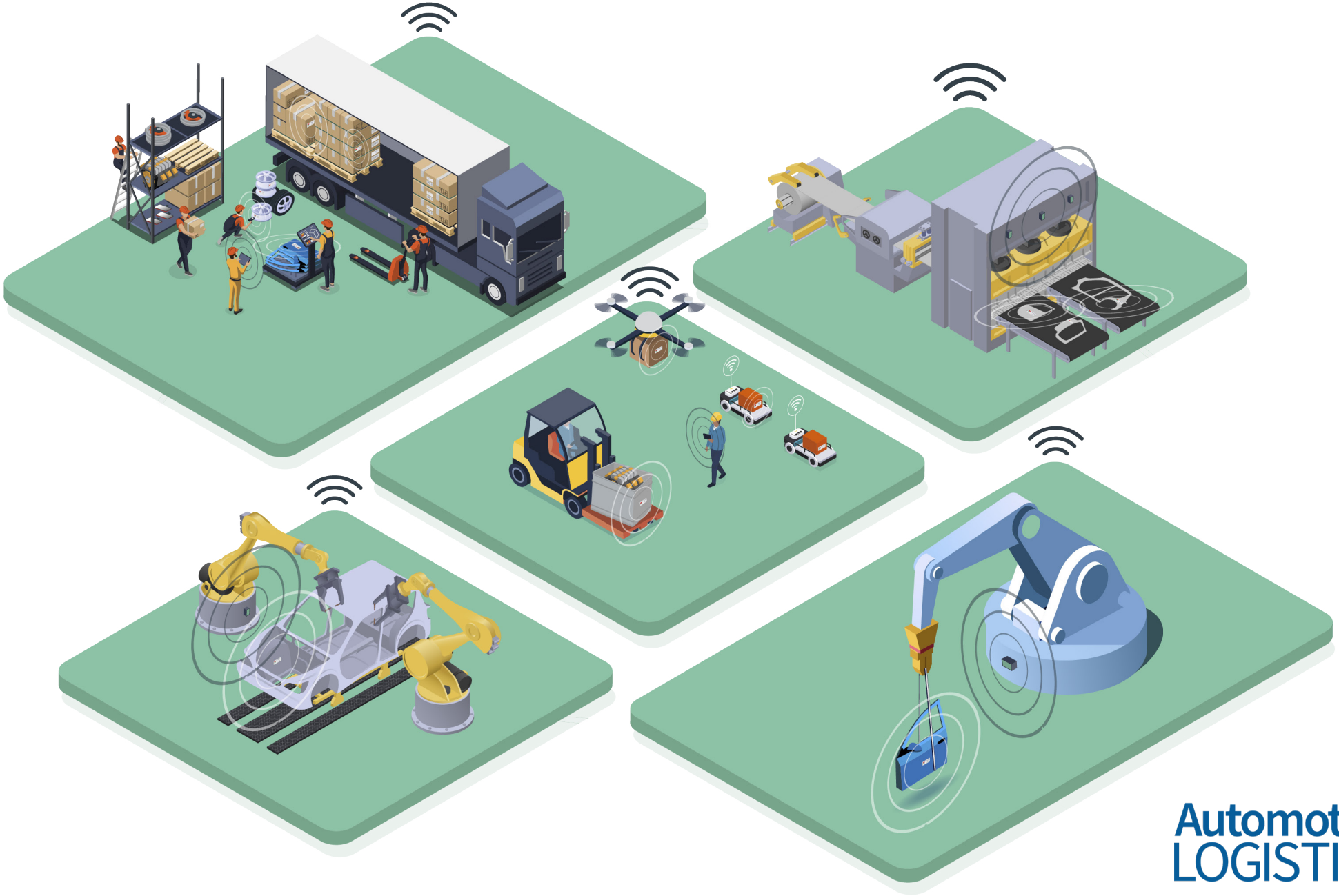
Tracking Every Part

How RFID Enables Better Automotive Supply Chain Visibility



Automotive LOGISTICS

Introduction: A rising need for real-time visibility

As Covid-19 swept the globe in early 2020, factories were shuttered and freight flows disrupted, affecting globally linked automotive supply chains. But while shutdowns brought the industry to a standstill, ramping production back up proved even more challenging. The industry has faced semiconductor, material, and labor shortages, along with scheduling chaos in global shipping. A lack of chips has forced manufacturers to close plants, while poor inventory visibility has made forecasting unreliable. Sales have been lost while costs have soared, damaging auto makers' bottom lines and brand images.

