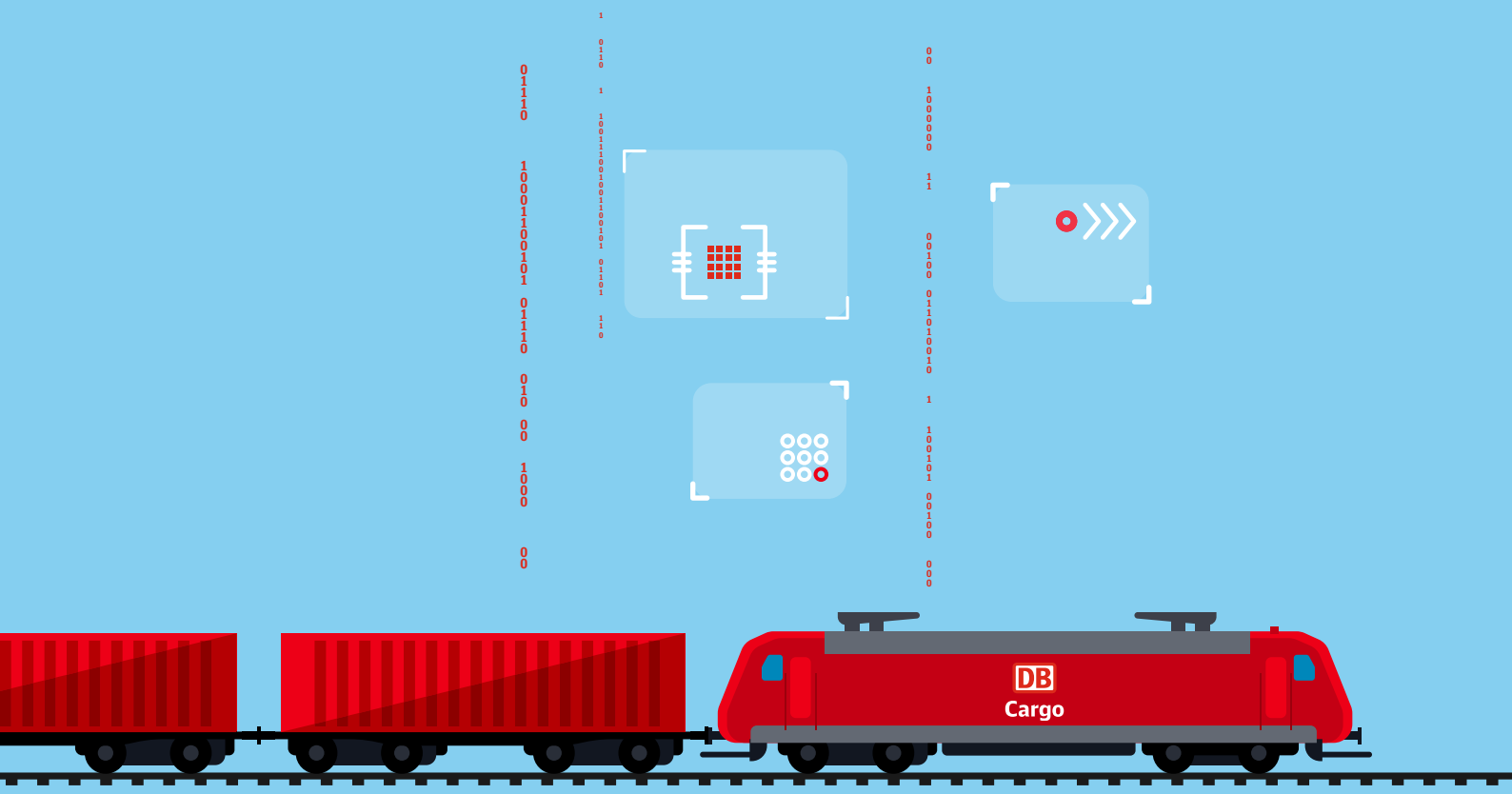
DB Cargo

White paper

Digitalisation and automation as the keys to logistics success – case studies and future potential



Foreword

Dear Reader,

We're pleased you've downloaded this white paper. Are you reading it on your mobile device right now – or are you someone who prefers to print things out? Either way, without digital technologies, this white paper would not have made it into your hands so easily and conveniently.

