



Think beyond the rails: Leading in 2025

Driving growth for railways

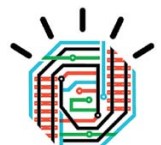
Executive summary

Both passenger and freight railways must continually improve, innovate and enhance the traveler and customer experience to drive revenue, maximize the availability of assets and infrastructure, and improve operational efficiency.

Despite steady progress, the rail industry needs to continue to pursue these objectives. By embracing an integrated rail ecosystem and new cognitive technologies to acquire, associate and apply information, railways can become more efficient and effective, and can create a more responsive and agile operating environment.

To achieve the interconnectedness that will power the near future of the railway industry, railways need to:

- Collaborate beyond their comfort zones by partnering with adjacent service providers, creating an ecosystem of value
- Use cognitive computing to harness data both inside and outside their enterprises to drive revenue, reduce cost, and win market share



Welcome to the cognitive era

Railway customers are demanding more control over their travel or shipping experience through channels of their choosing. Railway operations are experiencing more challenges and complexity in maintaining equipment and orchestrating resource deployments. Meanwhile, mountains of structured and unstructured data come from customers and partners using digital platforms and mobile devices enabled through the application program interface (API) economy. Rolling stock, track, sensors, digital video and transaction systems generate even more data. The challenge is harnessing and connecting this data to derive actionable insights to improve business results.

Cognitive systems can harness this data to advance rail industry imperatives, and help railways achieve the interconnected vision. Cognitive computing is the next evolution of technology systems capabilities that mimics the way the human brain works because it understands, reasons and learns, shifting technology's role from enabler to advisor and unlocking the potential of data.

Using powerful cognitive data capabilities, railway marketing and sales functions can deliver relevant, personalized offers and guidance based on each passenger's preferences, context and location, converting more sales and improving the passenger experience. Successfully guiding travelers' choices will provide credibility and trust in the services and solutions railways offer, thus placing railways top of mind among travelers' options.

For freight railways, the same holds true. By understanding, integrating and optimizing the needs of the constituent supply chain providers, railways enhance their place as providers of choice.

All rail operators can apply cognitive capabilities to rail infrastructure ownership and maintenance decisions, as well.

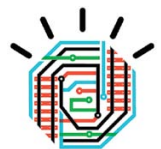
Maintenance engineers can predict asset performance based on sensor data, context and history for similar equipment. Planning leaders can better forecast to align capacity with demand, analyzing a multitude of variables to manage complex rail operations.

Railways that leverage cognitive systems will differentiate themselves in the market, win competitive share and increase the lifetime value of each customer.

The rail industry in 2025

The ability of new entrants, the digital disruptors, to enter the market and create value will accelerate. Disruptors aim to change the rules of the game—often starting by trying to own the customer relationship—and the railway industry must recognize that it needs to understand and satisfy the daily needs of its customers.

The transformation of both passenger and freight railways to become more interconnected, transparent and agile is integral to the future success of the industry. Becoming digitally focused and delivering actionable insights by way of machine-to-machine communications and mobile devices will enable operations to run more effectively and efficiently, and will improve the end-to-end experience. Because digital is the new normal, this transformation is not optional if a railway wants to remain competitive and thrive.



IBM Travel and Transportation Industry

Imagine the ideal end-to-end passenger experience or freight shipper experience. A totally different image from today's reality emerges: one with optimized efficiency, differentiated service, real-time decisions, shared knowledge, and adaptive and autonomic responses.

In order to achieve these visions, described in detail below, railways need to become interconnected beyond their current comfort zones by partnering with adjacent service providers and learning from cognitive systems to unlock data both inside and outside their enterprises. This will allow railways to directly and concretely address current and future industry challenges.

Passenger rail

For customers, getting from origin to destination is seamless. Railways offer door-to-door journeys, so they meet customers' travel needs at each step. Railways enjoy a higher conversion rate and better revenue from sales and marketing efforts. They communicate with customers in real time, and remember and automatically recognize customer interactions. Railways anticipate evolving customer preferences and offer assistance proactively. They communicate with customers through their preferred channels—especially mobile devices—and deliver relevant, timely and personal marketing offers.

Railways offer multimodal travel options through integration with ecosystem partners, including digital disruptors, and allow customers to choose the journey that is the most valuable to them, based on duration, cost, convenience and likelihood of disruption. Railways give the customers personalized offers and advice according to their preferences during this shopping phase in real time. Reservations cover all modes of the journey, including non-train travel. Personalized mobile applications provide real-time trip details, tickets, destination information,

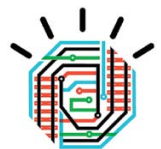
weather, travel times, queue times, maps and information about how to make connections between modes of travel. Railways incorporate social collaboration platforms and emotive insights from fellow travelers to enhance the travel experience.

In-journey advice and suggestions from railways are proactive and real time, based on each customer's location, context and preferences. Railways provide assistance and re-accommodation automatically in case of any disruptions. Mobile applications are personalized, interactive and essential tools to the travel experience. Employees are empowered to deliver exceptional in-person service by leveraging extensive real-time knowledge about their customers. Communication between customers and railways is fluid, including offers and feedback.

