



Business Technology Council

Aftermarket Technology Roadmap

*Essential technologies aftermarket professionals must understand and
aftermarket suppliers must master*

Published by MEMA Aftermarket Suppliers [Business Technology Council \(BTC\)](#)

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Technologies to be Published Soon

- AI / Machine Learning
- Application Data
- AR/VR/MR
- Bar Codes
- Cloud Computing
- Data Analytics
- Data Privacy
- GDPR / Data Privacy
- IoT
- IPO
- IPR Technologies
- Mobile Apps
- Product Data
- Product Support / Training
- Robotics (Warehouse)
- S&OP
- SaaS
- Smart / Digital Parts
- Social Media
- TecDoc
- VIO / PARC Data
- Voice Picking
- Web Marketing
- WMS
- XML

Executive Summary

Technology formerly meant word processing, MIS and EDI. It now encompasses predictive analytics, smart parts, cybersecurity, cloud computing, omni-channel strategies, IoT and the digitization of almost all aspects of the supply chain.

Success in the aftermarket in many ways is dependent on successful identification, deployment, training employees in the use of, updating and integration of various technologies – many of which companies do not have core competencies in managing. IT's role in ensuring competitiveness continues to expand, but no longer can stand-alone IT departments manage the breadth of the disciplines and technologies that are emerging and are disruptive.

MEMA Aftermarket Suppliers Business Technology Council (BTC) developed, published and updates this Aftermarket Technology Roadmap to guide aftermarket suppliers (and their channel partners) as they research technologies that must be understood, and in many cases, mastered. The Roadmap will be updated continuously to ensure aftermarket technology professionals and newcomers to the industry remain current and in the know.

Technology Roadmap Content

Each major technology is explained in stand-alone chapters, which include Definition, Description, Author and Resources. Links to relative content and related chapters provide additional information and resources. Subject matter experts have contributed content that enables readers to develop a good understanding of the technologies. Logos for BTC valued affiliate members are included with links to their respective websites.

Business Technology Council

MEMA Aftermarket Suppliers Business Technology Council (BTC) is the industry's forum for networking and exchange of best practices focusing on current and emerging technologies that support suppliers' efforts to reduce costs, improve efficiencies and pursue new business opportunities. All leading manufacturer brands and technology solution providers are members of the BTC. The purpose of the Council is to provide a forum for executives, managers and professionals to gain insight in the following key areas of focus:

- Sales & Marketing – BI, CRM, Digital Marketing, Data Analytics, E-commerce, E-tailing, Training, Forecasting
- IT – Network Management, Cybersecurity, EDI, ERP, Web Services, Cloud Computing, IT Outsourcing
- Data Management – PLM, PIM, MDM, Cataloging, Digital Assets, Mapping

The BTC holds several major events and sessions that enable suppliers to interact with other suppliers and to engage with the industry's leading channel partners. Events/meetings/sessions include the following:

- Aftermarket Technology Conference – the industry's top technology event
- BTC Spring Meeting – networking, roundtable discussions and content from subject matter experts
- Channel Partner Technology Town Halls – annual event that brings suppliers and customers together to discuss technology opportunities
- BTC C Fall Meeting – education and roundtable discussions for manufacturer members
- Aftermarket Business Technology Innovation Award Competition – New and established companies “pitch” their brand new innovations to compete for the votes of BTC members for this annual prestigious award.

Initiatives and work groups provide opportunities for members to address industry technology challenges. Past and current projects include:

- EDI and Bar Code Standards
- Cybersecurity Best Practices
- Master Data Management
- POS Data
- Aftermarket Technology Roadmap
- AR Content for Repair Shops

For more information on the BTC, visit www.mema.org/networking-groups/business-technology-council

EMERGING TECHNOLOGIES

3D PRINTING

1 | Definition

3D printing (also called *additive manufacturing*) is the action or process of making a physical object from a three-dimensional digital model, typically by laying down many thin layers of a material in succession.

2 | Description

It is highly likely that many Automotive Aftermarket manufactures utilize 3D printing in some fashion already. The technology has been improving in complexity, accessibility and affordability at a rapid pace, and its applications in manufacturing have grown. Any company engaged in prototyping and design engineering likely has at least one type of 3D printer available for producing component parts, adapters, connectors, or some other type of custom item used in the design and testing of new products. 3D printing allows for complete customization of design and avoids the use of costly prototyping services. Some have even begun using 3D printing in limited production processes as well.

But what was once a cutting-edge technology found only in engineering labs has begun to break out. Not only are these machines growing more versatile and efficient; the cost of them has been driven down to where many types of entry level 3D printers can be obtained for only a few hundred dollars. 3D printers began with simple plastics but are now used with a wide variety of materials such as metals, ceramics, and other composite materials, including the combination of more than one type of material per object. This allows all sorts of businesses, small and large, to grab control of this amazing new technology and apply it in ways that were previously impossible. For example – 3D printing is used in the aerospace industry, and many service components for the International Space Station are manufactured on-demand, on the station. In fact, 3D printing is so important to space missions that many systems are designed from the ground up with the notion that replacement parts will need to be 3D printed. A little closer to home, there are already OEM's that offer customers the option to purchase custom designed 3D printed body parts, allowing them to personalize their vehicle in ways never before possible.



Imagine a world where any service shop can have an industrial 3D printer along with an inventory of materials in stock. Instead of ordering parts from their local store or dealer, they instead are sent a one-time use CAD schematic that is then produced in the shop, on-demand. Imagine still if the telemetry of the customer's vehicle notified the shop ahead of time of a part's needed replacement, an eCommerce transaction is completed, and the design automatically sent to the shop. The replacement item could be fabricated and ready before the vehicle even enters the shop. Does this seem far-fetched? Perhaps.

Limitations to 3D printing are worth noting. While the capability of using different materials has grown, there are many materials heavily used in automotive parts that cannot be currently printed. Cast iron, sealing materials like nitrile and viton, brake pad material, filter media, complex electronics, high strength steel, and precision bearings all pose very interesting challenges for the 3D printing space. Additionally, many of the parts that COULD be currently 3D printed are readily available and cheap to purchase, such as plastic knobs, clips, pop rivets, etc. While it is possible that some of these challenges will be overcome as the technology develops, the possibility that the Aftermarket parts supply business will move heavily into on-demand 3D printing in the near-term seems unlikely.

However, the base technologies for that type of revolutionary change **already exist** and are constantly being refined and developed; the barriers to entry are shrinking. While it is difficult to imagine how a 3D printer could produce an alternator, fuel injector, or anything with a complex circuit board or CPU, there will continue to be major leaps forward in the coming years in the accessibility and capability of 3D printers. Automotive companies would be wise to keep an eye on this technology and continue to adopt 3D printing in their processes to gain a more in-depth knowledge and understanding of this powerful innovation. When on-demand 3D printing becomes a tangible reality, Aftermarket companies must be prepared to capitalize.

3 | Author

BTC Think Tank – Emerging Technologies

4 | Resources

- Jeff Marshall – [Pricedex](#)
- Joshua Dumas – [Mann+Hummel](#)
- Andrew Ciszczon – [Freudenberg-NOK Sealing](#)
- Adam Sworski – [Valvoline](#)
- Ram Chandrasekar – [PhaseZero Ventures](#)
- Scott Huston – [IHS Markit](#)
- Ben Johnson – [Mitchell1](#)
- Scott Tompkins – [Epicor](#)

EMERGING TECHNOLOGIES

5G COMMUNICATION & TELEMETRY

1 | Definition

5G is the acronym that defines the 5th generation wireless network which enables a new ultra-fast network, that is designed to connect virtually everyone and everything together - from the smallest of sensors embedded in machines and appliances to the city infrastructures, and everything in between. The technology is designed to deliver multi-Gbps data speeds, ultra-low latency, more reliability, enormous network capacity, and increased availability through a wide variety of conditions.

There are three bands of 5G - low, mid, and high. Most 5G transmissions in use today are in the low band range, which is the slowest and carries the least amount of information, but has the best signal reach and penetration of the three bands. The sweet spot for 5G connectivity is the mid-band or "C-band". It is faster than low band and carries more information, but is in limited use at the moment. 5G in the high band is the fastest of the bands but requires the most infrastructure (more transmitters) as the waves travel only a short distance and have trouble going through walls and weather.

2 | Description

To enable the desired wireless "connectivity of things" needed to power the bandwidth-greedy technologies of today and the future, mega-fast bandwidth is required. 5G is the superhighway of wireless technologies, enabling high-speed and high-bandwidth communication.

The power of 5G is being realized today. Telecoms are spending billions of dollars to acquire licenses and build an infrastructure to broadcast in a part of the 5G spectrum called the C-band which, most believe, is the best band for use in the automotive industry. This year, Verizon spent \$53 billion, and AT&T \$23 billion just to obtain FCC licenses in that spectrum.

5G in the automotive industry has been described as a "seismic event" - one that nearly every company tied to the industry is positioning themselves to take advantage of. 5G is one of the most important, if not the most important, enablers for the "connected vehicle", bringing better safety for the vehicle and its occupants as well as a more desirable passenger experience by connecting them to more robust services. How?

In-vehicle experience

From heads-up displays, enhanced high-definition infotainment to gaming systems and more, 5G will connect the vehicle to all sorts of new experiences for consumers. Companies not traditionally associated with the automotive industry, such as Samsung, have been working on vehicle infotainment technologies to overcome the challenges of streaming high-quality content to moving vehicles.

Doubting the real-world need for technology like this? Consider this: since 2014, General Motors customers using the in-vehicle AT&T 4G LTE connectivity have used more than 171 million gigabytes of data, which is equivalent to nearly 5.7 billion hours of music streaming or more than 716 million hours of video streaming¹.

Vehicle Autonomy and Smart Infrastructures

Vehicle connectivity from the vehicle to other vehicles (V2V), and the vehicle to everything (V2X) continues to evolve. 5G connectivity is key to this. To obtain an acceptable level of safety, Autonomous vehicles require high speed connections and data processing. According to Dr. Joy Laskar, co-founder and CTO of Maja Systems, future self-driving vehicles will generate as much as two petabits (two-million gigabits) of data.

Autonomous vehicles must also be able to see beyond line of sight and communicate almost instantly as they navigate. This capability produces an immense amount of data that must be transmitted between the vehicle, the cloud, the city infrastructure, and other vehicles. Example: a vehicle can incorporate V2X information from the available informatics infrastructure into its route planning. If an unexpected event occurs like an emergency vehicle approaching, communication with the city infrastructure and/or vehicles in the vicinity can warn the vehicle, allowing it to slow down and yield.

The reality of this can be seen with recent automaker partnerships. To enable its autonomous driving technology, GM and AT&T have partnered to start outfitting GM vehicles in 2024 with 5G connectivity and Microsoft services. Similarly, Audi and other companies including the school bus manufacturer, Blue Bird are currently testing V2X in Alpharetta, Ga., and the Fulton County School System. The technology uses 4G LTE or 5G to communicate wirelessly between vehicles and objects such as school zone signs and school bus stop signs to alert connected vehicles that they are in a school zone or that a school bus has stopped.

Vehicle Maintenance & Customer Retention

Because 5G technology will enable automotive companies to transmit larger volumes of data to and from vehicles at a fast speed, vehicle maintenance becomes much easier. Over-the-air updates have much potential. Recently, Sony and Vodafone Germany began drive testing Sony's VISION-S prototype 5G-equipped electric car which Sony says, "enables a continuous connection between the in-vehicle systems and the cloud, in order to synchronize data and control signals, and update the systems OTA (Over The Air)."



"There is no other IoT use case that has the same type of magnitude and complexity as automotive." - Magnus Gunnarsson, head of connected vehicle product management at Ericsson

Enhanced connectivity also allows automakers to develop a connected customer relationship over the life of the vehicle and all its owners. That relationship between the automaker and vehicle owner is extremely important for the OE in maintaining a revenue relationship with the customer beyond the vehicle warranty period.

5G and vehicle connectivity opens many opportunities for both automakers and the aftermarket as the industry reimagines itself. However, with opportunity comes many challenges. These connectivity-enabled features bring complicated technologies and components, which will require new tools and technician skillsets simply to perform basic diagnostic and routine maintenance services. The Aftermarket must stay closely aligned with the technology, including obtaining access to the immense amount of data it can generate, and be prepared to quickly adapt as this new technology and the applications it spawns continues to evolve.

¹ Automotive News

3 | Author

BTC Think Tank – Emerging Technologies

4 | Resources

List of Charter Members:

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ACES



1 | Definition

ACES (Aftermarket Catalog Exchange Standard) standard, owned and maintained by the Auto Care Association, was a watershed event in the evolution of catalog information development in the USA. As noted in the section of this Guidebook on “digital cataloging” this standard provided, for the first time in this region, a digital foundation for communication of catalog data. This information provided by the Auto Care Association for this standard provides several elements that are critical to its successful use by the industry.

2 | Description

- Defining the Vehicle on the Road: A master data base, the “VCdb” (Vehicle Configuration data base) that provides information about vehicle configurations operating in the marketplace, so that suppliers have a standardized table, to which, product data can be linked. Typically, a supplier would link its products to the specific vehicles that could productively use these products as replacements for the original products when they fail or are damaged. Accurate linkages are critical to the ability to find the right product for a given vehicle and product application.
- Defining the Products Themselves: A set of related standards called PIES (Product Information Exchange Standard) and its related data bases, including the PCdb (Product Classification data base, the PAdb (Product Attribute data base) and Brand table, all provide standardized, descriptive and detailed information about supplier products. After the supplier defines its products in this database, they can be linked to the VCdb above.
- A machine-readable format (XML, or extensible machine language) for use in sharing large amounts of data electronically.
- An information web site for users of the standards at “www.autocarevip.com”.

The advantage to the marketplace of using this standard, in cooperation with PIES, is that it significantly improves communication and mutual understanding among the channel partners of products and their specific applications to vehicles in the market. The ACES portion provides for a consistent application of products to specific “year, make and model” of vehicle, while the PIES provides detailed, standardized information about the products. Without this, the number of application errors (and the related costs that would result) in the market would skyrocket!

The ACES standard, itself, is provided free by the Auto Care Association, however the databases that are needed to use it effectively, in particular the VCdb in the case of ACES, is provided on a fee-based subscription basis. Please see more information about the PIES portion of the standard (and the fee-based data bases needed to support it) in its own section of this Guidebook.

The use of standardized data does come at a cost, but at a much lower cost than is needed to manually address the same information, and the same high-quality result cannot practically be achieved manually. This is made more important since most distributors in the marketplace prefer, or require, standardized digital data in the ACES/PIES format in the USA and Canada (Mexico is currently a mixture). It is also important to note that there are a number of companies that specialize in supporting suppliers in the development of ACES and PIES data, should that be an attractive approach for some suppliers.

3 | Author



Charley Johnson | Chief Executive Officer | OptiCat, LLC.

4 | Resources

[OptiCat](#) | [OptiCat Online](#)

EMERGING TECHNOLOGIES

ADVANCED DRIVER ASSISTANCE SYSTEMS (ADAS)

1 | Definition

Advanced Driver Assistance Systems, or ADAS, describe the groups of technologies designed to work and assist drivers in a wide variety of functions. In the context of emerging technologies, ADAS systems have been further defined in a gradient of 0 through 5, describing the level of autonomy of the system itself. Early ADAS systems included Cruise Control, Antilock Braking Systems, Rain Sensors, Traction Control systems, and Tire Pressure Monitoring Systems (TPMS).