You're already well aware that digitalisation has brought more convenience into all areas of our lives, making us more efficient. But you also know that the full potential of digitalisation has yet to be tapped, meaning there are many more gains in efficiency to be made, particularly in the business sector – and in your logistics processes. Perhaps that's just the reason you picked up this white paper.

In this publication, we'll show you just what digitalisation and automation can do in the logistics arena. These technologies are crucial, and not just to achieve the goal of decarbonising transport, though this is necessary to meet the German government's climate targets. Digitalisation and automation are also essential to meeting the needs of our customers over the long term.

In the following pages, you'll find many examples of the possibilities which already exist when digitalisation and automation technologies are applied to logistics processes. We'll also show you where the journey is headed. To do so, we've sought out expertise beyond our company's walls. We've talked with an expert who has deep knowledge of the subject matter – Dr Peter Holm, a professor of business administration at the Provadis School of International Management and Technology in Frankfurt, where he oversees six different courses of study on digitalising logistics.
In another section, two of our colleagues present future-forward solutions for smart logistics which are already being implemented in real-world settings today. You're sure to have heard of our link2rail platform. Even if not, we present it to you here, and our customer SSAB describes in detail how you can make successful use of our e-services. At the end of this white paper, you'll find a compact summary for your perusal.

Yours sincerely,

Thorsten Meffert
Vice President Marketing
DB Cargo Group

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A new chapter in rail freight transport

Logistics specialists consider digitalisation a top priority – this is evident in the latest publication from a study on trends and strategies in logistics and supply chain management, which was conducted by BVL.digital and the Institute for Business Logistics and General Management at the Hamburg University of Technology. This should come as no surprise, because digitalisation and automation have the potential to provide numerous benefits. With these technologies, logistics experts can optimise flows of goods and provide transparency by identifying bottlenecks and reducing idle time, for instance. Most importantly of all, these technologies allow logisticians to meet the quality standards and service requests of their customers and suppliers.

At the Provadis School of International Management and Technology in Frankfurt, there are now six separate courses of study offered on technologies for digitalising logistics systems. Dr Peter Holm, vice dean and professor for business administration studies at the university, has his finger on the pulse of the logistics industry when it comes to digitalisation and automation. "We recognise that many companies don't yet have this knowledge because it's never been needed before," says Holm. "It's hard work to digitalise logistics processes. It doesn't happen just like that. That's why we teach courses on the platform economy and the Internet of Things (IoT). Aside from knowledge, you need to have a firm commitment and large investments – but they're worth it." According to Holm, it's only by using digital solutions that companies can meet the growing demands of customers over the long term and transport even more within a shorter timeframe. What Holm considers to be particularly important for the future are platforms which manage entire supply chains, including ensuring secure data exchange between all parties, in addition to emerging technologies such as artificial intelligence (AI) and networking using the Internet of Things (IoT).

"It's hard work to digitalise logistics processes. It doesn't happen just like that. Aside from knowledge, you need to have a firm commitment and large investments – but they're worth it."

PROF. DR. PETER HOLM
Vice dean and professor of business administration studies at the Provadis School of International Management and Technology in Frankfurt

