the control of private sector innovators and investors.

Recommendation: GBR should lead the creation of an industry eco-system to nurture innovation.

As the "guiding mind" it can take responsibility for allocating funds and teams for the first deployment of promising innovation in the regions. Enabling this collaborative environment, underpinned by a common goal will give confidence to the private sector to invest in skills, facilities, supply chain, and product development.

GBR will also need to ensure it has the right people, well versed in research, development, and innovation activities.

Evidence: Transport infrastructure research at the University of Southampton has achieved significant performance and reliability improvements for railway and other critical infrastructure systems. It has led to substantial cost and carbon savings, supported government decision-making and enabled industry innovation for economic gain. The University of Southampton leads the UKRRIN Infrastructure centre of excellence. Amongst other outputs, the research has led to specific and measurable innovations such as the restart of the UK's rail electrification programme, delivering savings worth an estimated £650m to the UK economy. It has also estimated cost reduction of HS2 noise barriers by £65m and HS2 geotechnical works by £100m, thereby reducing the risk of further costly delays to the project.[20]

Conclusion

We hope that by adopting the recommendations outlined in this report, GBR can achieve its ambition of becoming a data and technology driven network, capable of meeting today's demands.

techUK and the wider technology industry stands ready to support this transformation. We are positive about this new era of rail travel and look forward to working hand-in-hand with the entire rail ecosystem.

About techUK's Intelligent Mobility and Transport Programme

techUK's Intelligent Mobility and Transport Group aims to deliver a digitally-enabled, interoperable, integrated and inclusive transport network that connects people and services with multiple modes of mobility. This programme's focus is to improve regulatory environment of the wider mobility services ecosystem by working together with Government and engaging with industry around priorities and key challenges.

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About techUK

techUK is a membership organisation that brings together people, companies and organisations to realise the positive outcomes of what digital technology can achieve. We collaborate across business, Government and stakeholders to fulfil the potential of technology to deliver a stronger society and more sustainable future. By providing expertise and insight, we support our members, partners and stakeholders as they prepare the UK for what comes next in a constantly changing world.

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