2 | Description

As described in the definition, ADAS is not a “thing”, and is not even a well-defined container of “things”. It loosely describes any feature designed to assist the vehicle operator in performing their duties in a safe manner. Some of the more common features of current and evolving ADAS features:

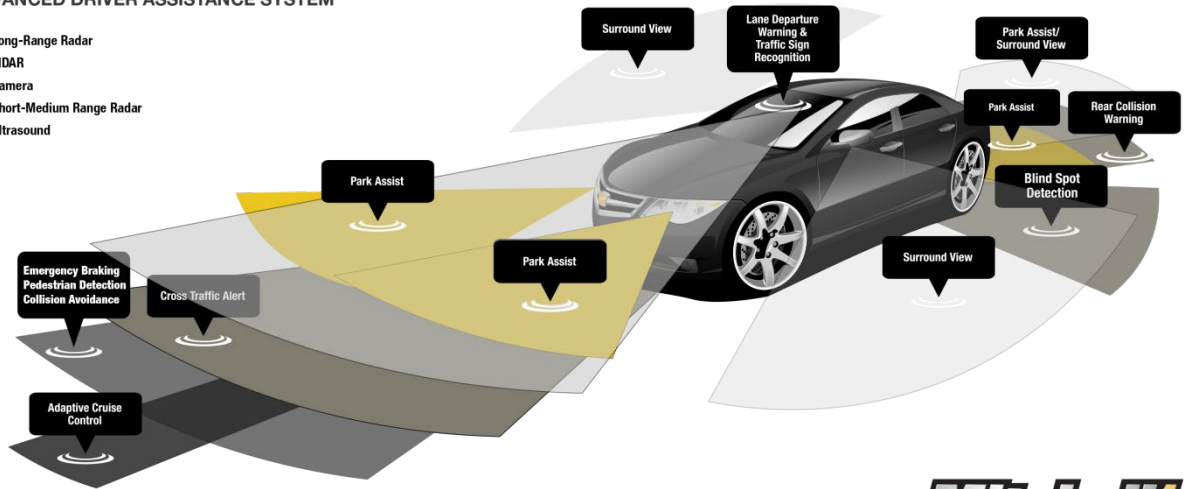
- Blind spot monitoring – advises the driver via visual and sometimes audible cues if they are attempting to change lanes and the vehicle’s ADAS systems detect a collision could be imminent due to a vehicle being present in the lane being changed to.
- Adaptive Cruise Control – uses the vehicle’s ADAS systems to detect a vehicle in front of the operating vehicle and maintaining a driver-set distance from that vehicle, regardless the operating vehicle’s set speed. For example if the cruise control is set at 70 MPH, and the vehicle in front of the operating vehicle is driving at 65 MPH, when the operating vehicle comes within a preset distance from the vehicle in front of it, it will reduce speed to maintain a preset distance until the vehicle speeds up or moves out of the way (or the driver of the operating vehicle changes lanes to allow an unobstructed view ahead).
- Pedestrian Detection/Emergency Braking – if the operating vehicle’s ADAS systems detect a person moving in front of the moving vehicle, it will warn the driver, typically via audible and visual alerts. If the vehicle has emergency braking feature, the vehicle may apply the brakes to avoid/minimize impact with the person in front of it.

Note this list is not meant to be inclusive of all ADAS features as there are many more fielded and in development.

ADAS

ADVANCED DRIVER ASSISTANCE SYSTEM

- Long-Range Radar
- LIDAR
- Camera
- Short-Medium Range Radar
- Ultrasound



Mitchell1

For these features to function as designed requires an assortment of detection devices, including ultrasonic sensors, cameras, radar and lidar devices which can be mounted in a variety of locations, but typically close to the surface of the vehicle. Many of these systems, especially the camera and radar/lidar technologies, must be precisely calibrated to the vehicle's thrust line and accounting for the geometries of the vehicle.

Many times, normal repair events which may not specifically involve ADAS components may require certain ADAS components to be recalibrated. Calibration may be required if the vehicle alignment is modified in such a way that the thrust angle of the vehicle is affected. Windshield replacements, when there is a camera mounted behind the windshield, may require a camera calibration. Removal of a front radar "black box" to gain access to a non-ADAS related component such as a radiator may shift the re-installation of that device such that a recalibration is required.

It is important that these calibrations are checked and performed when operations are done to the vehicle which may shift them, as the device and the vehicle's on-board computer system likely will not detect an out-of-calibrated device. Yet the "field of view" of that device may be shifted enough to cause vehicle behavior which is not as the manufacturer designed. Unfortunately, the undesirable behavior may only be noted when the vehicle and operator are in a situation where the ADAS features would otherwise be a benefit. Reports have been received about vehicles with out-of-calibration radar units sensing that a low overpass is detected as a vehicle in front and applying emergency braking when there is no need, causing a dangerous situation for the vehicle. This is only one example but is meant to reinforce the importance of maintaining proper calibration of these systems.

Some vehicles equipped with ADAS features must have specific calibration fixtures, including targets, and a significant clear and level floor space so the calibrations can be done accurately. Others are calibrated “dynamically” while the vehicle follows a driving route that allows the vehicle’s sensors to “see” objects at various speeds. Many companies today produce targeting fixtures, and many diagnostic scan tools include the ability to enable calibration on vehicles. It is important these calibration fixtures and tools are kept up to date with latest targets and software, as (like in any evolving suite of technologies) updates are made to processes as more is learned about vehicles after-sale.

Vehicle manufacturers and aftermarket tool and equipment providers both have opportunities to make these calibrations and diagnostics easier as time goes on. Some shops who may not have the required floor space to accommodate calibration fixtures and vehicle specifications may elect to outsource this work to those shops who have the capability. In either case it is important these vehicles are returned to their owners with the ADAS components operating as intended, or the consequences and liabilities could be devastating.

3 | Author

BTC Think Tank – Emerging Technologies

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Artificial Intelligence (AI) and Implications for the Automotive Eco-system

1 | Definition

Artificial Intelligence (AI) is defined as “the intelligence of machines or software, as opposed to the intelligence of human beings or animals”¹

There are many different types of Artificial Intelligence types and methodologies, ranging all the way up to ‘self-awareness’. For the purpose of this paper, we take a look at “conventional” AI which can analyze data and tell you what it sees, and “generative” AI, which can use that same data and create something entirely new.

2 | Description

While artificial intelligence was founded as an academic discipline in 1956², due to recent advancements in technology and techniques, AI is becoming prevalent and used more widely in a variety of use-cases. Deep machine learning capabilities, driven by companies like Nvidia and others, allow computers to process information for the purpose of creating knowledge and levels of intelligence at much faster rates than ever before. One of the most recent applications of AI has been labeled “generative AI”, which is led by applications like “ChatGPT” and others.

ChatGPT was developed by OpenAI and launched in November 2022. It’s interesting, due to its ease of use by less technical folks – it is capable of “having a discussion” with humans, with results that are not unlike human-to-human dialogue. People have asked it to write software code for them, write articles for newsletters, and more. In fact, the Emerging Technologies Think Tank at MEMA Aftermarket has conducted interviews with the public-facing ChatGPT system.

The public facing ChatGPT’s data is limited to “up to 2021”. So, it has no knowledge of events or facts that occurred post-2021. In addition, any submission made to it or “learning” it may do while performing a task for an individual or a company, is considered ‘public domain’ and will be applicable as it responds to other companies. For this reason, a variety of companies prohibit their developers from utilizing ChatGPT to assist in writing code, as anything generated from the public ChatGPT system will ultimately be made available to other users.

Other uses for this technology can be enabled using the “private” areas of the OpenAI infrastructure. As an example, Mitchell1, a MEMA member company, leverages OpenAI to learn about Mitchell1 customers and how to respond to reviews Mitchell1 customers may receive on

¹ Wikipedia Definition

² John McCarthy is considered one of the founding fathers of Artificial Intelligence and actually coined the phrase.

their website or social media. In another example, Mitchell1 leverages generative AI to recognize employees on their customer's shop's social media and websites.

While early days, customers seem to respond well to these applications and the staff at Mitchell1 are exploring many more opportunities.

In other use cases for AI, Mitchell1 utilizes it to comb through millions (over a billion) repair orders from a Data Lake to create data insights. These insights drive a commercial feature, "SureTrack", found in Mitchell1's proprietary ProDemand repair information systems. Technicians appreciate the ability to quickly home in on problems already experienced by hundreds of thousands of technicians, thus improving shop efficiency and profitability.

The Emerging Technology Think Tank believes these AI technologies will have broad applicability in a variety of stakeholder applications. As with any other tool, careful thought must be given to the desired goal of an AI implementation. It is generally unknown, at least to this author, how it might "react" to "negative learnings". Could it, for example, develop a bad attitude? We know from experience it can deliver incorrect information. As with a human, it will only be as "smart" as the information it possesses and how it interprets that information. So as with any other tool, mishandling could lead to unanticipated consequences.

Although ChatGPT is gathering all the attention today, other more complex applications are used in private industry, in the field of manufacturing and robotics, and more popular, "conversational" AI applications, such as SIRI, Alexa, Google Assistant, and others, are starting to become highly used tools in everyday life. Certain branches of AI, such as 'machine learning' and 'natural language processing', will likely yield more interesting applications relevant to the service parts industry.

3 | Author

BTC Think Tank - Emerging Technologies Group

4 | Resources

Mitchell1

ChatGPT

EMERGING TECHNOLOGIES

Autonomous (Self-Driving) Vehicles

1 | Definition

Autonomous, or self-driving, vehicles are vehicles which, using a variety of sensory inputs and computing power, can assist a driver in the operation of the vehicle. In some cases the vehicle could be operated without additional driver assistance, or perhaps without the means for a human driver to even be involved.

2 | Description

SAE, or the Society of Automotive Engineers, is the body responsible for identifying and determination of the intelligence level and automation capabilities of vehicles, ranking through 0 to 5. The following is the SAE definition of levels of automation:



SAE J3016™ LEVELS OF DRIVING AUTOMATION™

Learn more here: sae.org/standards/content/j3016_202104

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	SAE LEVEL 0™	SAE LEVEL 1™	SAE LEVEL 2™	SAE LEVEL 3™	SAE LEVEL 4™	SAE LEVEL 5™
What does the human in the driver's seat have to do?	You are driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering			You are not driving when these automated driving features are engaged – even if you are seated in "the driver's seat"		
	You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety			When the feature requests, you must drive	These automated driving features will not require you to take over driving	

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	These are driver support features			These are automated driving features		
What do these features do?	These features are limited to providing warnings and momentary assistance	These features provide steering OR brake/acceleration support to the driver	These features provide steering AND brake/acceleration support to the driver	These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met		This feature can drive the vehicle under all conditions
Example Features	<ul style="list-style-type: none"> • automatic emergency braking • blind spot warning • lane departure warning 	<ul style="list-style-type: none"> • lane centering OR • adaptive cruise control 	<ul style="list-style-type: none"> • lane centering AND • adaptive cruise control at the same time 	<ul style="list-style-type: none"> • traffic jam chauffeur 	<ul style="list-style-type: none"> • local driverless taxi • pedals/steering wheel may or may not be installed 	<ul style="list-style-type: none"> • same as level 4, but feature can drive everywhere in all conditions

Examples of where level 5 vehicles excel include off-road driving, and other terrains and conditions (snow covering lines in the roadway, for example), that Level 4 vehicles may not

necessarily be able to detect or intelligently comprehend. In other words, level 5 vehicles have a much more advanced environment detection system.

Autonomous vehicle operation is made possible using the same components utilized to deliver Advanced Driver Assistance Systems, coupled with advanced AI (Artificial Intelligence) and computational capabilities to interpret and react to inputs from the array of sensory input.

The current options are to add significant computing power (and cost) to the vehicle while bi-directionally communicating with cloud services. The continued evolution of 5G communications technology will be an advantage, while consolidation of on-board systems with higher multi-tasking computational capabilities will also be necessary.

Currently the highest availability of autonomy includes Levels 1 and 2, which are widely accepted as “ADAS” vs “Autonomous” (see ADAS section for more detail). An example of a Level 3 vehicle would be the Tesla Auto-Pilot and Cadillac Super-Cruise features.

3 | Author

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Battery Insights – Batteries in Operation and Chemistry Breakdown

1 | Definition

There is much discussion about the electrification of vehicles, and new powertrain technologies requiring new battery types. However, what does the battery landscape look like going forward for Starting-Lighting-Ignition (SLI) batteries in the light vehicle transportation sector?

2 | Description

There are approximately 288 million batteries on U.S. roads within the Light Duty Transportation Sector through 2022. Light Duty is defined as Cars, SUV's and Trucks (Rated 1 ton or less). This is defined as batteries and not vehicle registrations, because some vehicles have more than one battery in them.

SITUATIONAL ANALYSIS

The growth rates for all categories have been greatly influenced by Covid-19 and the low volume of new vehicle sales. Besides Covid-19, new vehicle sales have been down because of chip shortages and rising vehicle prices.

There are 4 battery chemistries currently being utilized today:

1) Flooded

DEFINITION – A lead acid battery with free-flowing electrolyte. The construction includes a cover with one or more vents through which gaseous products may escape. Commonly called an SLI (starting, lighting, ignition), or “Starter Battery”.

Wet cells are still widely used in cars, stationary (large) uninterrupted power supplies and of course, stand-alone energy systems.

This category makes up the largest portion of the market at 79.63%, accounting for 229.8M Batteries.

2) Advanced Glass Mat Technology (AGM)

DEFINITION - Unlike a “flooded” lead-acid battery, an AGM battery does not have free-flowing electrolyte. Separators made of mostly fine glass fibers hold the electrolyte like a partially saturated sponge.

AGM batteries are Valve Regulated Lead-Acid (VRLA) batteries that recombine the hydrogen and oxygen created during charge and discharge, back into water. This recombination keeps the

battery water levels within proper limits. For this process to work, VRLA batteries must be charged at specific voltages.

Each cell contains its own valve. If the battery is overcharged, gas pressure builds within the cell rapidly. If the pressure exceeds one and a half PSI, the valve(s) will open and let the gas escape, thus the term "Valve Regulated".

AGM is a premium battery option as it provides better cycling performance, severe service durability, Deep discharge resiliency and is vibration resistant. AGM Battery may be used in place of standard flooded and EFB batteries, but a standard Flooded and EFB battery may not be used in place of an AGM battery.

AGM batteries represent the second largest market segment at 17.71% or 51M batteries.

3) Enhanced Flooded Battery (EFB)

DEFINITION: A flooded lead acid battery with enhanced cycling capability and charge recovery compared to standard flooded starter batteries. EFB batteries are a fairly new technology and represent 2.56% of the market or 7.4M batteries. This is the same technology as a standard flooded with extra Carbon added.

An EFB battery can be a substitution for a standard flooded battery, but it cannot be substituted for an AGM Battery.

4) Lithium-Ion (12 Volt)

DEFINITION - Lithium-ion batteries, or Li-ion for short, are rechargeable batteries that use lithium-ion as the primary component of its electrolyte. It has a very high energy density. This results in smaller and lighter batteries when compared with other battery technologies or chemistries. They also have a very low self-discharge rate. The biggest advantage is the high charge and discharge capacity. Lithium-ion batteries can deliver up to 100% of their nominal capacity.

There are a number of types of Lithium-ion batteries, with different chemistry and other characteristics.

Lithium-Ion is the newest and smallest segment. It gains a large amount of attention because of Hybrids and EV vehicles. The current market size is .09% or 270K batteries.

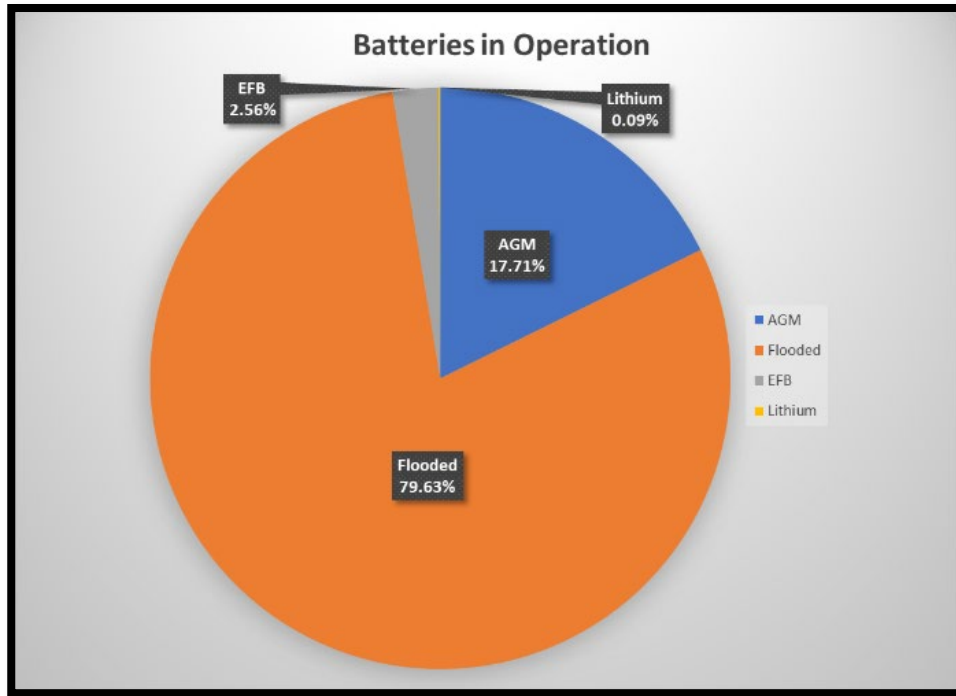


Figure 1 - US SLI Batteries in Operation

3 | Author

BTC Think Tank - Emerging Technologies Group

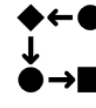
4 | Resources

- ¹ – Battery Council International (BCI)
- ² – S&P Global
- ³ – East Penn Manufacturing

Business Intelligence Technologies in the Automotive Aftermarket



People



Process



Technology

1 | Definition

Business Intelligence (BI) comprises of the People, Process, and Technology strategically used by an organization to develop sound business decisions based on facts. Utilizing organic, as well as external information (data), enterprises will employ talent to analyze (people), strategize and further develop data (process), and implement technology to sustain and grow the business. The goal of BI is for an organization to take full advantage of their talent and information in order to identify market patterns, strategize for the future, and better compete in an ever-shifting market place.