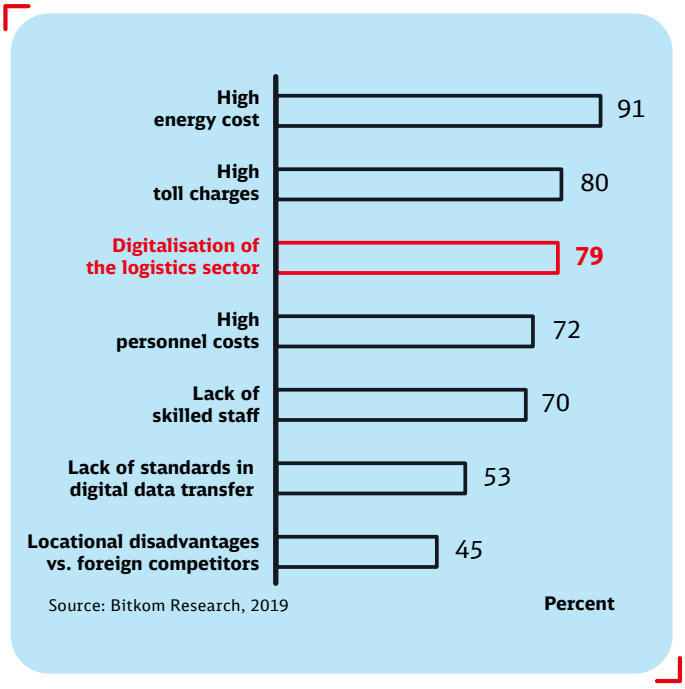
Given this potential, it's surprising that relatively few companies have implemented digital logistics solutions. Companies need to catch up at all levels. For instance, self-driving lorries are still a long way off from real-world implementation. Digital document management, too, is not yet a given at all companies. According to the trade association Bitkom, a mere 60% of all transport documents are machine-readable (as at 2021).

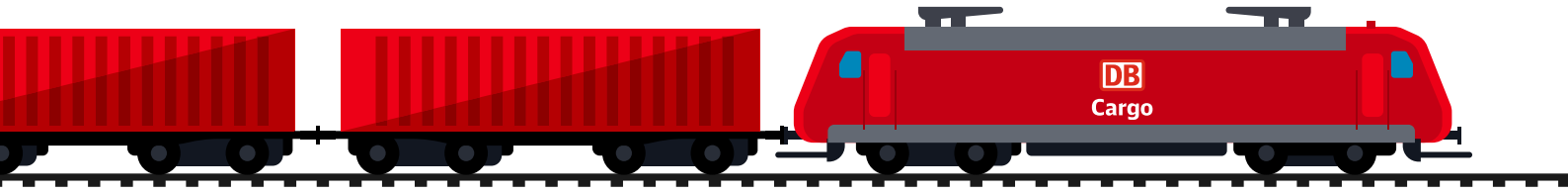
Yet there's no way around the digitalisation and automation of logistics processes. Only with the help of these technologies will it be possible to decarbonise transport in the first place, an urgent priority. Germany's current Federal Transport Infrastructure Plan forecasts that demand for transport volume will grow to 837 billion tonne kilometres by 2030 – an increase of more than a quarter from today's levels. Our roads, overburdened as they are, won't be able to meet this demand. To take pressure off the roads, to protect the environment and to achieve climate targets, it's critical that a significant amount of traffic is shifted from the road to eco-friendly rail.

Intelligently linking and analysing all of the data related to vehicles and processes allows rail operations to be organised in a completely new way with greater efficiency. This is one of the most important tools to increase transport volume in the existing rail network by up to 70% without laying any new track. And that's not all – the technologies underlying automation and digitalisation are opening a new chapter in rail freight transport.

The biggest challenges in logistics (2019)

Out of 514 companies surveyed, 79% consider digitalising logistics processes to be a challenge.





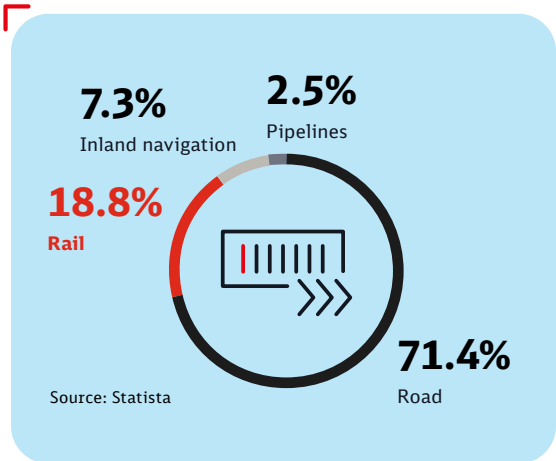
What's already working today: Digitalisation and automation in real-world settings

Several successful initiatives, products and solutions involving digitalisation and automation are already available on the market. Policy-makers have also recognised the importance of these issues, and subsidies have emerged to support them. The German Federal Ministry of Transport and Digital Infrastructure (BMVI) launched its Rail Freight Master Plan in 2017. The plan is intended to increase the market share of freight trains to some 25%. To achieve this, rail freight transport is receiving a lasting boost to its competitiveness and innovative capacity. A paradigm shift is taking place in transport policy, a change that's evident in the German government's plan to invest more in rail than in roads for the first time – starting in 2022. Shifting road transports to the rails would also relieve pressure on increasingly overloaded road infrastructure.

