# The Future of the Automotive Supply Chain

## Part 2 of 3: Supply Chain Professionals in the Americas and Europe Share Their Insights and Expectations

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Automotive Industry Action Group

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## Supply Chain 2025: The Americas/Europe

*Indeed, within the general sociocultural framework that supply chain professionals must work in, the only real certainty is that there will be a never-ending supply of uncertainty.*

Over the next five to ten years, the automotive industry worldwide will experience and, in some cases, initiate a great deal of transformational change — that much is certain. What no one knows, not even the largest automakers themselves, is what the precise nature and speed of that transformation is going to be, what the eventual outcome will be, or how it will impact the global automotive supply chain.

For example:

- Will electric vehicles (EVs) gain the market traction everyone expects but has yet to see?
- Will consumers respond predictably — or unpredictably — to shifting governmental regulations and incentives?
- Will climate concerns eventually decide the fate of the internal combustion engine or not?
- How soon will autonomous vehicles exert pressure on the market?
- Will private car ownership decline as generational attitudes toward transportation change?
- Will automakers eventually have to reinvent themselves as "mobility solution providers"?
- What impact will continuing international trade tensions have on the global economy?

All of these questions and more hang over the automotive industry as we move into the dawn of the 2020s. For better or worse, the automobile itself has become a bellwether for everything from climate change and income inequality to the many ways people may or may not choose to live in this new era of smarter technologies, accelerating technical capabilities, and expanding transportation options.

For their part, automotive supply chain executives are caught in the middle — between manufacturers, suppliers, and increasingly expectant consumers — responsible for the unenviable charge of maintaining a sense of order and stability in a global geopolitical environment that promises neither. Indeed, within the general sociocultural framework that supply chain professionals must work in, the only real certainty is that there will be a never-ending supply of uncertainty.

## The Americas/Europe: Top Trends 2025

For this report, AIAG and Thomson Reuters surveyed almost 100 upper-level supply chain executives in the Americas and Europe to help shed some light on the road ahead in these regions. And though broad sociocultural considerations continue to loom large, our task has been to identify and evaluate the real-world challenges and concerns of automotive supply chain professionals who must navigate the industry's day-to-day obstacles over the next five to seven years and beyond.

Though the "Americas" consists of two separate regions — the US/Mexico/Canada bloc and South America — and Europe is a separate geographic and political entity altogether, their markets and supply chains are inextricably linked in more ways than not. Many European automobiles are actually manufactured in the US and Mexico. Some American automobiles are manufactured in Mexico and Canada. And while South America has many of its own manufacturers, Ford, General Motors, Volkswagen, Mercedes-Benz, Fiat, and Renault all have presences there, primarily in Brazil.

**International Trade Tensions**

Given the interdependence of their supply chains and the current volatility of global politics, it is perhaps not surprising that the trend survey respondents say will have the most impact on the supply chain in the Americas and Europe is international trade policy and regulatory changes.

At the center of this issue is the US's ongoing trade war with China, which is the second-largest supplier of car parts to the US after Mexico, and — according to the US-based Center for Automotive Research (CAR) — accounted for 12% of all US parts imports in 2017. For automakers, the ripple effect of fluctuating tariffs directly affects consumer prices, sales, employment, and manufacturing logistics, including the supply chain. Faced with uncertainties over price and availability of parts from China, manufacturers have no choice but to develop plans for alternative

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sourcing, even if they don't use them. But source switching comes with its own inherent difficulties. Replicating established supply chain networks in new countries takes time, resources, expertise, discipline, and cooperation — and if the switch is made, it can be difficult, if not impossible, to go back.

Automakers the world over are also bracing for the consequences of Brexit, particularly European parts suppliers and automakers with manufacturing facilities in the UK, whose supply chains will be severely — and in some cases permanently — disrupted if the UK proceeds without sufficient caution or planning.

But that's not all. In addition to ongoing uncertainties over trade relations with China and the UK, automakers may soon be contending with a variety of new trade restrictions proposed in the recently renegotiated US-Canada-Mexico Agreement (USCMA) — NAFTA's replacement — which is intended to encourage more parts manufacturing in the US, but includes a number of revised labor value and regional content rules that have yet to be fully understood.