2 | Description

A robust BI environment speeds decision making by providing readily available information (data and insights) as one version of the truth. BI consists of technologies, applications, and practices for the collection, integration, analysis, and presentation of business information. In addition, BI can provide historical, current, and predictive views of operations, using internal and external data that has been gathered into data warehouses or data marts. Applications target sales, production, financial, and othersources of business data to maximize business management and performance. Lastly, an organization can measure their position on the “BI Maturity Model” and consider the Return on Investment (ROI) ofadvancing to the next level.

Where Do I Begin?

The best place to start....is at the beginning. The concept of BI can be overwhelming to an organization just starting to explore what their data can do for them. Many organizations do not have the resources and infrastructure to immediately use “big data.” For that reason, it is best to start with what is on handand slowly expand out. For example, the organization may have historic data on customers or SKUs by day or month. Even with just a basic tool like Excel, an organization can be successful with identifying trends and patterns to assist with predicting future trends.

Determine where you and your organization fit on the maturity model. What is the maturity model? In essence, it is a representational blueprint depicting the steps to business intelligence maturity (*see the Maturity Model Resource*). The model acts as a roadmap for future growth phases and investment forecasts for continuous progression. It will help you determine where you're starting from and if you have the right resources and technology to support that phase, as well as to progress to the next. It also provides a vision for growth and what the next steps will be. The five-steps in the model include "Basic Reporting," "Analytics," "Predictive," "Prescriptive," and "Cognitive." The "People, Process, Technology and Data" advance in each step, as well as the investment and ROI potential.

Identifying the problem is the best place to start. Remember, you cannot find a solution without knowing what you are trying to solve. The organization should understand the complexity of their data and define goals to reach an outcome. Setting clear expectations about outcomes and selecting projects that can meet ROI goals are vital to success. Additionally, identifying members of a BI Steering Committee along with SMEs (Subject Matter Experts) that manage the initial project through a multi-functional point of view will ensure proper input from each business group is considered.

Lastly, the worst thing to do is not even try. BI is very complex, and most people only see the end result, and not the work necessary to create and maintain good data to produce results. Take the marathon mentality with easy wins and show the value at lower maturity levels. Do not bite off more than you can chew as small wins lead to big confidence from all stakeholders.

Who in My Organization Can Help Us Start?

An organization should keep in mind that the best analysts and SMEs are not born but trained and developed by experience. If it is not possible to hire experienced business partners, the technical experts and experienced individuals already in the organization can often be developed. External courses and training may be more cost-effective alternatives for the long-term employee.

Opportunity is also a great option. Organizations might be surprised they already have an outstanding SME or analyst simply by challenging an employee and giving them an opportunity. A seasoned individual may already possess the technical skills needed to make a great business partner.

Organizations can easily make mistakes thinking "it must be easy" as they see the competitor's success. Developing data analytics programs takes time to perfect. Initially hiring external consultants to fill training gaps may be an effective tool before establishing processes. Companywide, focused departmental training campaigns can be considered to develop business partners. It will become easier to justify technical expertise as the organization advances through the maturity model.

A steering committee should identify KPIs and measurables to determine whether data is in line with expectations. Data Scientists might also play a role in tracking data specific KPIs at appropriate intervals (e.g., average sales data by quarter looks to be accurate, average return warranty data is accurate by quarter, materials sourcing costs appear to be on budget, etc.)

Now That I Started, What Do I Need to Consider with My Data?

An organization will initially spend most of their time on data management before reports and visual analytics (such as dashboards) are designed and developed. This includes cleaning, mining and understanding the data. Technical experts and experienced SMEs will know the data the best in the organization. Using them as a resource to help understand connections between data and relevancy is key to keeping data clean.

It is also good practice to establish solid “key” tables (metadata) to help quickly and transparently scrub data. Depending on the technology used, the most basic form may be an Excel lookup table. Data tables should be maintained in order to allow flexibility and to maintain high quality data as future needs change.

As the organization progresses through the maturity model, it is recommended that an organization invest in Data Scientist roles and immediately identify SME's that can validate data integrity.

Additionally, it is recommended that an organization follow and participate in creating aftermarket industry standards. Doing so will encourage alignment between Content Teams, BI, Customer Data, and Category Management standards.

Data Managers (or similar role) in the organization should have the authority to maintain a single version of the data and information. Individual employees should be discouraged or prevented from maintaining their own copies of data in silos in order to avoid multiple “versions of the truth.” Centralized data should be linked to or used as a database resource instead of localized copies of data. The Data Manager (or similar role) should document and communicate data management and accessibility rules to the user community.

This All Sounds Good, But How Do I Talk with The Decision Makers / Leaders?

Perhaps the single most important factor in progressing through the maturity model is Executive buy-in. Any resistance from management and leadership will be detrimental or fatal to BI. Investment in BI should be a directive from the “top” as a company initiative and not of rogue departments. Leaders will need to develop and communicate the concept of becoming a data-driven culture.

One of the best ways to communicate the importance of BI to the top is through proof. When an organization is “stuck” in traditional practices or making business decisions based on emotion, it is vital to present factual analysis and evidence. The Analyst or Manager should take the time to present data visually that either contradicts the emotions or supports the emotional decision but using empirical evidence to explain how/why the emotion worked. This way, the presenter can demonstrate how future decisions based on analytics will increase positive outcomes or avoid risks.

In addition to leadership buy-in, individual user adoption is critical as it can sometimes silently sway Executive buy-in. Not only will the data proof be required, but also a vision of what a data and analytics culture could bring to the organization.

Lastly, the expectations must align with results and a projected ROI. This may involve a

detailed strategy presentation to Executive Management showing the ROI at each maturity level. Understanding and transparently communicating unforeseen costs is also important. These costs may include ongoing system upgrades, maintenance and downtime, disaster recovery, and security. The biggest unforeseen cost is data storage and processing. As demand grows, so will information datasets with the number of transactions needed to aggregate data to the point a reporting tool can use it. Projecting these costs can be difficult until the data and systems are used and further developed.

Do I Need New Technology?

Technology is wonderful, but not everything. Consider that businesses for many years were very successful with just paper and pencil. It is hard to deny that the most common business tool today is Excel. For these reasons, it is not necessary to immediately purchase a costly software package in order to capitalize on Big Data.

Having “better” technology can certainly help, but without the technical experts or Analysts who can identify and interpret the results, technology is just a box. It is better to grow with information and technology, expanding as the need and experience increase.

It is important to build good infrastructure from the beginning so as technology changes, your organization can remain flexible. You can always “bolt on” new front-end analytics tools if the infrastructure follows best practices for handling data. Additionally, when you invest in BI, you are not investing in a “set it and forget it” solution. The job of a good Steering Committee is to research and advise on constantly changing technology and should propose the necessary upgrades and hardware changes to ensure user satisfaction. Set your expectations early. Technology cannot fix bad data. Clean data is the primary priority. Always remember the rule “Garbage IN is Garbage OUT.”

What Should I Expect from the Reporting Tools and Performance?

Employees need to be able to customize their data extractions using features such as filters and slicers (e.g. time, region), sorting, exporting, graphing, charting, and other visuals. All good reporting tools will only allow the user to filter and analyze the data the “wizard behind the curtain” has prepared and organized for them. Users should never need to access the raw, untouched data.

Business partners and users want “simple and easy,” accurate results. Getting to it as quick and easy as possible with the least number of clicks is always best. User mindsets are driven by what they experience at home; Alexa, Amazon, Siri, Google Home, etc. - instant gratification. With so many employees and customers tethered to their phones, mobile should be included in your strategy, at least at a mid to high level of maturity. Develop your dashboards accordingly, always keeping mobile in mind.

Additionally, BI requires significant amounts of horsepower on the front-end presentation layer in addition to the backend database servers. This is especially true as an organization

progresses through the maturity model. The more drive space, bandwidth, processor power, and memory, the better performance and experience your dashboard users will have.

So, what is the Answer?

Let us be honest, no white paper or college textbook is going to highlight the be-all-end-all answer you are looking for. Every organization is different, as well as their customers, situations, data, and business model. Discovering the best BI solution for you and your organization is going to take time, research and investment. What we can all agree on is that the worst thing you can do is... never try.

3 | Author

Matthew Lombardi | Bendix Commercial Vehicle Systems LLC



4 | Resources

[Bendix Commercial Vehicle Systems LLC](#)

BLOCKCHAIN

1 | Definition

The idea of digital assets is not new, and has become increasingly integrated with data ownership. Data moved from paper to computers to data centers in the cloud, and is now moving into blockchain records. Blockchain allows a new level of sophistication for connecting individuals to their own data and also enables people to take ownership of their digital identities.

Defining Blockchain:

A Blockchain is a digital ledger of transactions that is duplicated and distributed across a network of computer systems.

- **Consensus** – All the entities in the chain agree that each transaction is valid. It can be used to bring consensus to a wide range of transactions such as payment, warehouse management, transportation and delivery.
- **Provenance** – It allows you to know exactly where raw materials or products originated and where they are in the supply chain. Supply chain professionals can quickly see who owned assets and at what time. Provenance can be attached to any asset such as iron ore, foodstuffs, money, machines or intellectual property.
- **Immutability** – It is virtually impossible to tamper with an entry in the distributed ledger. Only a new blockchain transaction can reverse the effect of a previous one.
- **Finality** – The copies of the shared ledger all hold the same version of the truth. This builds trust as all parties have a single view of the transaction.

2 | Description

The first OE company to launch NFTs to associate a vehicle with a digital asset is Alfa Romeo (<https://www.inverse.com/innovation/alfa-romeo-nft>). They are launching an NFT with a blockchain record associated to the VIN of the vehicle. Although exact implementation is not disclosed, the best use case would be to allow both shops and vehicle owners to attach digital records of maintenance, upgrades, or repairs to their VIN. Imagine this as simple as taking a photo of your oil change receipt with your phone and uploading it to the blockchain record. The brilliant interface would allow the owner or mechanic to scan the VIN to add entries, and to access all the blockchain records associated to that VIN. The ultimate goal of the NFT records is to increase the resale value of the vehicle by empowering transparency of information to subsequent owners.

Ford participated in an exploration of utilizing blockchain technology and documented their exploratory use in the paper: Towards Privacy-Aware Traceability for Automotive Supply-Chains

(<https://www.cs.purdue.edu/homes/akate/documents/SupplyChainTraceability.pdf>). It called the technology Fordchain, and the example use case was for airbags. Ford's focus was on utilizing blockchain technology to ensure transparency of supply chain.

The automotive aftermarket can lead in the creation of data into VIN level blockchain records via NFTs for vehicles, and spearhead the collection of maintenance, testing, and upgrade data associated with the vehicle. The NFT market is projected to be \$240B by the end of the next decade (<https://www.somagnews.com/nfts-in-the-automobile-industry-big-step-from-the-giant-italian-company/>) as consumers adopt their behavior to utilize NFTs in real world applications. Today, an owner does not necessarily have readily available access to data for their vehicle because the data is collected by the repair shop, the OEM, or even DMV. With a blockchain record associated to the VIN, an owner can access information such as battery test results, tread wear, alternator function, OBDII diagnostic information, etc.

3 | Author

BTC Think Tank – Emerging Technologies

4 | Resources

List of Charter Members:

- Jeff Marshall – Pricedex
- Joshua Dumas – Mann+Hummel
- Andrew Ciszczon – Freudenberg-NOK Sealing
- Adam Sworski – Valvoline
- Ram Chandrasekar – PhaseZero Ventures
- Scott Huston – IHS Markit
- Ben Johnson – Mitchell1
- Scott Tompkins – Epicor

EMERGING TECHNOLOGIES

(Li-Ion Batteries – Circular Economy)

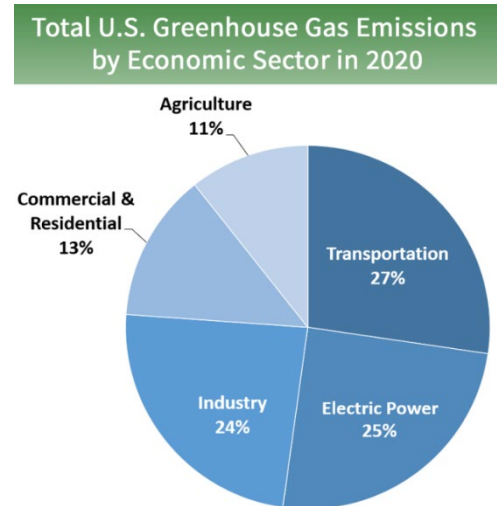
1 | Definition

A circular economy reduces material use, redesigns materials to be less resource intensive, and recaptures “waste” as a resource to manufacture new materials and products.¹

2 | Description

There is great focus worldwide on global warming and reducing Greenhouse Gas Emissions. According to the Environmental Protection Agency in 2020, the largest contributor in the United States is the transportation economic sector, accounting for 27% of the emissions.

As a result, the U.S. Government has made it one of their priorities to reduce our dependence on fossil fuels and escalate the use of advanced battery technology. This technology would focus on Li-Ion batteries in Hybrid and pure Electric vehicles.



SITUATIONAL ANALYSIS

For Li-Ion battery adoption to grow and be sustainable, it must be cost effective for the manufacturer and affordable to the consumer. To achieve this, there must be a sustainable circular economy.

In comparison, the lead battery industry operates the most successful circular economy in the United States. It recycles 99% of end of life batteries (by weight) each year -- approximately 130 million per year.³ The success of this system has been recognized by EPA,⁴ the World Economic Forum, and The Sustainability Consortium.

Li-Ion Batteries face several headwinds for growth.

- 1) Material accessibility
- 2) Material processing
- 3) Manufacturing
- 4) Recycling
- 5) Costs

The Federal Consortium for Advanced Batteries (FCAB) have published an Executive Summary called a National Blueprint for Lithium Batteries². FCAB is led by the Departments of Energy, Defense, Commerce, and State. The focus of this group is to address the head winds to move Advance Battery Technology forward.

In this summary, there are five goals that have been defined to move forward. Each contains a near term (2025) and a long term (2030) target.

- 1) **Secure access to raw and refined materials and discover alternatives for critical minerals for commercial and defense applications.**
 - a. By 2025 – Create partnerships for reliable supplies for key raw materials (Domestic and Foreign)
 - b. By 2030 – Eliminate Cobalt and Nickel in Lithium Batteries and integrate recycled materials into production, to aid in sustainability and a circular economy
- 2) **Support the growth of a U.S. materials-processing base able to meet domestic battery manufacturing demand.**
 - a. By 2025 – Create incentives on growth of domestic materials processing to reduce Cell cost
 - b. By 2030 – Support initiatives for Cobalt and Nickle Free innovations
- 3) **Stimulate the U.S. electrode, cell, and pack manufacturing sectors.**
 - a. By 2025 – Develop Form, Fit and Function Standards for Li-Ion Batteries
 - b. By 2030 – Reduce Cell Pack Costs by 50%
- 4) **Enable U.S. end-of-life reuse and critical materials recycling at scale and a full competitive value chain in the United States.**
 - a. By 2025 – Foster the design of battery packs for ease of 2nd use and recycling. Develop Federal policy to promote collection, reuse, and recycling of Li-Ion batteries.
 - b. By 2030 – Create incentives for achieving 90% recycling. Develop Federal policy requiring recycled materials in cell manufacturing streams
- 5) **Maintain and advance U.S. battery technology leadership by strongly supporting scientific R&D, STEM education, and workforce development.**
 - a. By 2025 - Develop policies to keep Intellectual property in the US
 - b. By 2030 – Develop Nickle and Cobalt free Cathode materials

4 | Resources

¹ – Environmental Protection Agency

² - Federal Consortium for Advanced Batteries (FCAB)

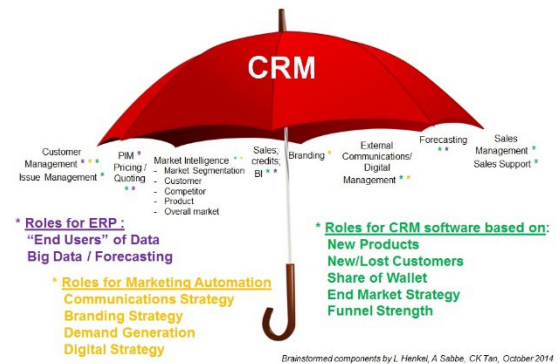
³ BCI National Recycling Rate Study, Nov. 2019 (available at <https://battery council.org/page/RecyclingStudy>).