Dense industrial and logistical sites need to have their own rail connection wherever possible. To make this a reality, the Federal Ministry of Transport and Digital Infrastructure has been subsidising the new-build, upgrade and reactivation of private sidings by covering up to 50% of eligible expenses. By the end of 2018, some EUR 120 million had been paid out to subsidise 164 private sidings. At sites where a private siding isn't feasible, targeted aid projects have sought to provide assistance. Currently, requirements are being gathered for a potential digital entry portal, which small and medium-sized transport companies could use to access rail freight transport in the future. Through its EVplus product, DB Cargo has also enabled its customers without a private siding to use door-to-door service for transports.

Additionally, the German government and Deutsche Bahn are planning to invest another EUR 86 billion in the digitalisation of the rail network until 2030. That's because, in order to improve rail transport, infrastructure and rolling stock have to be modernised. DB Cargo alone operates some 65,000 freight wagons and roughly 2,100 locomotives. This means the company hauls approximately 43% of all transport volume on the German railway. As such, DB Cargo has a key role to play in efforts to make rail freight transport more competitive. Aware of its role, DB Cargo is therefore blazing the trail for digital (rail) logistics with its comprehensive programme for digitalising and automating vehicles and processes all along the value chain.

Volume of German freight transport by mode (2019)



Case study 1:
Digitalising the DB Cargo fleet

The first step toward digitalisation was to install telematics and sensor technology on the wagons and locomotives to make them fit for the future. This means the vehicles are now part of the Internet of Things. That's because, in order to digitalise and automate logistics processes, wagons and locomotives must be able to communicate and transmit information. Holger Bartels is the head of the Asset Intelligence Center at DB Cargo. "We've equipped our vehicles with technology which makes them an active part of the rail freight information system," says Bartels. "Using the telematics and sensor technology we've installed, we're able to do things like detect the location of individual vehicles. We're talking about more than 65,000 freight wagons and roughly 2,100 locomotives here. We're now able to represent each vehicle as a digital object in our IT systems, link their information with the data from our existing systems, analyse it and make it usable." These data, including GPS data to identify a vehicle's position, are slated to be made available internationally for European rail freight transport. In this way, customers will always be able to tell where their transports are at any given moment. Of course, installing sensor technology and telematics on freight wagons and locomotives is not an end unto itself; instead, it represents the fruits of the first phase of vehicle digitalisation, with the ultimate aim of achieving subsequent milestones such as condition-based maintenance. Data about a wagon's condition can be used to draw conclusions about maintenance it needs, and the relevant work steps can then be taken quickly and simply at the right place and time, in the proper depot and using the proper materials.

"We've equipped our vehicles with technology which makes them an active part of the rail freight information system."

HOLGER BARTELS
Head of the Asset Intelligence Center,
DB Cargo AG

Case study 2:
Digitalisation and automation working in tandem

Installing telematics and sensor technology on vehicles provides a basis for considering more sophisticated solutions which use automation and digitalisation. Thus equipped, wagons and locomotives have the technology they need for other automation projects – including the project at Munich Nord station, which will become the first digital freight station, a place where trains will be handled using largely automated processes. Working with the Nuremberg Institute of Technology, DB Cargo has developed a system for use by shunting locomotives which enables them to take in their surroundings much like the human eye, using a video camera, an infrared camera, a laser scanner and radar – and thus laying the foundation for automatic train operation. This technology is currently being tested at Munich Nord freight station, where it will be further developed until it is ready for real-world use.