For example, according to the US Census Bureau's USA Trade Online, 37% of all US auto parts imports were from Mexico in 2017 (Mexico is the fifth-largest auto-parts producer in the world), and 11% were from Canada. Under NAFTA, 62.5% of the parts on vehicles manufactured in the US (Regional Value Content, or RVC) had to be sourced from North America. The USCMA bumps the RVC ceiling up to 75% of a vehicle's net cost, but also splits the RVC requirements into three categories, each with its own calculation: 75% for "Core Parts"; 70% for "Principal Parts"; and 65% for "Complementary Parts." The USMCA also requires that 70% of a US-manufactured vehicle's steel and aluminum be sourced from North America.

Like we said, it's complicated. In fact, there are so many changing variables and potential policy scenarios related to the US supply chain that it's almost impossible to predict how it will all play out. CAR itself tried, using both public and private data to develop ten different trade policy scenarios and found only one common denominator: in every scenario, average vehicle prices rose and sales fell.

**The Next Generation of Supply Chain Management**

The next two trends that respondents say are most likely to affect supply chains in the coming years are intimately connected: Job Skills and Knowledge Transfer, and Data Management and Predictive Analytics.

In an environment of perpetual uncertainty, supply chain executives and leadership teams are under increasing pressure to future-proof their systems by using more sophisticated data analysis techniques to anticipate possible supply disruptions and model different planning scenarios. These systems require highly trained, technically adept analysts to gather and interpret the data, and those tend to be younger people with less overall practical supply chain experience. Hiring

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and training new generations of supply chain technicians without sacrificing the institutional knowledge and crucial business relationships developed by older, more experienced professionals is an ongoing challenge, respondents say — but a necessary one.

Said one Tier 1 respondent: "There's a need for a talent shift in the supply chain, away from the old-school approach of 'send some RFQs, get your best price, beat them up a little bit, move on,' to a much more focused cost understanding up front — more analytical, tied closer to engineering, so it's more involving purchasing and supply chain at the design phase."

This shift from negotiating the cost of individual parts to considering the holistic impact of pricing on the entire supply chain requires not only a different mindset but also the technical know-how to process and analyze data from all parts of the supply chain to assess how it impacts the organization overall. As another respondent noted, "You've got to think about what value it's going to drive for the entire company because you might pay a lot for this crazy software, but it may sell a lot of cars."

Supply chain executives know they need to modernize the technologies they use to source and track parts and to analyze increasingly complex, interrelated supply chain systems, but that can only be done if knowledgeable personnel are available to develop and manage these new, more powerful technologies. Like it or not, supply chain management is becoming much more data-driven, and as more data becomes available, more pressure is being put on the supply chain by upper-level management to make the best possible use of all that information. That includes providing leadership with real-time assessments of the impact world events might have on the supply chain, as well as scouting reports to identify and prevent possible sourcing disruptions down the road.

Unfortunately, while automation may help with a shortage of capable warehousing personnel, the industry needs to focus some serious attention on recruiting, developing, and retaining the right staff to manage the more technologically integrated, data-oriented supply chain of the future.

*Europe's rapidly evolving charging infrastructure, along with an EV-friendly regulatory framework and broader cultural acceptance for EVs in general, is creating a welcoming environment for electrification in the EU.*

**The Electrification Conundrum**

The general consensus among industry executives and analysts is that electric vehicles (EVs) will eventually displace internal combustion engines (ICEs) and that this is a necessary transition given the automobile's role in the environmental debate over greenhouse gas emissions. But the consensus ends there because demand for EVs varies significantly from region to region, and certain market prerequisites — such as charging infrastructure, price competitiveness, performance, and more vehicle options — have yet to reach critical mass.

Consequently, the transition to EVs is forcing manufacturers to walk a delicate line as they invest heavily in new electronic technologies and components while simultaneously meeting continued market demand for ICE vehicles. This is particularly true in the US, where conventional SUVs, CUVs, and light-truck sales far exceed sales of passenger cars and EVs.