⁴ EPA Facts and Figures About Materials, Waste and Recycling, Lead-Acid Batteries (available at <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/durable-goods-product-specific-data#LeadAcidBatteries>) -

CRM

1 | Definition

CRM, or Customer Relationship Management, is a broad concept with multiple definitions. The most concise view is: CRM is a philosophy and a business strategy, supported by a system and a technology, designed to improve human interactions in a business environment. There are many ways to achieve CRM, but in its full sense, it is a way to capture a 360° view of the customer, supported by technology, such that companies can give better service, recommendations, and make better decisions around their Commercial strategies.



2 | Description

Consider the umbrella in the above picture. CRM is not simply a sales tool, but a process that enables the entire Commercial team (Sales, Customer Service, Marketing, Product Management, Pricing, etc.) through multiple integrated tools.

Sales Management: a CRM tool will include Account and Contact lists, Activities performed for the customer by company personnel, and Opportunity management. Opportunity Management is the definition of potential sales called the pipeline. A sales person may receive a lead (see below, "Lead Generation") that will develop into a customer need. This need will travel through several stages resulting in a "win" or a "loss". It allows a company to understand (1) where its potential sales are coming from; (2) when they might expect the sale; (3) resulting in accurate forecasting to ensure the customer gets the expected merchandise or service.

Service Management: integrated with Sales Management, this tool will include the Account and Contact lists, and will indicate issues management, with insights into past activities and sales operations. It becomes a collaborative tool used (generally) by Customer Service teams and viewed by Sales teams, and tracks the issue from inception to finish, keeping personnel accountable to finding the quickest resolution to an issue. A Service Management tool can also be used to track warranties and issue avoidance.

Pricing & Quoting: a system integrated with the central CRM to request a price and/or define a price with approval levels as appropriate. Because of the integration with the CRM Opportunity module, it allows Pricing Management to understand what prices "won" or "lost" and to understand the reason, competition faced, and region the pricing behavior took place, resulting in more efficient pricing. With regards to quoting, it helps to improve quoting for faster turnaround.

Business Intelligence: Integrating CRM with the ERP or BI system gives the sales teams an understanding of what a customer is buying and what credits/invoices are outstanding. This can lead to better service and recommendations. "White Space Analysis" shows what the customer is

buying and where he is not buying, creating an upsell/cross sell recommendation. This can also be used to incentivize the sales teams by showing a sales person the amount the customer is buying and how much it would take to achieve a certain monetary gain. BI, combined with CRM, will also help in forecasting.

Gamefication: Similar to showing the sales person how much more sales it would take to achieve commission/bonus, gamefication creates competition among sales team members in a game oriented fashion with objectives which are tasks or behaviors which lead to sales. The psychology of a sales person is very rooted in competition, and with additional incentive in “beating” his opponent sales person or sales team, this helps move potential sales through the pipeline faster.

Lead Generation/Marketing Automation: Marketing’s campaigns through the web site, digital, or email result in interest from potential customers. These interests are nurtured electronically. If a potential customer is interested in a potential product, the next time he opens the website the product or related product appears enticing the potential customer to click for more information. Similarly, a Marketing campaign may be emailed to potential customers who have shown previous interest. The potential customer’s behavior is captured and scored. Once the score gets to a desired level, the potential customer becomes a lead that is passed to the sales person who takes it and defines an opportunity. In addition, the behavior helps Marketing teams understand what customers want to see, and can improve Communication and Digital strategies.

Implementation pitfalls: CRM implementations have historically had a high failure rate because the focus has been on reporting the pipeline to upper management. It has been perceived by sales people as “management Big Brother”. A key to successful implementation is to demonstrate to the sales people how it can increase their individual sales.

3 | Author

Lisa Henkel | Sales Effectiveness Program Manager | Gates Corporation

4 | Resources

[Salesforce.com](https://www.salesforce.com) | [Marketo](https://www.marketo.com) | [Oracle Sales Cloud](https://www.oracle.com/sales-cloud) | [Big Machines](https://www.bigmachines.com)

Cybersecurity and the Dark Web



1 | Definition

Cybersecurity, computer security or IT security is the protection of computer systems from theft of or damage to their hardware, software or electronic data, as well as from disruption or misdirection of the services they provide.

2 | Description

“Cybersecurity” ...say it out loud once. It sounds very “Mr. Robot” or “War Games” doesn’t it?

Yet, at the end of the day, it’s simply the art of being logical and reasonable in an effort to protect your company’s most valuable and cherished assets. It’s a never-ending good versus evil campaign in an ever-changing war of minds and technology.

I often hear the statement “You can’t have TOO MUCH security protection!” Well, I’m here to tell you that this statement is utter nonsense. Would you spend \$100 to protect a \$20 bill? Absolutely not. That’s asinine! In the same way, you wouldn’t spend \$2500 on a piece of software to protect a \$500 laptop. Cybersecurity protection simply comes down to common sense.

To take this a step further, if you break down cybersecurity to its simplest form, you end up with Risk Management. It’s knowing the threats and understanding the countermeasures. It’s using sound judgement and diligence to come up with the most appropriate controls to protect your company’s investments. It’s measuring the value of an asset against the cost of the countermeasure. It’s measuring the pros and cons and coming up with the best solutions based on the relevant facts.

“Yes, but what about the dark web, and the scary side of cybersecurity?” Well, this is a topic that you could spend weeks, months, or even years diving into. It’s crazy, it’s unimaginably weird, and it’s technologically fascinating! It is quite literally, the digital Wild West.

For those hearing this term “dark web” for the first time. Imagine another internet where anything goes. An underworld of mystery. A part of the World Wide Web that is only accessible by means of special software, allowing users and website operators to remain anonymous or untraceable. As you can tell already, this is a recipe for some digital thuggery and mayhem to take place.

Wait, did you just say “Anonymous?” Aren’t they the hacker outfit that wears the creepy Guy Fawkes masks who express an overarching desire to combat censorship, anti-oppression, promote freedom of speech, and counter government control? Yep. That’s the one.

The Dark Web

"This is your last chance. After this, there is no turning back. You take the blue pill—the story ends, you wake up in your bed and believe whatever you want to believe. You take the red pill—you stay in Wonderland, and I show you how deep the rabbit hole goes. Remember: all I'm offering is the truth. Nothing more."

-Morpheus (Laurence Fishburne) – The Matrix



I guess you could say that cybersecurity is far-reaching and crosses many boundaries both corporately, politically, and socially. It's a mystery, wrapped in a riddle, wrapped in an enigma as they say. Well, or it's not. Maybe it's just us against them and not much more. I guess it really just depends on what you hear, who you talk to, or what you uncover on your own.

Whatever it is, it's here to stay and it's a vast ocean of knowledge and information. This is why I love it! This is why I live it! This is why I can never get enough of it.

If this an area that also interests you, I invite you to dig into to the fascinating world that is cybersecurity and the Dark Web. However, I warn you, what you find, can't be unfound. I've provided a few links below to enlighten your mind and pique your interest to dig even further.

Enjoy!

3 | Author

Kevin Pentecost | Standard Motor Products



4 | Resources

[The 3 Simple Steps](#) | [Cybersecurity Frameworks](#) | [The Dark Web](#)

Digital Assets

1 | Definition

With the ever-growing digital aspect to the automotive aftermarket buying process, it was only a matter of time before the Heavy Duty and Off-Road industries were going to see the same transformation. It's no secret that content is king, but it can seem like a daunting task as you think back to all of the products - probably thousands - that have very little to no associated data or visual information over the last few decades. The following provides a framework for building your content strategy.

2 | Description

In general, there are two types of content: 1) visual, typically referred to as digital assets and 2) technical, which are the specifications of the parts and their potential uses. This chapter will focus on the visual or digital assets.

1. The first step in any content project is to take a step back and think about the ultimate goals for your product content. Are you looking to enhance your personal brand and website or are customers/receivers asking for this content? If the latter is true, it is important to know what they need as this will always provide a good baseline for the minimum content needed for success. Receivers often will provide a digital asset document outlining their requirements, so you need to do is request it. If you are proactively creating content, it is important to build an internal workgroup with both the marketing and product teams to ensure you are capturing everything everyone needs.

2. With the goals identified, one should focus on what content to create. Most assets will fall into one of three categories: static images, video and more recently, 360°/3D imagery. Below are some quick definitions:

- Static images – These are your general product photos, i.e. front, back, left, right, $\frac{3}{4}$ marketing and any connectors. These images are generally needed for every part. The exact angles and number of images may change based on complexity, but when buying online, you need to see the parts. It is important to capture connectors so that buyers have an extra level of confidence they are selecting the right part during a digital purchase.
- Video – Videos work great for complex parts requiring deep explanation of function or even installation. Think of videos as your chance to explain to potential buyers both the value of your parts and how to use them. This may not be necessary for every part but can be very helpful as the complexity of the part or any unique features increase.
- 360° Imagery – These are interactive images which allow the buyers to rotate parts around and even up and over the parts to mimic an in-person experience. Over the past couple years, more and more receivers have begun asking for 360° imagery because it provides the buyer the opportunity to fully explore a product and reduce or even eliminate

any doubt they have selected the right part.

- As an added bonus to 360° images, you can often extract many - if not all - of the standard static images you need right out of the 360-degree file as a “spin set” view is typically made up of between 24 and 72 JPEG images depending on the number of planes captured.

3. Once you identify the goals of your project and the content required to achieve them, a plan should be created to reflect priorities and timing. Typically, there will be a significant number of priority items, but there also will be less-urgent items. A good rule of thumb is to review the drivers of your top 20% to 30% of sales. Receivers may provide their priority lists and deadlines. This allows you to manage the project based on immediate and long-term needs and help you select the right partners with which to work.

4. Now that we have covered the goals, priority list and the required content, it is time to build the image-capture strategy. Project size, goals, timing, number of products and new product release frequency will influence whether to build a studio and capture the images in-house or partner with an outside agency. A third party agency typically will be able to capture the images much faster as this is their core competency, and they can allocate more expert resources toward a quick project completion. Internal studios provide more control over the specific content and ownership of the process over time. General rule of thumb: If you have fewer than a few thousand products or release only a few hundred a month, working with an agency can be less costly and eliminate the need to hire a photographer/videographer, which would only be needed a few days a month.

Advanced agencies offer a hybrid approach in which they will help with the initial priority product list and then help set you up with your own studio to handle new products and the remaining backlog. They typically can build remote studios on-site at your facility for large upfront projects to eliminate the logistics of shipping thousands of parts and then can leave the equipment for ongoing image capture needs.

5. The final step in the process is **execution**. It often is helpful to use a “single touch” approach. One of the more challenging parts of photographing a product is actually sourcing and preparing the product. The actual image or video capture is just one small step. For this reason, it is important and the most cost-effective to capture everything you think you might need at one time.

If you are building an internal studio, work with a partner that can provide equipment to automate the image-capture process as much as possible. While there is no way to fully automate the creative process there is some stellar equipment available to make the process easier and faster for your team. If you have identified 360° imagery as a requirement, identify a partner that can train you how to double dip these assets to gather your static images at the same time.

If you select the agency approach, locate a partner that has experience in the aftermarket, as this will help ensure you capture all the images you need the first time. It is essential to utilize best practices for particular product types based on the information received from receivers and other manufacturers. If 360° images are needed, work with an agency that can pull some or all of the static images from those 360s in order to maximize your investment. This also is a great time to

have your agency capture weights and dimensions for shipping or attribution purposes. This saves you from having to pull the part off the shelf again later.

The final step in the digital asset creation process is to ensure you have a way to store and syndicate the images/videos. There are a number of software and service providers that provide these capabilities if you do not opt to have your internal teams handle it. If you are choosing to send the images to a number of receivers on your own, it can be helpful to have the files named for each of them when they are created so you can simply transfer the files without the need for renaming or reformatting.

3 | Author

Snap36

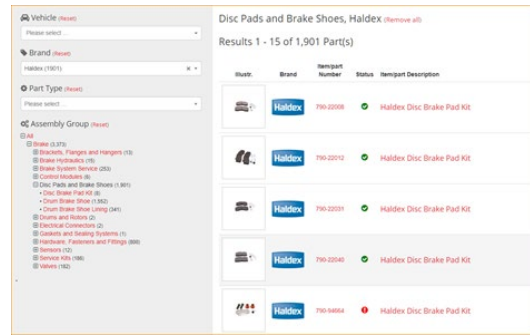


4 | Resources

[AutoCare Digital Asset Best Practices](#) | [Snap36](#)

Digital/Online Catalogs

1 | Definition



When most of us think of “digital and online catalogs”, we tend to think of Amazon, where many of us routinely purchase a variety of products, from food items to clothing to workshop tools, and much more. However, as the term applies to transportation related markets the meaning is much different. While the general operating approach may be similar, the use and proliferation of online catalogs is significant. So, where to begin... let’s start with a bit of history to provide a solid understanding of how we got here, then we will address how things work today and how they will likely work in the future.

2 | Description

The History

There are really two stories to tell that provide the best perspective on the development of cataloging... before the institution of digital (and digital standards) and after the introduction of that technology.

Before Digital Standards:

The Supplier’s Early Perspective:

In the beginning, catalogs in our industry were generally printed, with suppliers of parts providing a “catalog” of available products to their customers. Each supplier would choose what information it would include in these catalogs based on the products being sold. This might include the applications for the products (such as the vehicles the parts might fit), known as “applications”, as well as some level of product descriptive information (things like dimensions, materials, etc.), known as “attributes” data in the automotive marketplace. All this information was developed and stored in written or printed form in word processors using spread sheets at the supplier’s place of business, and catalogs were printed from formatted sheets provided to outside, or in house, commercial printers. This was a laborious and costly task that required substantial resources and product knowledge gathered by the company’s catalog manager from various departments within the organization, such as engineering, accounting, logistics and marketing, and from a variety of inside and outside resources to develop application data. An interesting note is that this catalog was often outdated and riddled with errors that were manually discovered by the time it had been delivered to the distributors and shops for use.

The Distribution Channels' Early Perspective:

Prior to digital tools and standards, the distribution of products was accomplished by distributors and retailers taking the information provided by suppliers in paper form and incorporating it into "catalogs." These might take the form of a distributor branded catalog or an accumulation of supplier catalogs all grouped on catalog stands for their own use and the use of their customers.

After Digital Standards

First, it's important to know that there are many applications of digital technology in cataloging and this paper focuses only on the highest level of market application. In this context, the use of digitized data, that is data usable and readable by a computer, streamlined the preparation of data for catalogs at all levels of the marketplace:

- Initially, this allowed suppliers to provide "digitized files" to the catalog printers instead of paper documents, thus allowing elimination of type setting by the printers.
- Next, the advent of digital standards allowed a "common language" to be applied, first internally by some enterprising companies. These companies developed their own standards and vehicle tables that allowed them to digitally assign products to specific vehicle applications, using paper-based supplier data, and later the supplier's digital spread sheets.
- The "big step" was brought about by the efforts of The Auto Care Association (ACES and PIES) in the USA, and TecAlliance (TecDoc) in Europe and other countries, to provide more comprehensive industry standards for industry wide adoption and use. After years of development, these standards represent the foundation of modern cataloging for the global vehicular industry. While there are other standards still used by some distributors and offered commercially, these two are the accepted standards sets for data preparation and distribution.
- With these developments, distributors can produce catalogs digitally using digital files provided by the suppliers and can add their own visual enhancements to their catalogs as they see fit. The digital nature of the information makes it relatively easy to provide catalog data through the entire distribution system, all the way to the shop floor for installation of the products into customer vehicles. The result has been a proliferation of online catalogs providing unprecedented access to national, if not global, product offerings.

It is important to note that the commonality of data provided by the standards is critical to the successful application of a supplier's product to the appropriate vehicle. As examples, if naming conventions are not consistent or if data measures are not consistent across supplier offerings, significant errors can result. This, in turn, results in warranty returns and dissatisfied customers.

Improving "speed" in the cycle of bringing new products to market provides more selling time for products versus the competition and allows suppliers to showcase their products more readily. The "digital standards revolution" has provided significant improvements in supplier speed-to-market, taking many months off the time needed to get products into selling positions at all levels of the distribution chain.

Finally, the advent of digital standards allows suppliers to communicate via the internet with customers at all levels of distribution, allowing the company story to be told in ways that was only dreamed about in the past. Offerings are now spreading beyond automotive to heavy-duty truck and other markets. More and more suppliers are joining distributors in more effectively “telling their product stories” and differentiating their products via online digital catalogs. Studies show that a high percentage (as high as 80%) of products are “shopped online” prior to purchase, either from an online catalog or from a brick and mortar store. Therefore, online digital catalogs using standardized data represent a significant opportunity for suppliers to make their messages heard by customers.

Please also see the sections covering more details on digital standards.

3 | Author



Charley Johnson | Chief Executive Officer | OptiCat, LLC.