Post-journey communication is a many-to-many relationship, with continual conversations connecting railways, customers, partners and suppliers across social networks. Communication is based on each customer's preferences, enabling the railway to build loyalty. Customers have the tools to share their experiences and travel plans easily, and are motivated to do so. Railways build customer advocacy by providing true value in each customer's door-to-door travel experience.

Freight rail

Freight railways monitor facilities, assets, systems and shipments in real time. Network velocity, on-time delivery, customer service, labor utilization and productivity are all improved. Downtime and delays are avoided. Railways leverage their operational cost advantages and extend their services as the focal point for door-to-door transport, now enhanced by insight into their own operational performance and partnerships with supply chain providers.



Freight railways and their customers communicate with each other in real time, including automatic notifications and alerts for shipment pick-ups and deliveries. System-to-system insights are shared amongst supply chain partners, who provide continuous re-planning and re-optimizing as needed to meet time-defined supply chain commitments. Trains and employees work in sync, and dispersed workforces are better equipped with tools that empower them. Timing, status, location, route and characteristics of shipments are automatically recorded and communicated with the buyer of railway services in real time.

Railway yards and terminals are geo-fenced and enabled with smart devices to automatically notify shippers when freight enters and exits rail and customer facilities. Railways monitor shipment conditions remotely and, when disruptions arise, corrective actions are taken automatically. Rolling stock and track can detect and predict conditions in real time. Temperature, movement, position and other in-journey factors are monitored, and at-risk shipments trigger notifications to the railway. Sensors detect any unusual variances from travel conditions and log the data, alerting railway inspections teams. These variances are also incorporated into the railway systems of record to continuously enhance the systems of insight.

When necessary, freight is automatically rerouted to deliver it on time, and facility staffing is adjusted accordingly. Final arrival times are calculated and automatically sent to the railway, shipper, logistics provider and end customer. Rail yards are optimized in real time to most efficiently and predictably move freight through the yard, minimizing dwell time and ensuring supply chain commitments are met.

Achieving the vision

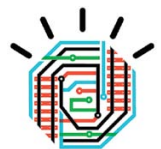
If railways are to achieve this vision, they need to address some business challenges. Defining these challenges, their dynamics and their implications is critical to tackling them effectively.

Asset, network and customer data

Knowing the status, condition, availability and location of all assets and infrastructure at all times is imperative to efficiently running operations. Also knowing the history, context, preferences and trip data of customers is equally important when running customer sales and service functions. All this data must be harvested, managed, analyzed and applied in real time—which presents a challenge. The need to be “all-knowing” about assets, networks and customers is beyond any human being, and requires cognitive computing to be effectively and efficiently managed. System-to-system communication from self-aware physical assets will spread with business processes that understand when, and if, human interaction and intervention is required.

Capacity, demand and utilization

Appropriately aligning capacity with demand requires optimization of the existing passenger and freight rail schedules and train sets to achieve increased throughput on existing rail infrastructure. Bottlenecks must be avoided to keep operations flowing smoothly and keep costs down. Rail companies are increasing asset utilization and optimization by making significant investments in partnerships and infrastructure to meet the capacity challenge.



Operational efficiency and reliability

Aging IT systems limit the efficiency of resources and reliability in established rail markets and prevent companies from responding quickly to changing needs. Railways entering new markets have the opportunity to adopt newer, more flexible technology infrastructures, leapfrogging current practices. Network failures and system outages can have a large domino effect that impacts customer satisfaction. Many current IT systems are old and complex, making the ingestion and sharing of new types of information and data difficult. They are often inflexible in their design and incapable of coping with growth.

Most systems still require significant worker interaction and lack the ability to anticipate, sense and respond, and move at the required velocity of today's supply chains. These systems are complex, and include managing and integrating the availability of locomotives, wagons and crews. For passenger railway ticketing and reservation systems, the need to transform is being driven by the elevated expectations and requirements of travelers. Baseline requirements now include extending the travel services value chain into an integrated end-to-end experience.

Government regulation

Government regulation can provide additional strain on railways and their operations, sometimes inhibiting profits or otherwise hurting their existing business model. In Europe, recent liberalization and privatization is forcing railroads to restructure their operations to improve performance and their cost structure. Governments can also apply requirements that aren't necessarily profitable, such as requiring rail service in low-population areas.

Ownership of different pieces of the rail operation by different parties, such as rolling stock, rails and stations, drives greater complexity. In North America, freight and passenger railroads are entirely separate entities, and passenger operators are

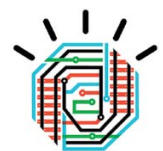
quasi-governmental organizations that rely heavily on government subsidies. This causes control issues for the passenger side because they do not own the tracks.