Meanwhile, Europe is much further along the path to EV adoption than the US — though even in Europe, EVs only represent about 2% of the overall market. Still, Europe's rapidly evolving charging infrastructure, along with an EV-friendly regulatory framework and broader cultural acceptance for EVs in general, is creating a welcoming environment for electrification in the EU. At the other end of the spectrum, survey respondents indicated that EV adoption in South America will significantly lag that of other markets for the foreseeable future.

For the supply chain, this continued bifurcation of the market means operating on two parallel tracks — one for ICEs and one for EVs — and planning for a dizzying array of contingencies on both fronts. In the US, for instance, a sudden and prolonged spike in gas prices could motivate consumers to switch to an EV sooner than they might have otherwise, which would mean rapidly ramping up production. On the other hand, continued low and stable gas prices in the US could have the opposite effect, significantly slowing the expected adoption rate of EVs.

Regardless, the inevitable march toward EVs prompted a majority of survey respondents to agree that the effective and efficient sourcing of battery components and other related materials would continue to be a significant challenge as demand for EVs increases. In addition, supply chains for EV batteries and electronics are not as well-established, so competition for reliable channels is likely to be intense, respondents say, with most manufacturers taking a multi-source, purposely diversified approach to help mitigate risk.

**Driverless Vehicles: Not So Fast**

*Industry-wide, some of the biggest proponents of AV technology — significantly Google and Uber — are scaling back expectations for widespread adoption of AV technology even while manufacturers continue to invest billions in AV R&D.*

As if all of the above factors aren't enough to keep automotive executives up at night, the looming introduction of autonomous vehicles (AVs) onto the world's roadways is another trend that has everyone's attention. This survey only asked respondents to assess the impact of autonomous vehicles on the supply chain up to 2025, however, placing AVs near the bottom of respondents' concerns — for the time being at least.

Industry-wide, some of the biggest proponents of AV technology — significantly Google and Uber — are scaling back expectations for widespread adoption of AV technology even while manufacturers continue to invest billions in AV R&D. Indeed, most manufacturers say they will have AV-ready vehicles prepared for highway driving sometime in the early 2020s (some, like Tesla, sell them now), whereas the infrastructure necessary for reliable urban AV driving isn't expected until closer to 2030.

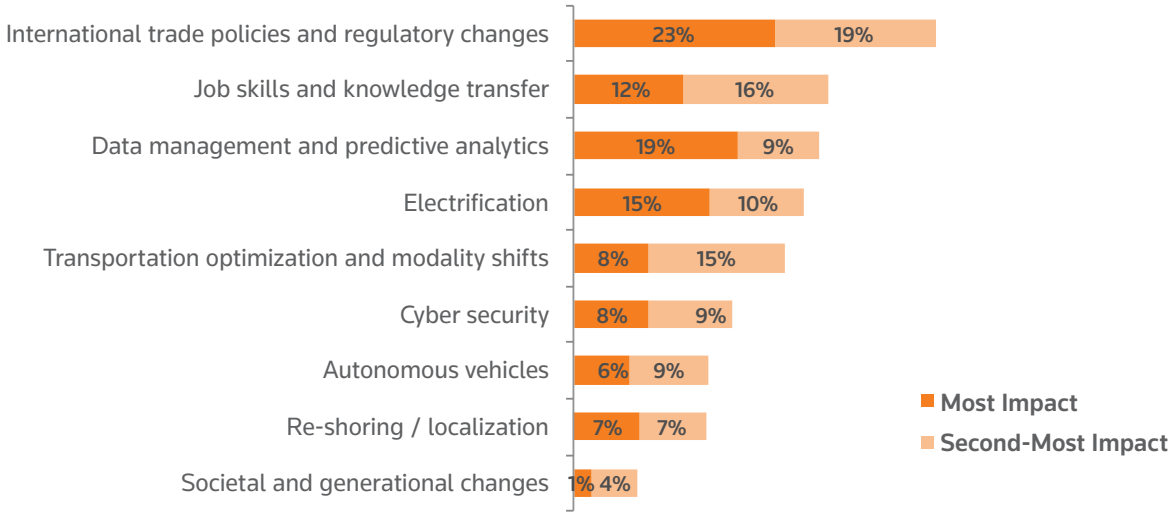
Despite the hype and occasional hysteria over these and other developments, responses from those we surveyed suggest that the impact of AVs on supply chains isn't expected to become a major factor until sometime after 2025. The extended timeline for AVs and EVs may also explain why respondents did not rank "societal and generational changes" as being very influential to the supply chain over the next five to seven years. How people view and subsequently use automobiles may change, our research suggests, but vehicles will still need to be built and sold, so the attitudes of younger consumers aren't likely to impact the supply chain much until and unless EVs and AVs become significantly more mainstream.