Supply chain visibility has become increasingly key in helping manufacturers identify non-availability of parts and make decisions about alternative supply, expedited shipments and changes to production schedules. For example, manufacturers have prioritized vehicles and configurations based on what parts they know are available.

With ongoing uncertainty, the industry will face this 'new never normal' for the foreseeable future. Manufacturers will need more visibility in real time, including material stock and inventory tracking at suppliers and assembly plants to minimize disruption, reduce waste and emissions.

To achieve visibility at scale, manufacturers must automate part and inventory identification, and ensure data is seamlessly connected across the supply chain.

1. Moving past manual parts ID in manufacturing

For decades, manual scanning, especially of barcode labels, has been the primary process for parts and inventory identification for automotive manufacturers. But vehicle manufacturers now produce many more model variants, with more options, accessories and electronics, compared to 30 years ago. As mixed-model assembly lines cope with high parts variety and frequency, there is a trade-off in the pace and complexity of production, and the limits to speed, accuracy and visibility that label tracking and manual scanning provide.

Thanks to productivity improvements, for example, throughput times are now much faster and production cycle times shorter, leaving less time to read components' labels, while at the same time manufacturers must track much more data, all of which is challenging for barcodes and manuel processes. Manual scans of inventory not only require more workers and are subject to errors, but they reduce the potential for real-time status updates, and instead rely on 'batch' processing. Meanwhile, a smudge of oil or a torn label can render codes difficult to scan or even unreadable.

Even the camera-based readers that some manufacturers use to read codes and scan labels automatically still requires a line of sight, and are thus less effective at tracking individual parts, especially once they have been fitted to vehicles.

With top quality standards like Six Sigma and *kaizen* in the automotive industry, there's no tolerance for code read mistakes, whether through human error or damaged labels. Manufacturers require higher accuracy and better data integration, especially to improve visibility and leverage IIoT opportunities.

RFID makes a smart difference

In response, more auto makers are moving beyond manual parts identification and instead implementing Radio Frequency Identification, or RFID, to track inventory across many areas of parts shipments and manufacturing operations.

An RFID tag becomes energized when a radio signal from a 'reader' device triggers it, prompting the tag to transmit information encoded within it. RFID tags can store significant amounts of data, whether to identify a single component, or store installation information, manufacturing dates, or unique serial numbers.

RFID tags are well suited to the harsh conditions, efficiency and speed of automotive production. As they can be embedded or encapsulated into parts, they are readable whether in a cardboard box, on a pallet, or in the back of a truck, while entire pallets or truckloads can be simultaneously identified without continuous counts. RFID tags do not require line of sight, which means manufacturers can identify parts even after vehicle assembly. And with digitally connected inventory across supplier, logistics and plant operations, manufacturers can quickly and seamlessly connect data on parts identification to production management systems, including across the cloud, enterprise resource planning (ERP) and manufacturing execution systems (MES).

The result is that using RFID to automate tracking achieves fast read-rates, has extremely low error rates, and enables smart manufacturing approaches.

2. RFID in automotive logistics: better visibility, better quality

The real benefits of RFID in the automotive supply chain begin when tier-1 suppliers or module manufacturers apply tags at the component level, which helps automate and increase data collection across parts delivery and manufacturing stages. With detailed visibility, OEMs and suppliers can identify potential stock shortages and avoid disruption.

Manufacturers can also make longer-term gains by encoding individual component serial numbers onto tags, which helps track components back to their individual point of production, identifying where workers or equipment might have caused errors or where efficiency improvements are possible.

Supporting JIT, preventing chargebacks

RFID can furthermore enable just-in-time and just-in-sequence deliveries. Suppliers must load and dispatch components and modules in controlled sequences so that they arrive lineside in the right order. Out-of-sequence components are expensive for an auto maker, causing stoppages and quality problems. Accordingly, penalties and chargebacks are exacted on suppliers that deliver incorrect components.

When a supplier applies RFID tagging, it enables automatic loading verification, which ensures the ordered components are included, and that shipments move through the correct doors and to the right truck. The result: smoother flowing assembly lines at the auto maker, and an avoidance of penalties by the tier-1 supplier.