4 | Resources

[OptiCat](#) | [OptiCat Online](#)

eCommerce Channels in the Aftermarket

1 | Definition

Throughout the 1960's there was a rise of buying and selling of goods through the transmission of data, made possible by the growing access to electronic data interchanges. This led to the process came to be called electronic commerce – or eCommerce as it's more colloquially known as today. While “eCommerce” and “online shopping” used to be an interchangeable language, it has evolved much further than simply checking out a cart on a retail website. As consumer requests and requirements become more demanding, it is up to suppliers to navigate this ever-changing world. Understanding the fundamentals, developing comprehensive strategies, utilizing the industry data standards and anticipating disruption are all key factors when establishing a robust online presence that will proactively support your business goals and sales force.

While eCommerce is already a major component in consumers' daily lives, it is only going to grow. It is estimated that eCommerce sales are projected to grow to 599.2 billion USD by 2024 [FE International]. And with this growth will come an ever-increasing need to manage your brand effectively and be prepared to adapt as outside factors change. The worldwide outbreak of Covid-19 is a recent example that greatly accelerated consumer spending on eCommerce. Amazon sales increased 37.4% in 2020 [Practical Ecommerce], while Walmart saw eCommerce sales increase by 79% [CNBC]. Looking specifically at the automotive aftermarket sector, eCommerce is showing a 50% average year over year increase since April of 2020 [Hedges & Company]. Consumers understand that buying online allows them to get lower prices, conveniently compare products online and have a wider choice of items to purchase. In turn, businesses see higher margins, scalability and consumer and technology insight. Now that we have established the importance of readying your brand for the eCommerce world, let's review the different types of sales and distribution/fulfilment styles your organization can adapt into to maximize success.

2 | Description

eTailing, often referred to as “online shopping” or general “eCommerce”, refers to purchases made by any consumer or shop through public websites. Such examples are O'Reillyauto.com, ShopLitens.com and CarParts.com. eTailing requires companies to tailor their business models to capture internet sales, which can include building out distribution channels such as warehouses, webpages, and distribution centers. This also includes a growing trend of buying online, pick up in store (BOPIS). eProcurement, also known as “supplier exchange,” entails purchases made by a shop/WD through proprietary retailer or shop systems. These are

sales made through a web interface or other networked systems. Such examples are Alliance's "MyPlace4Parts," and NAPA's "ProLink". The final, and historically most common, model of sales is offline sales. Offline refers to conventional purchases made by consumer or shop in-store or by phone. eProcurement and offline sales combined are referred to as "traditional" sales model.

When defining eCommerce channels, the main ones are business to business (B2B) and business to consumer (B2C). B2B refers to companies that sell their products to other businesses such as distributors and service centers. B2C is when a business sells its products directly to consumers. While B2B and B2C models are very different, both are focused on the end user. Both models engage in superior customer service, customer-centric sales processes, and work to retain customer loyalty. All of which add to the authenticity and credibility of the brand.

Looking beyond their focus on the customer, how these models operate are vastly different. Some examples include product pricing and complexity, branding methodologies, purpose of sales team and product knowledge. Using the B2B method product pricing is complex and costlier, while B2C aligns pricing with individual capacity and is less complex. B2B utilizes white paper research and industry forums/networks for branding while B2C relies on broadcast advertising and endorsements. In B2B, the key purpose of the sales teams is to build relationships while B2C sales teams exist to maximize transaction value. And in B2B, product knowledge requirements are high with extensive industry vernacular while B2C has very low need to be subject matter experts. This is a key point as consumers like options, therefore presenting your products with detailed information, enhanced images and detailed digital assets is no longer "above and beyond" practices but the minimum you need to sell products.

Within the B2B method there are two popular sub-methods used: B2B 1 Party distributors (B2B 1P) and B2B 3 Party distributors (B2B 3P). A 1P relationship means that the marketplace acts as the distributor and the brand is the wholesale supplier. 1P offers brands no visibility to who is actually buying the product, such as when sold on Amazon, which means there is also no control over pricing. Examples of B2B 1P would be Amazon and Walmart. A 3P relationship is when the brand is the retailer and sells directly to buyers through the marketplace. This means 3P has full visibility as to who the seller is, it does allow them to control pricing. Examples of B2B 3P would be Etsy and Ebay.

When choosing an eCommerce model to follow, you must also weigh the different fulfillment methods. 1P relies on the Direct Fulfillment and Traditional Order fulfillment. In a Direct Fulfillment model, the eCommerce business takes no physical possession of the items on sale. Instead, orders are sent directly to the manufacturer who is responsible for storing the items and shipping them to customers. Some benefits to the seller of this method are lower ongoing costs, eliminates inventory risk and allows for product flexibility. However, the manufacturer must bear the inventory carrying costs and additional cost associated with shipping individual orders to the end consumer. Traditional Order fulfillment is closest to the traditional retail model. The business owner or retailer acquires stock directly from the wholesaler at a discounted rate and applies a margin onto each product and delivers to consumers directly. Some benefits to this model are lower costs of good sold, stricter inventory management and brand control. 3P relies on Outsourced fulfillment model, taking inventory and shipping moving those duties to a privately owned space that will handle those services for you.

Some benefits to this model are not storing your own inventory, having to handle the logistics of shipping and being able to gain a geographic footprint by using multiple fulfillment centers.

3 | Author

Paul Arena | Manager Product Data Services | Gates Corporation



4 | Resources

[FE International](#) | [Practical Ecommerce](#) | [CNBC](#) | [Hedges & Company](#)

Electronic Data Interchange (EDI)

1 | Definition



Electronic Data Interchange (EDI) is the business process electronically communicating transactional information that was traditionally communicated on paper, such as purchase orders and invoices.

2 | Description

EDI has been utilized for more than 50 years, and at a glance, it represents quick and accurate digital data exchange within the supply chain. It basically is an electronic postal service between trading partners. Its longevity has created rumors that claim it is becoming obsolete, but in reality it is quite the opposite. In the past, the term EDI was only used when referring to two formats: ANSI X12 and EDIFACT. Today, the term encompasses over 300 formats, including XML and PDF. It also is common to use EDI in a broader sense to refer to business transactions involving API integration with e-commerce sites like Amazon and eBay Motors, and/or integration with internal applications like ERP and WHS.

EDI Standards and Document Specifications in the Aftermarket

Standards are the rules (structure, content, syntax) that define the language for document exchange between trading partners to ensure a common meaning across systems. ANSI X12 and UN/EDIFACT are the most prevalent formats used in the aftermarket industry.

- Common EDI Documents:**
- 850 Purchase Order
 - 810 Invoice
 - 855 PO Acknowledgement
 - 856 Shipment Notice
 - 997 Functional Acknowledgment

Just as a spoken language can have many dialects, each standard can have numerous EDI specifications, or specific rules that determine required and optional document information (i.e. item number, quantity, and shipping address). In the automotive aftermarket, there is Super Spec. It uses the X12 standard foundation and overlays common data rules to create industry-wide specifications that must be adopted if trading partners opt for EDI communication.

EDI Communication Methods and Protocols

A communication connection is required to transmit, or send, EDI data between trading partners. To establish a connection, different methods with varying protocols are available:

- **Point-to-Point Direct Connections:** Trading partners transmit data directly via secured protocols, such as Applicability Standard 2 (AS2), Azure Messaging Queue, File Transfer Protocol (FTP) with Virtual Private Network (VPN), Secure File Transfer Protocol (SFTP) and File Transfer Protocol Secure (FTPS), as well as HyperText Transfer Protocol (HTTP). These protocols determine how the

data is delivered. Direct connections offer full control over EDI operations but require investment in hardware/software and IT experts to manage the environment.

- **Outsourced Services:** Companies that do not want to invest in the infrastructure and personnel required to manage EDI in-house often choose a third-party EDI service provider to manage implementation, trading partner onboarding, and daily maintenance/support.
- **Indirect Connections:** A Value-Added Network (VAN) is like an electric post office—a third-party service that routes data transmission to and from trading partners.
- **Web-Based EDI:** Ideal for small companies with no technical staff and limited funds that must quickly become EDI compliant, web-based EDI uses a portal that enables trading partners to transform documents into human-readable web pages, but it requires manual intervention.
- **PDF-to-EDI:** Paper-based documents are converted to EDI with 100% accuracy, eliminating manual processing involved in traditional EDI and automating all non-enabled partners.

EDI Benefits

Companies often view EDI as an obligation they are forced into by larger trading partners, but EDI can benefit businesses at every level: small, medium, and enterprise. See below:

- **Cost Reduction:** By eliminating manual data entry, companies can save a significant amount of time and money, while reducing the risk of penalties and chargebacks due to data entry errors.
- **Increased Accuracy, Efficiency, and Productivity:** By automating workflows, human errors are eliminated, and processing time is reduced for better allocation of valuable resources.
- **Improved Visibility Throughout the Supply Chain:** EDI gives access to critical transaction information and data reporting, thereby improving business partner relations.
- **Security:** EDI ensures the secure exchange of critical information through protocols, encryption, verification, confirmation, and other measures.
- **Full Integration with Internal Applications:** Integration with internal applications, such as ERP or WHS, prompts a quick return on investment (ROI), among other benefits.

3 | Author

Joe McManus | Senior Sales Executive | TIE Kinetix



4 | Resources

[EDI 101: Back to the Basics](#) | [X12 Directory of Transaction Sets](#) | [Super Spec](#)

[Corcentric](#) | [GCommerce](#) | [Tie Kinetix](#)

EMERGING TECHNOLOGIES

ELECTRIFICATION OF THE VEHICLE

1 | Definition

For the automotive industry, electrification can be attributed to any electrically enabled technology designed to improve operational efficiencies and reduce the carbon footprint of the vehicle. Start-Stop, Hybrid, Plug-in Hybrid, Mild Hybrid, Battery-Electric Vehicles, Electric HVAC are some examples of electrification which has been introduced and continues to evolve.

2 | Description

Most new vehicles being launched include growing levels of “electrification” up to and including “Battery EV (BEV)”, which eliminates the internal combustion engine. OEMs just in North America are planning to launch more than 70 EV models between 2020 and 2027. Forecasts suggest by 2030 around 14 percent of new vehicle sales will be of “Battery Electric Vehicles”, with another 23 percent including some level of electrification augmenting the ICE (internal combustion engine) including variants of “mild hybrid” including start-stop, electric HVAC and many other technologies designed to enhance the driving experience while reducing the carbon footprint. While debate continues on the adoption curve, there is no doubt electrified vehicles are more common on our roadways.

With these technologies come new challenges as the industry must learn and react to technology which will change parts on the vehicle, the symptoms these parts exhibit as they wear and break, as well as the methods for diagnosing, replacing, and programming new components to perform as expected. These challenges are expected and the industry has dealt with these in the past.

Unknown aspects of electrification, especially variants which include a high voltage battery pack (which can cost thousands of dollars to replace) include recycling of these batteries when they fail. To date there haven't been volumes to cause issues, but this will undoubtedly change and present opportunities for companies who can find uses for them. The used car market is still unsure about electrified vehicles since much of the time used car customers don't desire a used vehicle which will likely require an expensive battery replacement. Used vehicle buyers may also not be ready (or capable) of investing in charging infrastructure for the new owner's home. If vehicle scrappage rates for these vehicles increase due to low demand in the used car market, new challenges and opportunities will emerge for the industry to contemplate.

One electrified technology not specifically focused on due to current population and forecast are FCEV (Fuel Cell Electric Vehicles) which utilize Hydrogen to create electricity to power the vehicle. Benefits are that refueling is an experience consistent with gasoline or diesel fueling events, and that this technology has little impact on existing power grid infrastructure. Hurdles have been investing in infrastructure to

create and distribute hydrogen through the nation. Interesting variants of this technology are being explored which would utilize Ethanol or Methanol through a reformer to create Hydrogen. This solution would still generate CO2 as an emission, but claims are that it would be essentially carbon-neutral. If proven feasible ethanol or methanol are easily created through various crops, and existing infrastructure could be leveraged to distribute.

Regardless of “speed of adoption” of any of the listed technologies, electrified vehicles are on our highways today and as an industry we must support them with reliable replacement components, service processes, tools and capabilities. On vehicles not equipped with an ICE, the manufacturer has more options about information they are required to make available since there is no CARB requirement on those vehicles. Industry collaboration with the vehicle manufacturers must be in place to ensure the aftermarket as well as the vehicle dealership service department has access to the information and tools to properly maintain these vehicles.

To close, today we are still in the infancy of electric vehicle evolution. Many changes are in flux, from the types of electric motors used, their configuration, related power electronics design, (chargers, inverters, DC/DC converters, etc) battery design, (type, energy density, storage, etc) and even fuel cells. It is unclear what the future holds, but it is clear a massive amount of resources are directed at development, from governing bodies to private industry, it is a race to see who can emerge a clear winner; not from hearsay, but from real, tangible, market share. The automotive aftermarket industry needs to prepare for these changes, or risk getting left behind.

3 | Author

BTC Think Tank – Emerging Technologies

4 | Resources

List of Charter Members:

- Jeff Marshall – [Pricedex](#)
- Joshua Dumas – [Mann+Hummel](#)
- Andrew Ciszczon – [Freudenberg-NOK Sealing](#)
- Adam Sworski – [Valvoline](#)
- Ram Chandrasekar – [PhaseZero Ventures](#)
- Scott Huston – [IHS Markit](#)
- Ben Johnson – [Mitchell1](#)
- Scott Tompkins – [Epicor](#)

EMERGING TECHNOLOGIES

1 | Definition

Emerging Technologies are technologies for which development or practical application and promise are still largely unfulfilled or undeveloped in potential, while they may have existed for a period of time.

2 | Description

In the context of the Automotive Aftermarket, which is an innovative, yet conservative industry, Emerging Technologies provide both a threat and opportunity to the strength and well-being of the industry as a whole, from grassroots product engineering through the service of the vehicle.

The purpose of this document is to promote comprehensive and holistic thinking about how, collectively, emerging technologies will change our supply, selling, and fulfillment ecosystems in the aftermarket; and prompt thinking upon the tools and methods we will need not only to adapt our service parts offerings to emerging vehicle technologies, but how we will need to scale our efforts through the next generation of transition.

Consider the boiled frog parable. While the science behind the parable does not check out, the lessons still ring true. We have many examples to learn from such as Blockbuster, Xerox, Kodak and Toys R Us. The changes and innovation that impacted their industries did not happen overnight; some even originated from these companies. Ultimately, these companies chose NOT to change or waited until it was too late.

Adapting to change was hard enough when the pace of change was visible and manageable, but what happens when the pace of change is neither?

That is where we, as an industry, are heading.

SITUATIONAL ANALYSIS

Moore's Law has seemingly hit a wall, but progress continues. For those unfamiliar, Moore's Law relates to the doubling of transistors on a chip every 2 years, while we pay less for them. This progress underlies many of the largest technological advances in recent history. It is the enabling technology that other enabling technologies have relied on. Think cloud computing, smartphones and social media: now think about the intersection of these technologies, **data**.

As of 2018, 2.5 quintillion bytes of data are generated every day, which means more than 90% of the data generated in the world was generated within in the last 2 years at that time. This pace has and will increase as the Internet of Things and increasing adoption of internet-enabled devices continue.

While the development of these emerging technologies is accelerating, cost, availability and affordability of these technologies are improving at a faster rate. One key resource is getting more expensive: **Skilled and Talented Workforce**.

Already in the automotive industry, partially accelerated by COVID-19, there is a transformation taking place in the way vehicles are researched and purchased, with competitors emerging to challenge the traditional brick and mortar dealerships. Consumers are spending more time evaluating not only which vehicle they may purchase next, but from where; and whether they will pick the vehicle up or have it delivered. This behavior applies to the service of vehicles and perhaps even which parts they prefer to purchase or have installed.

In most aspects of their lives, consumers feel more informed and empowered to make decisions. However, information is just one aspect of the evolving customer experience. The likes of Amazon, Google and Facebook are changing the speed, ease and convenience of purchase transactions. A seamless experience where product can arrive within 2 hours is not far from becoming the norm.

To answer these consumer expectations, we have seen high growth in the number of independent repair facilities with their own web presence and investments in SEO (Search Engine Optimization), reviews and other technologies to better market themselves in an online marketplace.

OBJECTIVE

The Charter Members of the BTC Think Tank were charged with identifying what it felt were the potential ‘Game Changers’ – technologies which would and could threaten the automotive aftermarket through disruption; or, alternatively, be embraced by the automotive aftermarket to add value and further innovation in the applicability of emerging technologies to its business, manufacturing, product and its sell chain models.

This new industrial revolution will pose many challenges over the next generation, and beyond, and corporate leaders will be challenged with the cost and speed of change, and the costs associated with transition. The role of Research & Development over the next 10 years should change dramatically, through inclusionary practices designed to have all operational areas of the business involved.