Workforce skills preservation

At most railways, the workforce tends to be an older demographic, who carry with them years of valuable experience and expertise in the industry. As this workforce ages and exits, there is an erosion of human resources skills, as "tribal knowledge" can often be lost. This knowledge is difficult to replace once it has left the railway. A solution to this challenge is to gradually transfer the knowledge base from individuals to cognitive systems, preserving it from generation to generation. Humans can teach cognitive systems the knowledge and logic that is essential to their railway, because cognitive systems are capable of capturing, learning and reasoning. In turn, these cognitive systems can serve as a teaching tool for new employees by continuing to pass on the knowledge they have preserved.

Customer relationship disintermediation

Owning the customer relationship means earning the loyalty of the party that controls railway revenue, therefore, it is imperative to sustain and enhance the customer relationship through new services and trustworthy interactions. However, this ownership has increasingly been transferred to third-parties, such as the aforementioned digital disruptors, online travel agencies (OTA) and third-party logistics providers (3PLs), who manage the distribution and sale of railway services. This disintermediation means relinquished control over the relationship with customers, who are becoming rail-provider agnostic and treating railroads as a commodity. To avoid competing on price alone, railways must retain control of the customer relationship and differentiate themselves based on the value of their services.



The path forward

An interconnected railroad will not be built overnight. It requires bold steps, investments and the will to create real transformation.

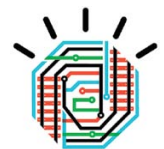
In order to achieve true end-to-end interconnectedness, railways need to take advantage of the cognitive systems that exist today. Cognitive systems have unique capabilities to harness data to deliver insights that improve railway operations. They interpret structured and unstructured data, and natural language from a broad variety of sources inside and outside the enterprise, including weather, the internet of things (IoT) and social network data. In real time, they form hypotheses about possible actions, assign a confidence level to each and prescribe a recommendation. And they continually learn, adapt and improve these recommendations.

Additionally, predictive analytics, enhanced by cognitive capabilities, can help railways on the path to interconnectedness. Predictive analytics allows railways to improve asset productivity, generate relevant customer offers and optimize maintenance, among other functions. The IoT network of physical objects, enabled with connectivity and ever-increasing intelligence, is also an instrumental technology to leverage when striving for railway interconnectedness. This invaluable technology enables rolling stock, track, stations and travelers to transmit and exchange data automatically—system to system, system to traveler, and system to ecosystem partner. Applying these capabilities across the railway in a scalable, flexible and adaptive manner on the cloud is essential.

Doubling down on these technologies will produce better business results from personalized customer sales and service, optimized capacity and demand planning, and improved operational efficiency. Railways who achieve this vision will differentiate themselves in the market, win competitive share and increase the lifetime value of each customer.

Rail executives should consider these questions in planning the path to an interconnected railway:

- Can your operational and asset data be measured, sensed and incorporated into near real-time decision making?
- Are you fully harnessing the power of your railway's data by capturing, associating and applying it?
- Are your business functions flexible and responsive enough to meet individual customer demands and preferences?
- Can you predict your maintenance needs based on actual conditions, and apply the learning to future maintenance situations?
- Do you know the status, condition and availability of all assets and infrastructure at all times across your rail network?
- Do you have insights into your partner ecosystem performance?
- Are you capturing your customers' transaction history, context, preferences and trip data, and applying this knowledge to subsequent customer interactions?
- Are your systems fully integrated with those of adjacent service providers, suppliers and partners to leverage your combined capabilities so you can offer a better service to your customers?



Conclusion

Technology is enabling new entrants and competitors to quickly create value, threatening the traditional rail model. Rail executives should strive to develop an interconnected rail ecosystem by embracing disruption. Deploying cognitive technologies will enable railways to become more efficient and effective, and will allow them to operate with more responsiveness and agility.

We are on the brink of an explosion of growth in cognitive computing; railways should use this time to begin their transformations and lead the pack, rather than being forced to do so after their competitors have already taken the lead.

For first movers, becoming interconnected by leveraging cognitive technologies can help create important competitive advantages—an expanded rail ecosystem, optimized operations, new revenue model opportunities and improved customer relationships.

As the rail industry embraces connectedness and cognitive technologies, this investment will accelerate new railway intelligence, enabling enhanced industry-wide knowledge and business model innovation.

Deciding how and where to leverage cognitive systems to become interconnected is a strategic business decision that requires careful consideration. IBM stands ready and uniquely qualified to help you develop and execute your strategy for the cognitive era.

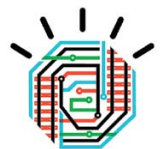
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Keith Dierkx is Director of the IBM Global Rail Innovation Center and a member of the IBM Industry Academy. He has worked with railroads for over 25 years, primarily in logistics and information technology. He has been CIO of a global transportation company and Vice President of a successful Silicon Valley startup. Keith is currently on the Business Advisory Council at the Northwestern University Transportation Center, was a Technology Board member at the Auto-ID Center, now EPC Global, at the Massachusetts Institute of Technology, and served on the advisory boards at multiple university labs, as well as transportation and IoT startups. Keith may be reached on Twitter [@KWDrail](#) or by email at kwdierkx@us.ibm.com.

For more information

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