"The greater the importance of sequencing and scheduling, the more important that RFID becomes as a means of improving the flow and efficiency and quality assurance of the process," notes Richard Wilding, professor of supply chain strategy at Cranfield University's Cranfield School of Management. "Potentially, too, there's a strategic benefit: a greater ability to cope with complexity."

RFID: suited for complexity

Quickly and accurately identifies parts across high model and option variation

Connects data to manufacturing systems and IIoT in the cloud or locally

Identifies parts across pallets and bulk shipments without continuous counting

More durable than relying on physical codes and labels

This data collection can also support traceability in recall scenarios, even after components have been fitted to finished vehicles.

“With full visibility into the as-manufactured vehicle, where the auto maker knows exactly which parts are on which vehicle, it is possible to pinpoint recalls more precisely,” says Heikki Haavisto, sales director for northern Europe and the Americas at RFID systems supplier Turck Vilant Systems.

“The result is that recalls are limited to much smaller batches, which is obviously much less costly.”

Tracking packaging pools

RFID-enhanced visibility offers great benefit to returnable packaging. Auto makers and tier-1 suppliers often rotate returnable transport items (RTIs) – usually customized to individual components or modules – in loops between assembly and component plants. RTI pools can reduce costs, in-transit damage, and emissions, while improving cube utilization. However, controlling asset flows and avoiding losses are challenges, with missing RTIs costing manufacturers millions of dollars each year. The Automotive Industry Action Group (AIAG) has estimated annual RTI losses at around $1 billion in North America alone.

Automotive OEMs and tier-1 suppliers require RTIs to flow smoothly, predictably, and evenly between the various parties. A concentration of RTIs among a few tier-1 suppliers or distribution depots will lead to shortages elsewhere. RFID tags, applied to each RTI, provide instant visibility on locations, preventing equipment loss and avoiding supply chain disruption from shortages.

By identifying issues with late returns or missing equipment, manufacturers can improve RTI availability and reduce the turnaround times for returnable equipment.

Case Study

Tracking on-time delivery

One of the world's largest tire manufacturers sought to increase its on-time and in-sequence delivery performance by using RFID to automate identification and selected a system from industrial tracking specialist Turck Vilant Systems with RFID tags from Avery Dennison Smartrac.

Each tire is equipped with one tag by the tire manufacturer, with the correct tire verification validated during both picking and loading, using an RFID solution that tracks up to ten tires loaded on a forklift's forks. This automation allows for significantly faster and more comprehensive tracking.

The result: the tire manufacturer's auto maker customer now tracks individual tires, as opposed to batch-level tracking of tire shipments. This change has led to cost-efficient visibility, loading transparency and an accurate shipping process, with a much greater data quality across production and delivery processes.

3. RFID in automotive manufacturing: better control, better efficiency

Using RFID in manufacturing doesn't just automate parts tracking. It improves production control even as model volume and variety increase. Part number data can be read in granular detail across servers and local devices, allowing automotive manufacturers to optimize production and material flow in the cloud, while smart equipment at the edge reacts immediately to changes.

For example, by having real time and reliable data on the status of critical part numbers in plants and at suppliers, manufacturers can better manage parts ordering and replenishment. With more stabilized supply data, these companies can also avoid holding extra buffer stock, as has been common following shortages of semiconductors and other vital materials.

Improving the speed and accuracy of material identification can furthermore help manufacturers to track obsolete part numbers, such as those that require engineering changes.

With more manufacturers integrating closed loops and recycled material into production processes, automatic identification can also be important in ensuring the sustainable recycling of parts by tracking the full origins and information of each component.

Data gathered from RFID tags contribute to long-term quality improvements across manufacturing workflows. With just one RFID solution, for example, a manufacturer can manage all production and storage processes, allowing it to identify errors, inefficiencies, and potential pinch points.

"With end-to-end RFID, suddenly the 'big picture' is available," notes Stephan Freichel, professor of distribution logistics at Cologne University of Applied Sciences.

"An automotive manufacturer maybe wasn't looking for data on bottlenecks and product flows and instances of excessive dwell time, but suddenly, they've got it and can analyze it. They're getting information flows, as well as material flows."

Capturing end-to-end production data

An advantage for auto makers in using RFID is identifying serialized car parts throughout every production stages. With tags in place, manufacturers can use RFID read points across their facilities – at a combination of different gates, forklifts or readers on conveyor belts, for example – to track each major component from delivery through material stock, bodyshop, paintshop, assembly and finished product yards and warehouses.