RECOMMENDATION

The 21st-Century business model for R&D should expand to a more holistic, inclusionary approach, which encourages input from all key departments using a “Monitor – Assess – Apply” model. This is, simply, a new model for the “**Corporate Suggestion Box**”, enabling the assessment of ideas for new products, new design techniques, new manufacturing and procurement practices, and new customer fulfillment, service and support models using new, emerging technologies after assessment of their applicability in the circumstances.

There is no doubt that technological advancements are going to continue at breakneck pace, but what does that mean to the automotive aftermarket? The purpose of the BTC Thinktank on Automotive Emerging Technologies was just that – to consider what known emerging technologies have an application in the automotive industry, and how can the aftermarket sell chain convert itself into a ‘Value Chain’ to enhance the end user experience, leveraging emerging technologies. Subsequent sections in this chapter present a comprehensive, but not exhaustive list of what is appearing on the technological horizon, and present opportunities for the aftermarket industry to explore and exploit emerging technology to create opportunity, value, and thus remain a relevant component of the supply chain within the economy.

COMPANION DOCUMENTS

Emerging Technologies – The New Customer Ecosystem

Emerging Technologies – 3D Printing

Emerging Technologies – Electrification of the Vehicle

Emerging Technologies – Power Systems

Emerging Technologies – 5G Communication & Telemetry

Emerging Technologies – ADAS (Advanced Driver Assistance Systems)

Emerging Technologies – Autonomous Vehicles

3 | Author

BTC Think Tank – Emerging Technologies

4 | Resources

- Jeff Marshall – [Pricedex](#)
- Joshua Dumas – [Mann+Hummel](#)
- Andrew Ciszczon – [Freudenberg-NOK Sealing](#)
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- Scott Tompkins – [Epicor](#)

EV Service Readiness

1 | Definition

This document describes the current state of service readiness in the aftermarket repair community. Service readiness is defined as, “the ability for the aftermarket repair industry at large to service the growing electric vehicle population as they continue to come out of warranty and be available for aftermarket repair facilities to service them.” For the purposes of this document, this will include the availability of replacement parts as well.

2 | Description

Electric Vehicles continue to grow in popularity and sales in North America, driven by high petroleum prices, advanced technologies, increasing ranges between required battery charge events and prices getting closer to “mass adoption” ranges. Electric vehicles, by design, include many high voltage components which require special training and equipment. This document evaluates the current state of readiness and the reasons behind those conclusions. To begin with, we asked ChatGPT for its analysis. Note that since ChatGPT’s reference information is only current through September 2021:

From ChatGPT: “As of my last knowledge update in September 2021, the readiness state of the automotive repair industry to service electric vehicles (EVs) varied depending on factors such as geographical location, market demand, and the proactive efforts of repair shops. However, I don't have information on developments beyond that date. Here's a general overview of the situation up to that point:

1. **Training and Education:** Many repair technicians and mechanics were not well-equipped to handle the specialized systems and components of electric vehicles. EVs have different powertrains, battery systems, and electronics compared to traditional internal combustion engine (ICE) vehicles. Training programs and certifications were being developed to bridge this knowledge gap.
2. **Tools and Equipment:** Electric vehicles require specialized tools and equipment for diagnostics, maintenance, and repair due to their unique components and systems. Repair shops needed to invest in these tools to provide effective service for EVs.
3. **Charging Infrastructure:** Repair shops needed to have access to appropriate charging infrastructure to deal with EVs that require charging during service. This was particularly important if the repair shop was handling battery-related issues.
4. **Safety Concerns:** Working with high-voltage systems in EVs required specialized safety protocols and training to prevent accidents and ensure technician safety. Repair shops needed to adopt these safety measures to work on EVs safely.
5. **OEM Support:** Original Equipment Manufacturers (OEMs) were working to provide support to repair shops by offering training, technical resources, and access to genuine parts for EVs.

6. **Regulations and Codes:** Repair shops needed to be aware of and compliant with regulations and codes related to handling EVs, including safety, environmental, and disposal regulations for batteries and other components.
7. **Market Demand:** The readiness of the automotive repair industry to service EVs also depended on the local market demand for electric vehicles. In areas where EV adoption was higher, repair shops were more likely to invest in the necessary resources and training.
8. **Independent vs. Dealership Repair:** Dealerships often had an advantage in servicing EVs, as they had direct access to manufacturer training and support. Independent repair shops faced more challenges in acquiring the necessary expertise and resources.
9. **Transition Period:** The transition to electric vehicles was gradual, and during this period, repair shops had time to adapt and enhance their readiness to service EVs. However, the pace of adaptation varied.”

Interestingly, not a lot has changed since the ChatGPT conclusions were generated. The challenge is that most shops continue to be very profitable and service bay/technician utilization is saturated, without the addition of EVs to the workload. Additionally, although EV sales have increased in the past few years, they still make up a very small percentage of the overall car parc, and many shop owners are resistant to investing in the training and tools required to service them. Finally, aftermarket parts companies have been slow to add EV-specific replacement parts to their offerings, and some vehicle manufacturers have been slow to enable purchase of these components by the aftermarket repair facilities.

Implications to the repair industry are significant. While many consumers still complain about range anxiety and initial purchase price, amongst the factors keeping them from transitioning from ICE to EV-equipped transportation, there are many households purchasing the lower-priced models as “commuters” for work or school etc. And, as these household “mixed fleets” begin to bring those vehicles into the shops that have historically serviced their entire fleet, if the shop cannot now service the EV vehicle, the risk to the shop is that the consumer will seek out other service centers who can.

This creates a complicated problem for the shop owner. Today they don’t “need” the added EV business, but the possibility of losing long-time customers is becoming more “real”. Adding to that pressure, large service chains are making aggressive moves toward EV service support. For example, Bridgestone Firestone has launched EV services at certain retail locations, and that is expected to expand. As these larger, well-funded chains add EV services, the smaller independent service garages will need to match those services or face decline in customer base.

3 | Conclusions

It should be noted these observations reflect a snapshot in time, and all things EV are evolving rapidly. As of this writing, however, it is the opinion of the Emerging Technology Think Tank that the aftermarket repair and parts industries are behind and losing opportunity to the OE’s service and parts capabilities relating to servicing customers with electric vehicles; and thus, risk loss of consumer confidence until that perception is changed.

4 | Author

BTC Think Tank - Emerging Technologies Group

5 | Resources

ChatGPT

Global Vehicle Data



1 | Definition

The Global Vehicle Table is a comprehensive standardised database describing the attributes of the cars and light commercial vehicles which are on the road throughout the world. It covers all cars and light commercial vehicles and countries and regions for which the data is available.

2 | Description

Today there are approximately 1.4 billion cars and light commercial vehicles in use around the world. The data pertaining to these vehicles is brought together from a variety of sources including vehicle manufacturer production figures, websites and electronic catalogues, vehicles in operation data (VIO), new vehicle registrations and used car websites.

The Global Vehicle Table is the foundation for global parts manufacturers and parts wholesalers to organise their product marketing and data management activities and to optimise the tools they use in their daily business.

This Global Vehicle Table identifies these vehicles at a level of granularity which allows, on the one hand, the key attributes to be identified in order to link the spare parts easily to the vehicle and, on the other hand, to map the vehicles to the vehicle tables used today in, for example, the ACES and TecDoc standards.

There is increased demand for more granularity in the vehicle attributes in order to be able to link the right parts to the right vehicle easily which is becoming an increasingly complex task.

3 | Author

David Winter | Executive Vice President | TecAlliance



4 | Resources

[IHS Markit](#) | [TecAlliance](#)

Load Sheets

1 | Definition

Load sheets are distributor specific files that are formatted to obtain specific product information and pricing to be consumed by distributor's ERP (Enterprise Resource Planning) system or portal.

2 | Description

Load sheets are used when PIES (product information exchange standards) has not been adopted or cannot be used due to limitations by ERP systems. These files have data fields and pricing information that is specific to the distributor. Load sheets can have a variety of names for the same data field and differing standards with formatting which can cause issues for automating the process. This is further complicated as manufacturers on average manage 11 separate load sheets with over 100 columns. These issues can often hinder manufacturers data processing times and introduce data integrity problems leading to distributor dissatisfaction. Communication is key between trading partners to make sure complications are avoided. With the help of off the shelf or in-house software, juggling multiple load sheets can be made less demanding to bridge the gap until PIES adoption is achieved.

3 | Author

Jordan Roberts | Technical Product Specialist | [Continental](#)

4 | Resources

Aftermarket Technology Conference Load Sheet Presentation

National Security

1 | Definition

The government defines national security as “the security and defense of a nation state, including its citizens, economy, and institutions, which is regarded as a duty of government.” Traditionally connected with military conflict, national security deserves a more holistic view, with energy and economic security taking center stage in today’s ever-changing landscape.

2 | Description

Energy independence and security are directly impacted by the move to embrace electric vehicles, particularly battery electric vehicles, (BEVs) which depend solely on batteries for energy. These batteries, and associated propulsion systems, use tens to hundreds of pounds of minerals to construct. Without proper planning, if BEV predictions come to fruition, we could swap oil independence for dependence on critical minerals from foreign entities not necessarily friendly to our interests.

The purpose of this document is to promote critical thinking around how supply chains must consider national security as a factor in deciding how new economies of scale are built to support EV infrastructure and to highlight new opportunity creation which will result.

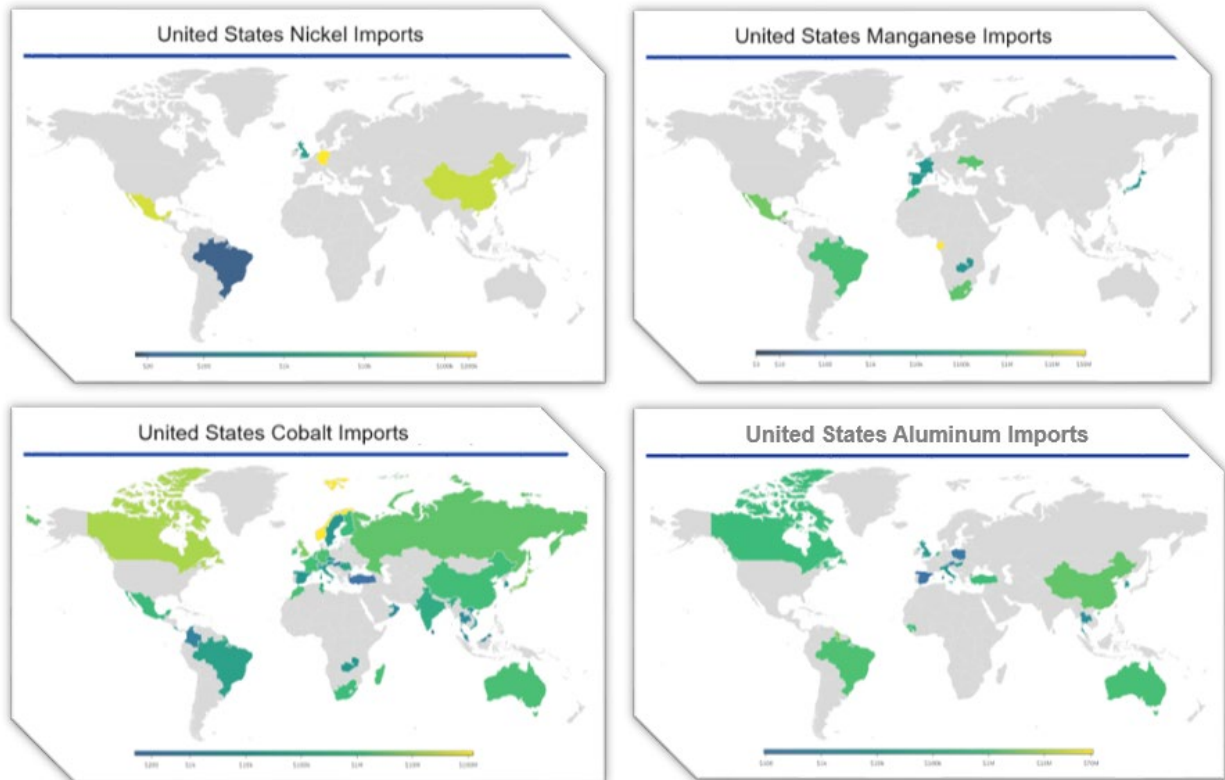
SITUATIONAL ANALYSIS

EV batteries come in various forms, with many more in various stages of R&D as the industry races to increase energy density and subsequent range. Some of the most common types of lithium-ion batteries include:

- LFP – lithium-iron-phosphate
- NCA – nickel-cobalt-aluminum
- NMC – nickel-manganese-cobalt
- NCMA – adds aluminum to increase nickel and slash cobalt (cost reduction)
- LCO – lithium cobalt oxide
- LMO – lithium manganese oxide

Outside of commonly discussed lithium, there are a handful of other important minerals critical to batteries and China controls about three-quarters of the market while Russia provides a

significant amount of nickel in global markets. (npr.org) Joe Manchin, chairman of the U.S. Senate Energy and Natural Resources Committee recently stated “more action is going to be necessary to get supply chains – including mining, processing, manufacturing and more – where they need to be domestically to keep up with the growing demand for these critical minerals instead of increasing our reliance on China.” Manchin also commented, “Recycling provides a tremendous opportunity to avoid outsourcing the raw supply of critical minerals we need while creating new economic opportunities right here at home.” Outside of lithium, the world maps below show the distribution of other key mineral imports as reported by the USGS in their 2022 Mineral Commodity Summary.

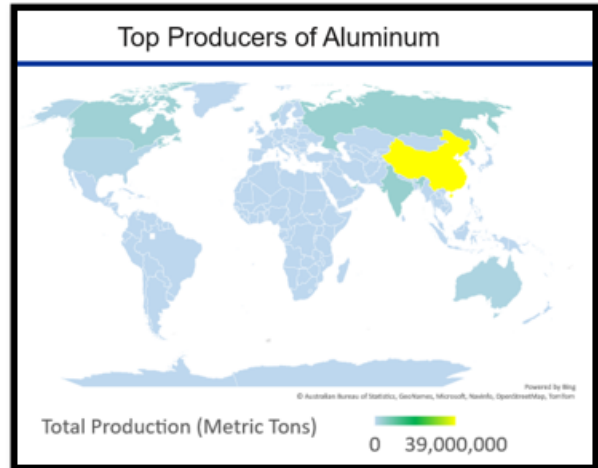
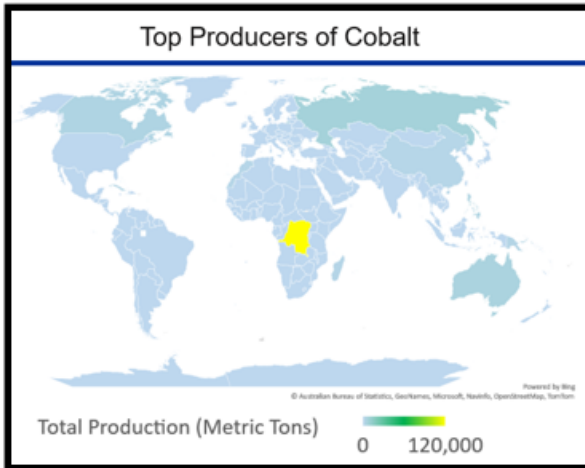
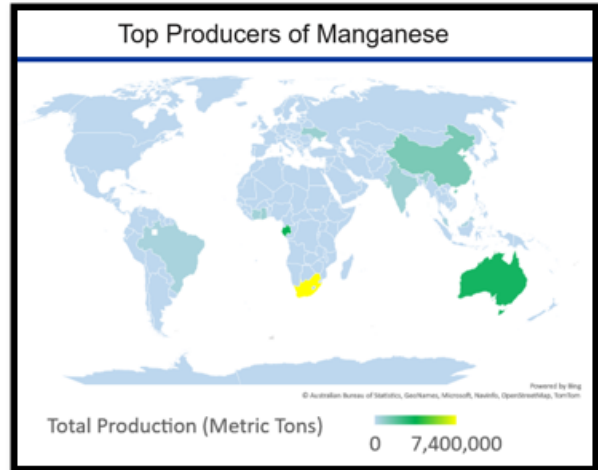
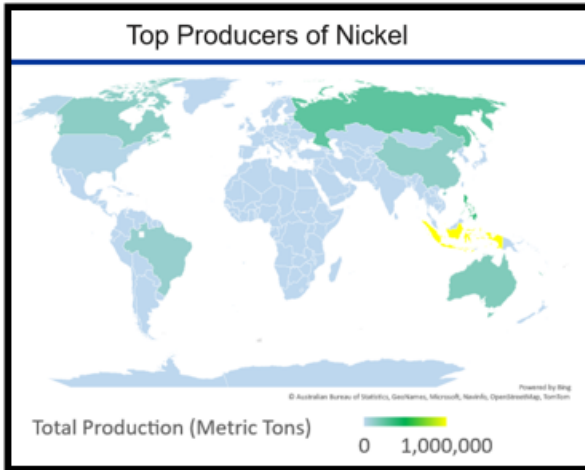


Source: USGS Mineral Commodities Survey 2022

Lithium supplies are also dominated from outside of the U.S., with the top three producers being Australia, Chile, and China. Although not covered here in detail, copper will be a key component in EV systems, partially in the battery, but even more so in the electric motors themselves, putting significant upward demand pressure on supply chains.