If and when AVs reach market critical mass, however, most — if not all — will be EVs as well, and this will introduce into the supply chain an entirely new array of parts, electronic components, software, and infotainment options, as well as new types of automotive suppliers who may be unfamiliar with the demands and necessities of working with major automotive manufacturers.

As vehicles themselves become ever-more connected and intertwined with people's personal devices and data, the specter of cybersecurity is also an area of rising concern. Many respondents cited the potential vulnerability of increasingly interconnected systems to malevolent hackers and identity thieves, though the industry has yet to work out precisely who is responsible for what when it comes to preventing cyber intrusions on the roadways and in the supply chain.

**The following is an in-depth analysis of these and other trends that supply chain executives in the Americas and Europe say are going to be occupying their time and energy in the next five to seven years.**

***International trade policies and regulatory changes, as well as job skills and knowledge transfer, are the trends expected to have the greatest impact on the supply chain.***




*What's changed is that executives and managers now view supply chain data as a source of strategic insight and as a means to scenario-plan for such eventualities as changing tariffs or disrupted supply lines.*

## International Trade Policies and Regulatory Changes

The ripple effect of trade tensions between the US and many other countries, China in particular — as well as concerns over Brexit — have created a climate of worrisome instability for supply chain professionals in the Americas and Europe. Virtually everyone in the automotive industry is also bracing for the potential — and as yet unknown — impacts of the renegotiated NAFTA replacement known as the US-Mexico-Canada Agreement (USMCA). NAFTA rules still apply until the new agreement is ratified into law, but make no mistake: the automotive industry will be disproportionately impacted by the USMCA compared to other US industries.

In general, the agreement shifts incentives to induce manufacturers in North America to use more North American-made auto parts, but it also includes several labor-related stipulations, such as a requirement that automakers produce at least 40% of their vehicles in plants that pay workers at least $16 per hour. The USMCA also complicates supply chain tracking and reporting by introducing an entirely new formula for taxation of auto parts based on a new three-tiered classification scheme for individual parts.

Again, how all this will play out remains a mystery. But to maintain consistent sourcing strategies and reliable operations amid constantly changing polices and regulations, 82% of respondents agreed (and 21% strongly agreed) that companies would need to invest more heavily in knowledgeable compliance staff and provide them with the resources, technology, and training necessary to meet the demands of this highly unstable trade environment.