In June 2021, DB Cargo and the German Federal Ministry of Transport and Digital Infrastructure (BMVI) held a ceremony to officially open the shunting yard of the future. "Once the project is finished, the shunting yard's capacity will have increased by up to 40%. Freight trains will be able to depart more quickly, more flexibly and more frequently," says Norbert Kahl, head of the Digitalisation and Automation Strategy organisation at DB Cargo AG. These are important factors for being able to transport more freight on the rails. The German Federal Ministry of Transport and Digital Infrastructure has also provided subsidies for this project totalling more than EUR 14.5 million as part of the German federal programme to promote pioneering rail freight technology.

In this project, DB Cargo is working with partners in science and industry to test partially automated damage detection using artificial intelligence (AI), automated brake testing and digital automatic coupling (DAC), which provides trains with a constant supply of electricity and data in addition to automatically coupling its freight wagons. These technologies will allow freight trains to be formed much more efficiently in the future.

"Digitalisation and automation in rail freight transport are the keys to shifting more traffic to the eco-friendly rails."

NORBERT KAHL
Head of the Digitalization and Automation Strategy organization, DB Cargo AG

As Kahl sums it up, "digitalisation and automation in rail freight transport are the keys to shifting more traffic to the eco-friendly rails. The technologies will be implemented in discrete steps. As we implement them, we'll be focussing on increasing the capacity of the existing rail network and introducing new, efficient processes in railway operations. In this way, we'll be investing directly in growing rail transport."

Case study 3:
Automatic train operation

The maximum capacity of all available infrastructure must be tapped in order to achieve the growth targets for rail freight transport and thus allow for the decarbonisation of the transport sector. Automatic train operation (ATO) will make this possible, a technology which operates on the standardised, interoperable European Train Control System (ETCS). This is why DB Cargo has made ATO and ETCS top priorities, alongside digital automatic coupling. As early as 2016, DB Cargo proved with its test train that automatic train operation was technically feasible. Five different scenarios were studied at that time: approaching a wagon-set for coupling, running an optimal speed profile, detecting obstacles, precision braking and fully automated driving. In the next step, a research consortium led by DB Cargo succeeded in testing four different ATO systems running on ETCS technology on a public network in Switzerland in 2020 – a first in the history of European rail freight transport.

These past successes are now serving as the basis for DB Cargo's work at the DB CargoLab, where it is developing more solutions for rail freight transport which are viable for the future. "Deutsche Bahn's Innovation Lab is outstanding," says Peter Holm. "Top experts at the lab have been specifically assigned to work on solutions to advance digitalisation and automation in rail freight transport – and in particular to make it affordable." ●

ATO

Automatic train operation (ATO) optimises the energy use of trains as they drive, while optimally balancing capacity utilisation. The new-found flexibility and shorter transit times which result are expected to convince customers to move their transports to the rails. The locomotives and their routes have also been equipped with additional systems to implement the various grades of automation (GoAs). ATO is playing a significant part in achieving the target of decarbonising transport.

ETCS

Train protection systems (TPSs) ensure a safe distance is maintained between trains and also monitor compliance with speed limits. Efforts are currently underway to gradually transition to the European Train Control System (ETCS). TPSs are being harmonised in order to eliminate technical barriers to cross-border rail operations.

The components of ATO and ETCS systems installed on routes and in vehicles communicate with each other. This data is then used by the traffic management system (TMS) to coordinate train movements, which the ATO system then carries out. With automation in place, longer trains can run at closer intervals, which allows for more transports on the rails overall.

link2rail provides information to meet customer requirements.

Another important milestone was the introduction of DB Cargo's link2rail platform in spring 2020. The platform offers various electronic services, also known as e-services, thus closing the digitalisation gap. With link2rail, all ordering and transport processes can be navigated with a few clicks. Information on the platform is always up to date, and even large amounts of data are compiled and displayed in an easy-to-read format. Customers can use link2rail to request empty wagons, create freight orders, view order status and history, and track shipments. To support these services, GPS and sensor data are intelligently linked with data pulled from existing IT systems.

Available e-services:

EMPTY WAGON Save time when placing empty wagon orders: Orders can be placed and tracked online, and an order view displays all relevant information. Customers can submit orders from their systems using an approved template.