The imbalance in material supply needed for BEVs is not lost on government, as demonstrated by the inflation Reduction Act of 2022. Starting in 2024, vehicles won't qualify for a tax credit unless a certain percent of their battery minerals and components come from domestic sources

or the U.S.'s free-trade partners. Even so, by 2027, EVs would need to get 80% of their critical minerals and 70% of their battery components from compliant sources in order to qualify for the tax credit. Automakers and energy experts alike have criticized these timelines as unrealistic, arguing that the targets won't be met and will likely dilute the effectiveness of the credits as a result. (Emerging Tech Brew, article 8/5/2022) The maps below show the top producers of these key minerals, it's clear much work needs to be done to achieve parity domestically in mineral production.



Source: USGS Mineral Commodities Survey 2022

RECOMMENDATION

Recent legislation coupled with the need to fight climate change will create a range of new opportunities as our economy transitions to EVs. Supply chains will adjust as a nationalist mentality influences how mining, manufacturing, and recycling of battery materials develops. New jobs will be created to service each area, vehicle designs will converge on those that

optimize life-cycle value, resulting in new business models. The automotive aftermarket needs to understand, prepare, and take advantage of the opportunity these changes will bring, or risk getting left behind.

3 | Author

BTC Think Tank – Emerging Technologies

4 | Resources

- Jeff Marshall – Pricedex
- Joshua Dumas – Mann+Hummel
- Andrew Ciszczon – Freudenberg-NOK Sealing
- Adam Sworski – Valvoline
- Ram Chandrasekar – PhaseZero Ventures
- Scott Huston – IHS Markit
- Ben Johnson – Mitchell 1
- Scott Tompkins – Epicor

EMERGING TECHNOLOGIES

THE NEW CUSTOMER ECOSYSTEM

1 | Definition

Digital infrastructure is a key emerging technology that impacts every aspect of businesses large and small. When combined with other emerging technologies such as 5G, data science, virtual and augmented reality, electrification, autonomous driving, smart infrastructure, etc., the business models of how automotive companies serve customers will change rapidly.

Defining Customer Experience. The new customer ecosystem has three components:

- **Information Flow:** Data, content, information, brands, and knowledge sharing could impact or enable each of these experiences.
- **Product Flow:** Materials, parts, products, inventory, order fulfillment, warranty, returns management, service products could be shared and fulfilled across the experiences.
- **Money Flow:** How the payments, credits, financing could impact or organized to enable or impact these experiences.

2 | Description

The Emerging Customer/Fulfillment Ecosystem

Advancements in technology are rapidly changing consumer behavior. Consumers are embracing technology as it better their lives. Most consumers spend more time online researching and purchasing goods. Buyers want to evaluate other consumers' reviews of products and services before making decisions. Consumers have access to immediate information which empowers them to make decisions based on their individual preferences. Digital technology also allows marketers to push content at consumers they have identified as potential purchasers of their goods and services.

These changes offer opportunity to those who recognize and position themselves to deliver customer experiences aligned with these new customer expectations. Those who choose not to recognize and embrace the changing consumer expectations may find themselves challenged not only for continued success, but for survival. Change is often unexpected and can happen very quickly. Change in their respective industries sent giants Kodak and Blockbuster back to the drawing boards. And one only needs to study the story of Sears, Roebuck and Co to understand how denial can mean disaster for a company. The speed of change is now hitting the automotive industry, faster than Henry Ford could say "Mass Production."

As these technologies continue to evolve, the opportunity is within reach to create a unified customer experience across the channels and user types in automotive ecosystems. Technology makes this change not only easier and possible, but more critically a necessity to serve all user types with full lifecycle perspective. Let's explore the channels in the context of "unified customer experience."

A manufacturer could choose to use the traditional go-to-market channels like dealers, distributors, retailers, service shops and others to serve their consumers in B2C and B2B markets. Alternatively, a manufacturer could innovate to use direct-to-consumer models with networks of on-demand service providers. Similarly, a unified customer experience powered by cloud computing infrastructure could enable procurement, buyers, services, technicians, and other user types to interact more efficiently inside automotive ecosystems. How would this impact, change or transform the current business models?

A unified customer experience removes silos from the process. Customers can enable inclusion of their preferred service provider(s) into their communications eco-system, allowing the vehicle, owner and service provider access to information which will help them partner in maintaining, diagnosing, and repairing the vehicle as required. Communications can be extended to the providers of parts and other services to augment the customer experience. Information can be made available which can be used to forecast parts needs well in advance of the component failure. And that information can be combined with car parc data so more effective stocking at distribution centers with the parts which will be required – by region and season – so that vehicles in need of service have immediate access to the parts and technicians required to keep them operating as designed. Most car navigation systems can already suggest the nearest gas station or fast-food restaurant. A unified customer experience creates the opportunity to personalize and expand those recommendations when integrated with everything in the connected devices ecosystem, data science, and ease of doing business

The internet of things and automation changed how consumers shop and manage their homes. Faster and continuous innovations, reducing costs of computing, connectivity, storage, and open-source software brings affordable innovation to all segments of automotive customer and consumer ecosystem. This change also attracts multiple non-industry players to explore and disrupt traditional boundaries of automotive ecosystem as we have known for the past 100+ years.

At the core of all this transformation is the evolution of thought leadership with a "unified customer experience" approach to stay relevant to go-to-market channels, including dealer and distributor networks, OEMs and aftermarket customers and consumers, retailers, and service shops.

The time is now to plan and build digital core competencies and pursue unified customer experience business models to respond quickly to market needs and customer preferences. The new integrated customer and consumer ecosystems serve as an overarching mechanism to leverage all other emerging technologies including electrification, assisted and autonomous driving, data science and analytics, machine learning and artificial intelligence algorithms, 5G, etc.

How well a company utilizes these technologies and participates in these ecosystems will determine leaders and winners in the automotive industry sooner than most think. For example, while most automotive companies may not see compelling business case with navigation systems making personalized fast-food recommendations today. The digital pureplay disruptors could leverage the similar connected technologies and easily erode into their businesses. How about connecting “check engine light on” to a list of preferred service providers to fix or update software, etc. Embracing the emerging digital customer experience is not only a core competency for growth, but necessary for survival.

3 | Author

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4 | Resources

List of Charter Members:

- Jeff Marshall – [Pricedex](#)
- Joshua Dumas – [Mann+Hummel](#)
- Andrew Ciszczon – [Freudenberg-NOK Sealing](#)
- Adam Sworski – [Valvoline](#)
- Ram Chandrasekar – [PhaseZero Ventures](#)
- Scott Huston – [IHS Markit](#)
- Ben Johnson – [Mitchell1](#)
- Scott Tompkins – [Epicor](#)

PIES™



1 | Definition

Without ACES® and PIES™, navigating the complex world of automotive aftermarket data is like driving through a maze blindfolded. These industry standards act as a roadmap, ensuring accurate product information and compatibility. Maintained by the Auto Care Association®, these standards are like cheat sheets for wrangling data chaos in the industry. ACES® and PIES™ aims to give the industry a smooth ride through the maze of fitment and product information. Leveraging these standards within your data ecosystem allows you to speak a similar language within the industry to get your products to market faster.

PIES™ stands for Product Information Exchange Standard and is owned by the Auto Care Association. PIES™ is an exchange standard, meaning that it is a standard for defining how we exchange data between the data provider and the receiver of the data.

What PIES™ is:

- A unified format for exchanging data between a provider and a receiver.
- Aimed to increase efficiency in acquiring product data so products can be onboarded faster, enriched, and published to your customers in a timely manner.
- PIES™ data covers 32K+ product types.
- These types are organized into product categories.
- The data includes product attributes, brand IDs, prices, dimensions, weight details, kits, etc.
- It also includes digital assets, marketing content, UPC codes, hazardous material information, and country of origin.
- PIES™ standards include the Product Classification Database (PCdb), Brand Table, and Product Attribute Database (PAdb).

What PIES™ is NOT:

- Governance of the data within the XML file.
- Magic wand for solving all your catalog problems.
- Standardize across all receivers on what elements each receiver requires.

2 | Description

The PIES™ Standard is a comprehensive framework consisting of 15 XML segments designed to facilitate the efficient sale and management of products throughout the product sourcing process. This standard ensures that your product meets customer needs and is distributed effectively. It's important to note that while not all segments are mandatory, their inclusion depends on the specific requirements of the receiving party.

PIES™ Segments

1. The Header (HEAD) segment serves as the introduction to the file, encompassing vital global information such as the brand, language, technical contact details, and versioning dates for the PCdb and PAdb. This segment provides the necessary metadata for accurate processing and understanding of the file's contents.
2. For pricing information, the Price Sheet (PRCS) segment can be utilized if you wish to exchange price sheets via PIES™.
3. The Market Copy (MKTC) segment is used to present branding and marketing descriptions applicable to many items, essentially serving as a repository for brand-wide information.
4. Complementing this is the Digital Assets (MKDA) subsegment, which allows you to attach digital assets broadly to all products within the PIES™ file.
5. The core of the PIES™ file is the Item (ITEM) segment. This looping segment enables you to provide detailed information for each product.
6. Within the ITEM segment, the Description (DESC) subsegment allows for multiple product descriptions tailored to different uses and receiver needs.
7. The Price (PRCE) subsegment enables communication of various pricing details, with the flexibility to include multiple pricing options.
8. Extended product details are covered in the Extended Product Information (EXPI) segment, which includes information such as country of origin, regulatory details, tariff codes, product lifecycle, and warranty information.
9. The Attribute (ATRB) segment is essential for communicating the attributes necessary to sell your product to the end consumer, including industry-specific attributes defined in the PAdb through their association with a specific PCdb.
10. The Package (PACK) segment is crucial for conveying volumetric data about your product, which is important for shipping, warehouse management, inventory management, supply chain efficiency, and shelving planning in physical stores. This segment also includes GTIN/UPC codes and packaging dimensions.
11. If your product contains hazardous materials, the Hazardous Material Package (HAZM) subsegment within the PACK segment provides the necessary details.
12. For companies offering kits, the Kits (KITS) segment communicates the part numbers contained in a kit or a set Bill of Materials (BOM), allowing for repeated elements to identify all components.
13. The Interchange (INTE) segment provides data on alternative part numbers, including competitor and OE interchange part numbers, essential for ensuring compatibility and alternatives.
14. The Digital Assets (ASST) segment is dedicated to managing various types of assets specific to a product, such as images, 360-degree spin sets, videos, and PDFs. This segment includes fields for indicating the physical or online location of these digital assets.
15. Finally, the Trailer (STOP) segment marks the end of the file, summarizing the number of products and the transaction date, ensuring a clear conclusion to the file's data.

3 | Author

Sam Russo | Head of Industry | Pivotree



4 | Resources

[Pivotree](#) | [LinkedIn](#)

Online-to-Offline (O2O)

1 | Definition

Online-to-offline (O2O) commerce is a business strategy designed to bring potential customers from online channels to physical stores to make a purchase. It brings people from the web, Instagram, email, and digital ads to a brick-and-mortar store; with the goal of providing a seamless digital experience before, during and after the purchase.

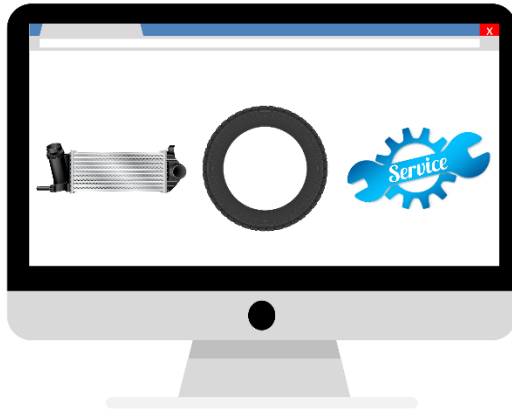
2 | Description

Although the O2O marketing strategy is a relatively new concept, there are some in the automotive industry who have been using this model for quite some time and with great success. Tire Rack is a prime example. TireRack, started selling tires online nearly 20 years ago and today works with a large network of installers across the country.

Parts stores too have had a strong online presence and have used the O2O model to both increase revenue and develop consumer loyalty to their brand. However, in recent years we've seen that evolving. Purchases made this way were generally for the DIY individual or repair shop. However, we now see companies such as Amazon offering O2O services that allow consumers to purchase both the part and service online, then receive the service either at home or at a local service repair chain. Companies such as RepairSmith and Firestone direct provide menu services online and mobile servicing as well.

Currently, these mobile services make up only a small portion of the service industry, about 2% with the exception of windshield repair which is closer to 60%. However, these numbers will increase dramatically over the coming years. We can say this with confidence based on the clear fact that consumer expectations have changed. With Amazon, Door Dash, and local Grocery and specialty stores delivering items often within a few hours, consumers have now become accustomed to shopping online and receiving goods in an extremely timely and convenient manner. These ideals and expectations are permeating pretty much all areas of trade including the Automotive Service industry.

The pandemic in many ways has given impetus to O2O becoming not just a viable option for sellers both static and mobile, but an actual necessity for the company to survive and thrive in the years to come.



The vast majority (87%) of shoppers begin product searches on digital channels

Many consumers, for example, select a shop via an internet search—and if they do find it using another method, it's still likely that they'll research the shop online anyway, hoping (or even expecting) to find a few things:

Customer reviews. This is key, as consumers rightfully want to choose a shop with proven reliability.

Online scheduling. Your customers are likely busy folks, with many commitments and limited time. They want to know exactly when you can service their vehicles. With an online scheduling tool on your website, you offer customers the convenience they desire.

Information on pricing and services. With countless search engines and applications available at our fingertips, you can expect your customers to be at least somewhat educated on the services they think they need. They value transparency and want to possess at least some information on what they can expect when they walk through your doors.

By understanding consumer values, you can adjust your shop to meet these expectations and remain competitive.

It is important to realize that O2O is not just a strategy to benefit Parts Stores and repair shops. It can be utilized to benefit other areas of the parts and repair chain.

Manufacturers are a case in point. While it is true manufacturers typically do not sell directly to consumers, they can still increase revenue using O2O strategies. Dorman Products is a prime example of this model. Using an intuitive search engine to research a needed part, the customer is directed to the nearest parts stores or retailers that have that item in stock. This benefits the manufacturer, the parts stores, retailers, and the consumer.

AI has been proactively transforming aftermarket services as well. As AI technology continues to advance, the O2O connection will seamlessly bridge the interaction between consumer and repair shop. While there are many hurdles

that must be crossed to reach this level of benefit it should be a matter of great focus.

The impact of the Gen Z and Millennials generations should not be overlooked. They have come of age in the digital era and are accustomed to speed and convenience as part of their daily life. They trust the process and will expect more from it in the coming decades. By the year 2025 Millennials will make up 75 percent of the U.S. workforce. Currently, **85.9% of Millennials make purchases online**. They depend on ratings and reviews to make informed purchase decisions, regardless of channel. 99.9% read reviews when shopping online and 63% do so when shopping in-store. This is a major reason why it is imperative that all aspects of the automotive aftermarket move to this model to keep up with the rapidly changing landscape we find ourselves in.

The distinct and very encouraging advantage O2O provides is that every niche of the Automotive aftermarket can benefit from it. Whether you are a large box store or a mom-and-pop shop; with the use of online resources both can benefit by enlarging their customer base, brand recognition and the ultimate goal of boosting sales.

3 | Author

BTC Think Tank – Emerging Technologies

4 | Resources

- MOTOR magazine June 2019
- Aftermarket Matters August 16, 2022
- RetailDive August 15, 2018
- Franchise Update magazine Issue 3 2019
- Accurate.com May 25, 2021
- Lasership.com
- eMarketer February 26, 2020
- PowerReviews.com
- Shopify.com June 28, 2021

PIM



1 | Definition

Product Information Management is a practice by which all information required to market and sell products to all sales channels is governed, managed and systemized. PIM is the acronym by which the technology systems developed to manage all these elements is commonly known.

2 | Description

PIM systems for the automotive and commercial vehicle aftermarkets are highly specialized software applications that enable companies to manage and maintain four key areas of functionality in which specific processes are tightly intertwined.