The RFID readers can link directly to plants' ERP and MES, capturing a log of all serialized components and an as-built record of the components going into each car. Such data help OEMs to continuously improve workflows at each stage of production and ultimately reduce cycle times. This information also forms the basis for machine learning and artificial intelligence-based optimizations in manufacturing processes.

RFID is not the only automated option in identifying parts, as camera-based code readers can be fast and highly accurate. However, few systems can capture data so flexibly, regardless of whether the part is visible, or already fitted onto a vehicle.

Durability can also be as important as speed or connectivity, with RFID tags effective in various conditions, and can even be adapted to sustain extremely high temperatures.

"Contactless, and automatic, RFID delivers better and more accurate data – but without interrupting production flows in order to gather that data," observes Cranfield School of Management's Richard Wilding.

The quality of the data that RFID captures brings cost and margin benefits especially as it also helps OEMs to increase output and model variety.

"Coordinating complexity can be challenging, and doubly difficult in demanding manufacturing environments characterized by physical extremes in which barcode labels are easily damaged," says Lauri Hyytinen, market development manager for the automotive industry at Avery Dennison Smartrac.

"Get it right, though, and the benefits are threefold: cost savings, which are achieved through lower error rates; additional output; and higher margins – because manufacturers that can successfully manage complexity can then offer more variants, and increased customization."

Case Study

Painting a clearer picture

An automotive contract manufacturer, which has built vehicles for global car brands such as Mercedes-Benz and Porsche, was using barcode technology to track the painting cycles of car chassis going through the paint process.

The barcode system fed into the plant's MES, which helped ensure the correct number of painting cycles for each chassis. However, the label system proved unreliable, leading to data losses and errors.

In response, the company attached to each chassis special heat-resistant RFID tags capable of withstanding temperatures of 220C (430F).
The system has led to a higher level of parts traceability, greater data accuracy, better control and reduced manual activity.

The ROI of RFID in automotive manufacturing

Helps to reduce inventory and enable just-in-time production

Reduces disruption in production thanks to validation of parts shipments, picking and linefeeding

Cuts waste in shipping and packaging, and identifies parts and material for recycling

Speeds up vehicle production and and increases capacity to produce profitable variations

Conclusion: Connecting the future of automotive supply chains

The capital intensity of automotive production often dissuades OEMs from investing in systems that don't offer quick returns on investment, especially in replacing relatively cheap, existing technology.

"Payback periods in the automotive industry are really, really short," stresses Steven Carnovale, assistant professor of supply chain management at Rochester Institute of Technology's Saunders College of Business, and an associate editor of the Journal of Supply Chain Management.

But the need for more connected and agile supply chains is changing the equation for automated, flexible identification technology like RFID.

Carnovale suggests that manufacturers should look beyond the direct cost savings of RFID to other efficiency gains, such as JIT-driven inventory management, reduced manual operations and errors, and mitigating disruption. Auto makers and suppliers should also consider the incremental revenue and margins gained from increased production and the ability to offer greater customization.

Automated, reliable part identification is also valuable in achieving sustainable supply chain goals, such as avoiding wasteful shipments. RFID also helps to increase the recycling of parts thanks to the data provided through production, usage, and end-of-life processes. That is one reason why tier-1 suppliers should consider implementing RFID even before auto makers require them to do so, argues Daron Gifford, automotive industry lead at management consultancy Plante Moran, which produces the annual North American Automotive OEM–Supplier Working Relations Index Study.

"Those suppliers who have recognized the benefits of RFID understand that it can be considered as a competitive differentiator, prompting auto makers to reward them for adopting best practices by awarding them new business," he notes. "The information on an RFID tag can provide valuable lifecycle information, through production and assembly, usage, and warranty data. As the industry moves forward, this type of information will be central."

Rochester Institute of Technology's Steven Carnovale agrees that in the current economic climate, post-Covid, connected and sustainable supply chains have never been more important.

In this context, OEMs and suppliers are using RFID to gain the real-time manufacturing and usage data they need to manage today's production complexity. However, it will also help manufacturers refine data ecosystems at all production stages, and leverage more connected and predictive analytics across the supply chain. Such gains will be immeasurable.

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