ORDER Efficient order management: Customers can place transport orders, make bookings and track them digitally, providing more transparency and making the process more efficient.

TRACK&TRACE Provides estimated arrival times and notifies customers of schedule changes ahead of time. To provide this service, satellite, geolocation and sensor data are evaluated and artificial intelligence is used to merge it with information from infrastructure managers.

INVOICE Transparency in accounting: Customers can view, filter and export all invoiced services in the system, eliminating the need to print out invoices.

GEOFENCE CONTROL Digitally delineates an area relevant to a company: Wagons within a specific boundary can be identified based on GPS data. Users have access to a view that shows the number of wagons, their location and their idle time. When standing times are near expiring, users automatically receive a warning, which saves them demurrage charges.

RECYCLING Designed for customers in the steel and SCRAP industries: Shipment volume, empty wagons and capacity at steel mills can be coordinated, quantities released and empty wagon orders triggered automatically. Standard functions such as Track&Trace are integrated into this process.

Details about Track&Trace

What information is collected?

All wagons are equipped with a basic telematics device, which consists of a communication unit, GPS and impact sensors. Solar panels supply power to the devices, and data are sent to the DB Cloud every ten minutes.

Intelligent sensor technology enables empty wagons to be dispatched more quickly.

Eventually, thermometers and humidity sensors will be used to quickly identify and mitigate potential corrosion.

How are data delivered to the customer?

The mobile communications network will be used to transfer wagon data from base devices to the DB Cloud (link2rail Intelligence), where the data will be associated with the wagon type and condition. These data come from existing systems such as those used by dispatch and maintenance. The data are then compiled in link2rail Intelligence, DB Cargo's data intelligence service.

Customers can use link2rail to access the compiled data for individual shipments. link2rail can be used more traditionally as a portal in an Internet browser, or the same services can be directly linked to customer systems using programmable interfaces called APIs. When customers connect link2rail to their own business data, they're able to manage their logistics chain more efficiently. DB Cargo leverages the collected data itself to improve processes. Sensors and telematics solutions are used by dispatch and customer service to help transports run more smoothly. Transport planners analyse data, for instance, to optimise transports one after the other.

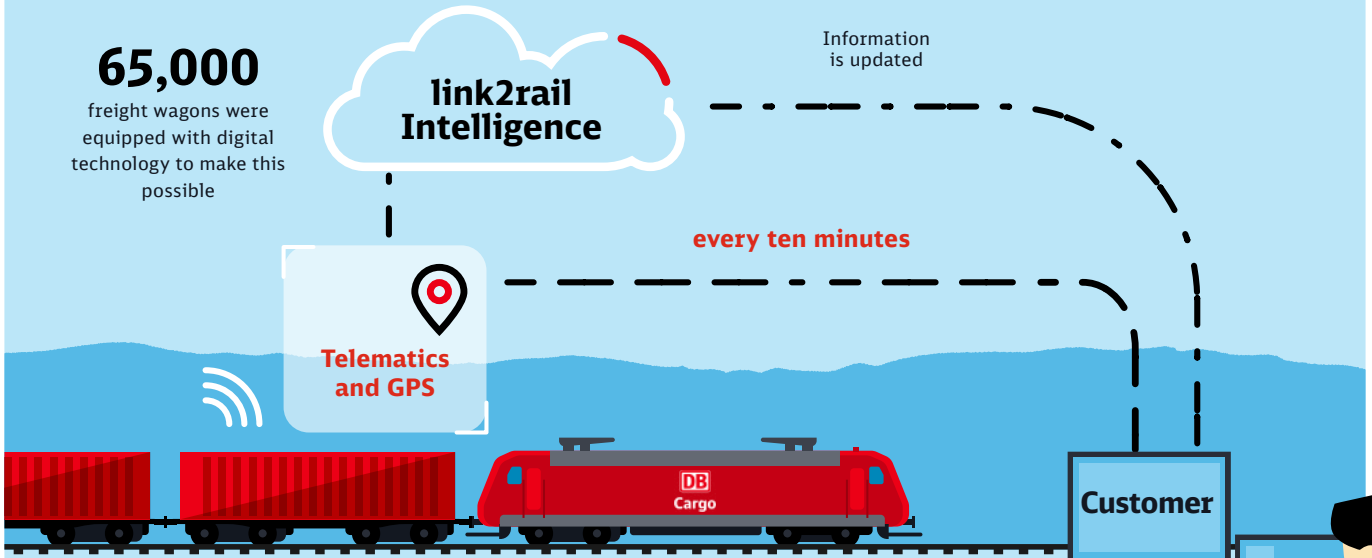
The research organisation for rail transport marketing at the University of Münster conducted a study which analysed customers' perception of link2rail and the basic e-services. During the study, users were interviewed about their expectations before the system was introduced and about their experiences after it went live. Responses were overwhelmingly positive.