Product Management enables the creation and maintenance of all customer-facing information related to the product, including interchanges, supersessions, product attributes, images and other digital marketing content. Catalog Management pertains to the creation and maintenance of vehicle application records. Pricing Management enables the determination, optimization and segmentation of pricing related to the market and/or specific supply contracts. Partner Management enables the creation of customer-specific files representing the products a customer buys, along with content that applies to that customer, such as customer-specific pricing, customer-specific part numbering, and other customer-specific data elements and file formats.

PIM systems for the aftermarket rely on a number of external reference tables for decision support and providing visibility to enriched information across the enterprise. The VMRS Code Table, Product Attribute database (PAdb), Vehicle Library (VCdb), the Car Parc (vehicles in operation) and the Product Classification database (PCdb) are examples.

PIM System outputs include traditional publishing of parts and application catalogs, and, in addition, outputs for aftermarket standards, such as Auto Care Association's ACES and PIES standards, Edgenet and outputs for other e-Catalogs, OptiCat and 1-World Sync data pools for traditional distribution and big-box retailers, and TecDoc in other international markets.

3 | Author



Jeff Marshall | Director of Business Development | [Pricedex Software](#)

4 | Resources

[Pricedex Software](#) | [Stibo Systems](#) | [Teradata](#) | Vertical SKUs

POS Data

1 | Definition

Down-channel Point-of-Sale (POS) transaction data -- inclusive of Inventory -- which provides any manufacturer visibility to SKU-level part performance at the point of consumption.

Combining POS data with aggregate market intelligence and analytics helps guide channel programs, improve service levels to customers, and grow brand sales.

2 | Description

Aftermarket parts suppliers have a longstanding tradition of providing collaborative services to their channel partners. During the 1980s and '90s, manufacturer representatives walked in the back door to help stock the shelves of tens of thousands of jobbers in an effort to support their mission to offer the right part, in the right place, at right time. Their "vision" of real-world market dynamics were limited, however, to their own shipment data, and any local sales and inventory "reports" that were handed to them during each sales call.

Today's suppliers must have ready access – even on a daily basis – to 80% of their down-channel POS data in order to ensure strong brand and product performance at the point of consumption. Leading suppliers are provisioning cloud-based repositories to centralize and provide seamless visibility to their down-channel POS data. Sales reps can then access daily alerts to brand and part performance for their assigned customers via their mobile devices.

The critical next step in this evolution is to combine aggregate market data and advanced analytics that drive fact-based decision making and stronger, more effective marketing and sales strategies. Aggregate POS data from varied market intelligence sources can then be combined to paint a picture of the **full** market potential for any brand. Advanced analytics can centrally automate services across the entire channel for customer loyalty programs, assortment/inventory optimization, and even category management projects.

3 | Author

Rod Bayless | Sr Director, Industry Data Analytics | Epicor Software



4 | Resources

[Epicor](#) | [Insights 2 Action](#) | [NPD](#)

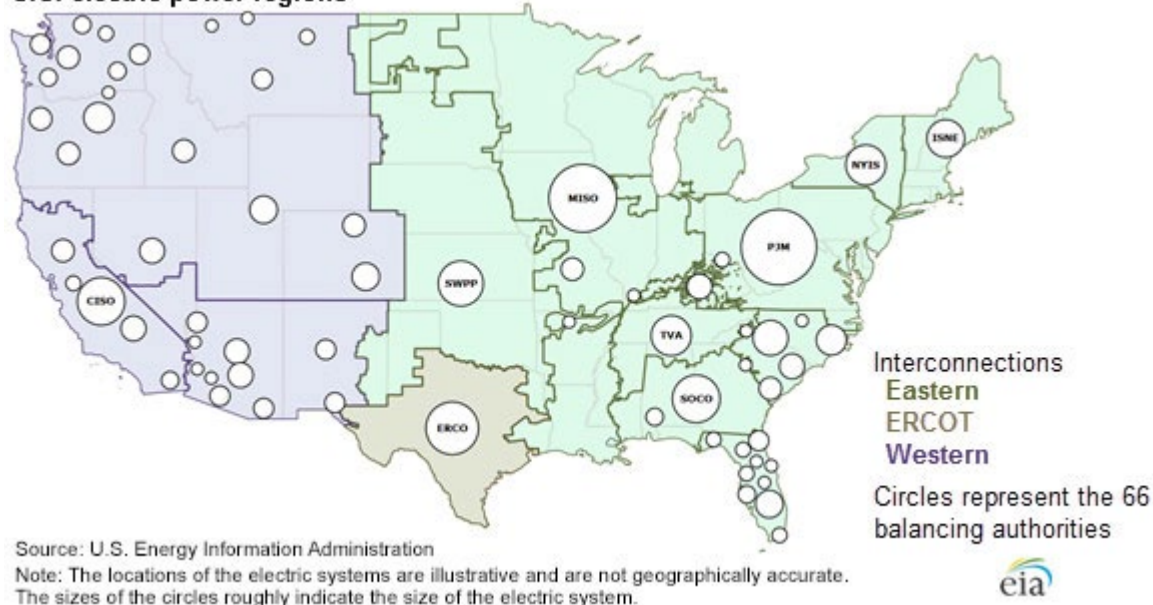
The Truth about “The Grid”

1 | Definition

Ever wonder why the Texas power grid (Electric Reliability Council of Texas aka ERCOT) failure only affected Texas?

Despite the name interconnections, the 3 main interconnections shown in the EIA graphic below operate independently. This is also why the Northeast Blackout of 2003 only affected southern parts of Canada and 8 states from the Northeast. The interconnections apply to the connection of local grids or electric utilities within each of the 3 main interconnections.

U.S. electric power regions

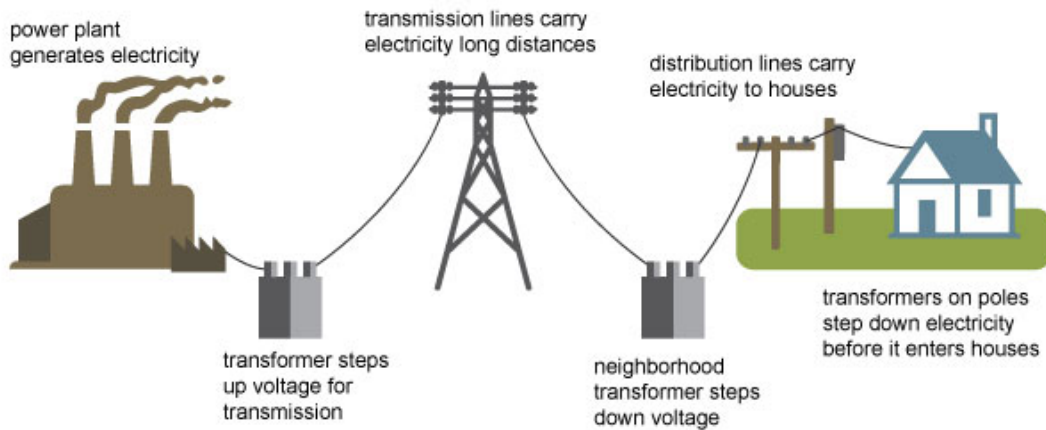


The grid can be thought of as the larger system combination of 3 functions: generation, transmission, and distribution.

“The power system consists of more than 7,300 power plants, nearly 160,000 miles of high-voltage power lines, and millions of low-voltage power lines and distribution transformers.”

The actual operation of the electric system is managed by entities called balancing authorities. Most, but not all, balancing authorities are electric utilities that have taken on the balancing responsibilities for a specific portion of the power system.”

Electricity generation, transmission, and distribution



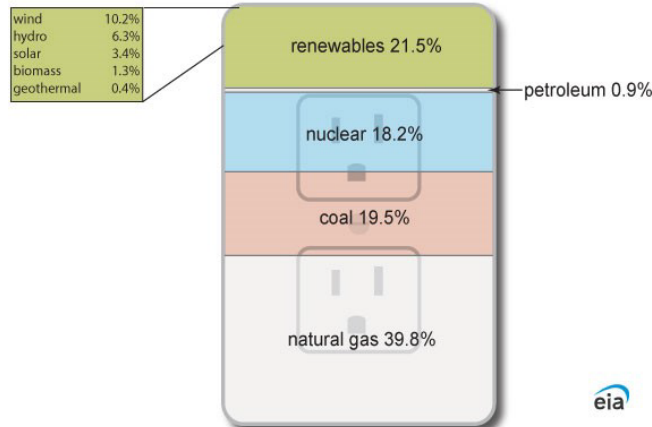
Source: Adapted from National Energy Education Development Project (public domain)

2 | Description

In 2022, total U.S. utility-scale electricity generation was about 4.24 trillion kilowatt-hours (kWh). Fossil fuels generate about 60% of that figure as shown in the graphic below.

Sources of U.S. electricity generation, 2022

Total = 4.24 trillion kilowatthours



Data source: U.S. Energy Information Administration, *Electric Power Monthly*, February 2023, preliminary data
 Note: Includes generation from power plants with at least 1,000 kilowatts of electric generation capacity (utility-scale). Hydro is conventional hydroelectric. Petroleum includes petroleum liquids, petroleum coke, other gases, hydroelectric pumped storage, and other sources.

At the end of 2022, the United States had 1,160,169 MW—or about 1.16 billion kW—of total utility-scale electricity-generation capacity.

For the sake of simplicity, consumption can be equated to retail electricity sales, which was about 3,909 billion kWh—or about 3.9 trillion kWh—in 2022, an increase of about 103 billion kWh from 2021. Retail sales include net imports (imports minus exports) of electricity from Canada and Mexico.

As you look into the future, EVs and climate change will be adding consumption to the grid every year. Like other parts of the U.S. infrastructure, the grid is in need of some serious TLC. Based on 2019 figures the US would need to generate 20-50% more electricity just to meet the increased demand from EVs. A similar study from the US Department of Energy estimates it to be around 38%.

The impact of climate change is much harder to quantify as there is a lot to unpack. Rising air temperatures will increase the demand for cooling and thus electricity. Reductions in electricity usage from warmer winters are marginal. Rising water temperatures and sea levels threaten power plants capacity due to flood exposure and significant efficiency reductions. Regardless of the source, all power plants rely on water for cooling and operations. Combine this with extreme events such as droughts and the chances for blackouts can only increase.

Much of the existing grid was initially developed in the early to mid-1900s. In 2022, nearly \$20 billion was announced in government financing opportunities as part of the Building a Better Grid Initiative.

However, cost, materials, and labor aside, perhaps the largest challenges are administrative, legal and political. Permitting can take months to years with even longer lead times for the legal and political battles arising from investments that affect multiple states.

There are emerging technologies such as vehicle-to-grid (V2G) that can potentially help the grid handle peak demand. V2G is where vehicles plug in during inactivity to provide electricity back to the grid. The current charging infrastructure is unidirectional and V2G would require bi-directional charging. VGI (Vehicle Grid Integration) and V2X (Vehicle to Anything) take this concept further through the integration and optimization of vehicle and grid interactions including the home.

Significant challenges stand in the way. Many of which overlap to the challenges facing the grid. In what may be an eye-opening twist for many, the biggest challenge is not the technology itself and its evolution, it is the administration and management of that technology through regulations, standards, and legal agreements.

3 | Author

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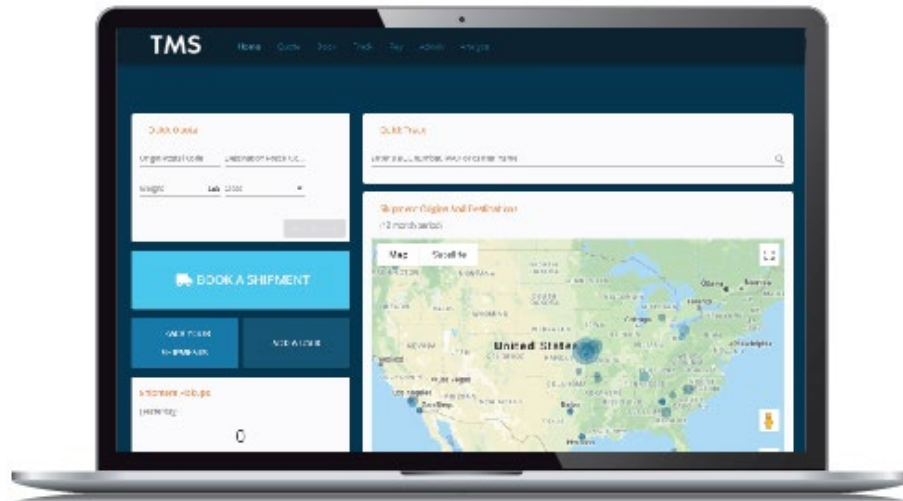
4 | Resources

[U.S. Energy Information Administration - EIA - Independent Statistics and Analysis](#)
[Delivery to consumers - U.S. Energy Information Administration \(EIA\)](#)
[The 2003 Northeast Blackout--Five Years Later - Scientific American](#)
[How Texas' power grid failed in 2021 and who's responsible for fixing it | The Texas Tribune](#)
[Grid Modernization Initiative | Department of Energy](#)
[How much electricity would it take to power all cars if they were electric? \(usafacts.org\)](#)
[Energy Supply, Use and Demand | Fourth National Climate Assessment \(globalchange.gov\)](#)
Freudenberg-NOK, Corteco Division

TRANSPORTATION MANAGEMENT SYSTEM (TMS)

1 | Definition

A transportation management system (TMS) is a logistics platform that uses technology to streamline the shipping process. From quoting a shipment through delivery, a TMS platform optimizes the physical movement of goods (inbound and outbound) and offers technology components for on-demand shipment creation, BOL creation, carrier scheduling, tracking, reporting, contract management, document storage, freight bill audit and payment, business intelligence, and compliance.



2 | Description

Transportation management systems consist of load optimization, carrier selection, route planning and optimization, delivery confirmation, freight audit, bill payment, and other administrative components that cover four main areas of transportation management:

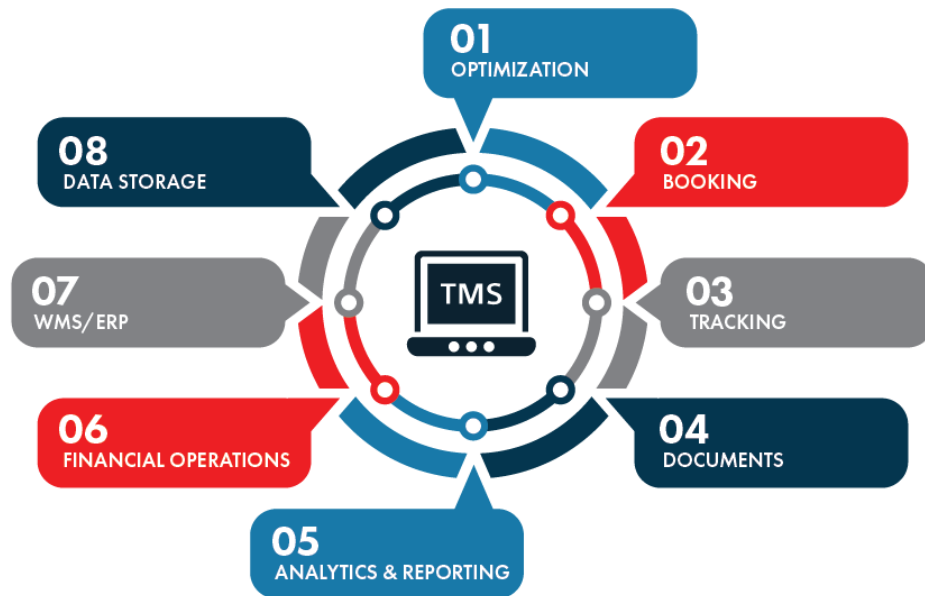
- **Planning:** It gives shippers visibility to their data across all company locations, vendors, and shipping modes and allows for route planning, carrier optimization, and document management.
- **Shipment Execution:** It enables the execution of the transportation plan, including carrier-rate approval, carrier sending, electronic data interchange (EDS), etc.
- **Follow Up:** It allows for follow up at each milestone of the transportation process, tracking, document editing, customs clearance, invoicing, alerts, etc.

- **Measurement:** It includes business intelligence capabilities to measure KPIs, uncover trends, and identify opportunities across the supply chain.

While transportation management systems vary in functionality and complexity, any modern TMS platform should be cloud-based, with responsive design, and built to ensure stability, security, scalability, and resilience.

And because each business is unique, another important component of any high-quality TMS platform is cross-platform integration.

As demonstrated below, there are multiple points along the life cycle of a shipment, where data is needed, and that data often comes from different sources (carriers, warehouse management systems, financial services, vendor websites, documents, etc.) A TMS should be able to be customized to pull data from and integrate with other technology platforms in each of the following areas, in order to execute each shipment:



3 | Author

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[LogisticsManagement.com](https://www.LogisticsManagement.com) | [Techopedia](https://www.Techopedia.com) | [eShipping® Proprietary TMS data](#)