- Customers are highly satisfied with the platform.
- The Order and Empty Wagon e-services meet customers' expectations.
- Track&Trace's consignment tracking service exceeds expectations. Customers described the introduction of this e-service as a clear milestone in quality.
- From a general standpoint, the system's simpler processes and user friendliness garnered particularly positive ratings.

Additionally, a competitor analysis has revealed that, by introducing link2rail, DB Cargo has surpassed all other train operating companies when it comes to digitalising the customer journey, while catching up to online freight forwarders at the same time.

link2rail functions

Customers are highly satisfied with link2rail: the Track&Trace function in particular exceeded expectations.



link2rail in action

The transports sent by SSAB, a DB Cargo customer, are becoming more transparent, more efficient and cheaper

The highly specialised global steel producer SSAB is the industry leader in decarbonising steel production. The company focusses on innovations like fossil-free steel, i.e. steel which generates virtually no carbon emissions when produced, a product which is set to enter the market in 2026. Sustainability plays an important role in logistics, too. SSAB transports hundreds of thousands of tonnes of steel from Sweden and Finland to customers in over 13 European countries through hubs in Rostock and Antwerp and Swedish sites in Borlänge and Oxelösund – all using the eco-friendly rails. DB Cargo has been partnering with the company for more than ten years.

A company transporting this kind of volume to so many different destinations needs technical solutions to help with monitoring. That's why SSAB decided to launch a pilot project in spring 2020 to use link2rail's API for Finnish transports starting in Rostock. Heikki Hellsten is the head of logistics for the Finland organisation. "We wanted to link the wagons' location information with our tracking systems in order to optimise our transports," says Hellsten. Using the Track&Trace e-service, SSAB is now able to precisely monitor the location of each individual wagon. "We wanted to be able to see our shipments and know where the wagons were at any given time. With link2rail, we're able to better communicate with our customers and monitor our supply chains more granularly because the supplier routes are connected. This saves us time and money, which means we can all use our resources more efficiently."

DB Cargo and SSAB thus share these specific aims: provide real-time transparency for all transports, continuous status updates and dynamic estimated arrival times. By using link2rail's API, the company has moved quite a bit closer to achieving its goals. "We recognise that link2rail is a solid system, and implementation went smoothly. Our delivery precision has improved, meaning that our sub-contractors' resources have become more reliable," says Hellsten. His colleague Magnus Eliasson is responsible for rail transports in the Sweden organisation. "Digitalisation is essential for our transport processes. link2rail is an important piece of this, but we've still got a long way to go," says Eliasson. DB Cargo has already begun to address the company's request for information on arrival times and is currently developing a solution to meet this need. Hellsten and Eliasson agree that "working with DB Cargo is a very good experience, and we're pleased to be working hand-in-hand to continue moving digitalisation forward." ●

"Our customers say link2rail's functions are highly valuable, and they confirm that they can optimise their internal processes using our services."

DR ERIC PFAFFMANN
Vice President for Digital Customer Interface and programme director for link2rail, DB Cargo AG

What does the future hold?

In time, DB Cargo will expand its automation and digitalisation efforts to encompass all rail freight transport processes. As it does so, the company will focus on the following areas: digital access, automated train formation, automatic train operation and digital, automated maintenance. Here's the impact this focus will have on these areas:

Digital access
DB Cargo's Asset Intelligence Center (AIC) is providing a platform which will enable data to be used across all of Europe and allow new data to be processed. Digital platforms like this one will soon have to meet ever more stringent security requirements in order to provide support for companies' various operational processes from top to bottom. Solutions such as link2rail are being incorporated into the value chain, which is being planned and managed with integration in mind. Companies thus have access to transparent, flexible solutions which they can use to schedule and manage transports, helping to meet the growing need for information.

Automated train formation
Once automated, train formation is managed and implemented using real-time information. Data are processed digitally throughout the entire process, and decisions, such as those made by dispatch, are prepared using supporting systems. With systems like these, time-intensive, arduous manual labour on the tracks will become a thing of the past. As digital automatic coupling (DAC) is introduced, train dwell times at shunting yards are expected to grow even shorter.

Automatic train operation (ATO)
DB Cargo is laying the foundation for ATO even today. By the end of 2024, the company will have the technology in place to run a one-year-long test of ATO in 2025. The test will involve two locomotives equipped with (and approved to use) ATO technology, which will run on the Dutch portion of the Betuwe route – from the port of Rotterdam to Zevenaar – and will be equipped with ETCS Level 2 technology. The project is being funded by the German Federal Ministry of Transport and Digital Infrastructure (BMVI). "Automatic train operation is an essential tool for businesses to experience success with rail freight transport. The ATO project has a particularly high priority for making rail strong," says Norbert Kahl.

Digital and automated maintenance
Artificial intelligence (AI) creates the conditions necessary for automated maintenance and eliminates the need to manually inspect trains in inclement weather. In the future, freight trains will pass under a gantry bridge, which will capture images of each wagon from all sides. DB Cargo is working with the University of Wuppertal, the Fresenius University of Applied Sciences and DB's AI experts to develop algorithms which automatically detect and report damage sustained by freight wagons. This technology also offers another benefit: it can check freight wagons from above, something that has previously been impossible in this way.

Peter Holm offers the following perspective:
"The technologies I think will continue to gain traction in the coming years are artificial intelligence and data analytics, which will enable DB Cargo to link its own data with external data sources, thus allowing the company to analyse rail freight transport with greater precision. Another key enabling technology for logistics companies will be the Internet of Things, which works using sensors and speeds up data transfer in rail freight transport using the 5G mobile communications standard. Lastly, quantum computers will also help to increase the precision of the entire rail system and make scheduling easier."

Conclusion

Digitalisation is a game changer

Booking a freight wagon should be as easy as making an online purchase – only then will rail freight transport have a chance of eventually replacing road haulage as the first choice for transport. By giving companies easier access, rail service becomes a more appealing option. This also goes for fully automatic operation and an intelligent vehicle fleet. While this all may sound logical, it also represents a humongous task. That's why DB's teams are working across disciplines – experienced engineers, data scientists and experts in logistics and digital transformation – to leverage automation and digitalisation to adjust processes so they meet the needs of its customers, ensuring viability for the future.

By doing this work, DB's teams are ensuring that the eco-friendly rails will become the first choice for freight transport.

According to Peter Holm, however, companies themselves must now become more actively involved with these new technologies and improve their business models across the board. The potential efficiency increases which digitalisation and automation can bring in logistics must be tapped in order to keep pace with competitors. "We need to be moving faster and more boldly when it comes to implementation," says Holm.

Take-aways from this white paper

1. In order to shift traffic to support the achievement of climate targets and to meet increasingly sophisticated customer needs, companies have no option but to analyse their logistics processes along the entire supply chain now and use digitalisation and automation to make changes as needed.

2. Digitalisation and automation don't happen overnight. This white paper recommends analysing where logistics process could use digital technologies to become more efficient and thus more cost-efficient and eco-friendlier, and then starting the projects that result from this analysis.

3. We would be glad to provide you with advice and assistance in all matters related to digitalisation and automation, whether regarding the use of digital technologies which suit your company or our experience with automating vehicles and maintenance. If you have questions or are you interested in discussing these topics further, please reach out to us with a message.

DB Cargo

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