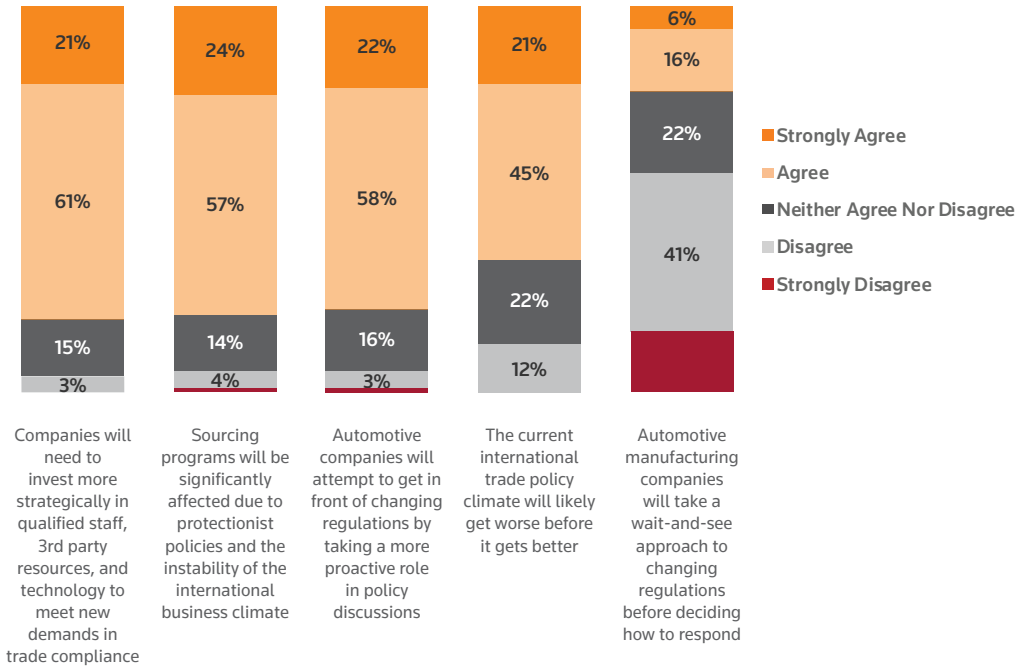
In practice, this means upgrading current systems to help manage, analyze, and leverage the growing trove of data generated by current supply chain operations. And given that a majority of respondents (66%) agreed that the international trade climate is likely to get worse before it gets better, the demand for real-time feedback and insightful data analysis will only increase. What's changed is that executives and managers now view supply chain data as a source of strategic insight and as a means to scenario-plan for such eventualities as changing tariffs or disrupted supply lines. And increasingly, supply chain managers are being called upon to run cost-benefit analyses, explain what the data means, and recommend options for cutting costs, improving efficiency, and neutralizing threats.

*One near certainty is that automotive companies cannot afford to take a "wait and see" attitude before deciding how to respond to changing regulations.*

Consistent sourcing is the main issue, of course, and 81% of those surveyed agreed (24% strongly) that protectionist policies and general trade instability would continue to have significant impact on international sourcing programs over the next five to seven years. To mitigate the risk of supply disruption, 78% of respondents agreed that multi-region sourcing would increase, and that reliance on single and solo-regional sourcing would diminish. Furthermore, 80% of respondents agreed that in addition to these measures, automotive companies will try to influence policymakers on the front end by advocating for favorable trade policies.

One near certainty is that automotive companies cannot afford to take a "wait and see" attitude before deciding how to respond to changing regulations, respondents said. Only 24% of respondents agreed that reactive caution was a winning strategy, while the majority (56%) agreed that proactive planning and strategic preparation were the preferred approach.

***Roughly 25% strongly agreed that international sourcing programs will be affected due to protectionist policies.***




## Job Skills and Knowledge Transfer

A tectonic shift in the skillset required for future supply chain personnel is taking place across the industry, due primarily to the incorporation of more sophisticated forms of technology into the overall process. Unfortunately, this need for a new breed of supply chain specialists is also happening at a time when recruitment is difficult and finding technically qualified young people who are willing to work in a factory environment is particularly challenging.

Though technology plays a significant role in this trend, respondents to our survey also noted that insufficient outreach efforts on the manufacturing side were at least partly to blame and that automakers could be doing a great deal more to recruit, train, develop, and retain qualified workers. To ensure an adequate future labor supply, 73% of those surveyed thought companies would need to take matters into their own hands by creating new technical training programs and teaming with educational institutions to help prepare the next generation of workers.

An aging workforce is also causing concern for those in purchasing/sourcing roles. Indeed, as older, more experienced personnel retire and the need for younger, more tech-savvy hires continues to rise, the role of purchasing/sourcing personnel in the overall enterprise is also changing. A total of 83% of respondents agreed that purchasing/sourcing personnel will need to develop new skills — primarily in data analytics, forecasting, compliance, strategic cost containment, and even marketing — to meet the evolving needs of their organizations.

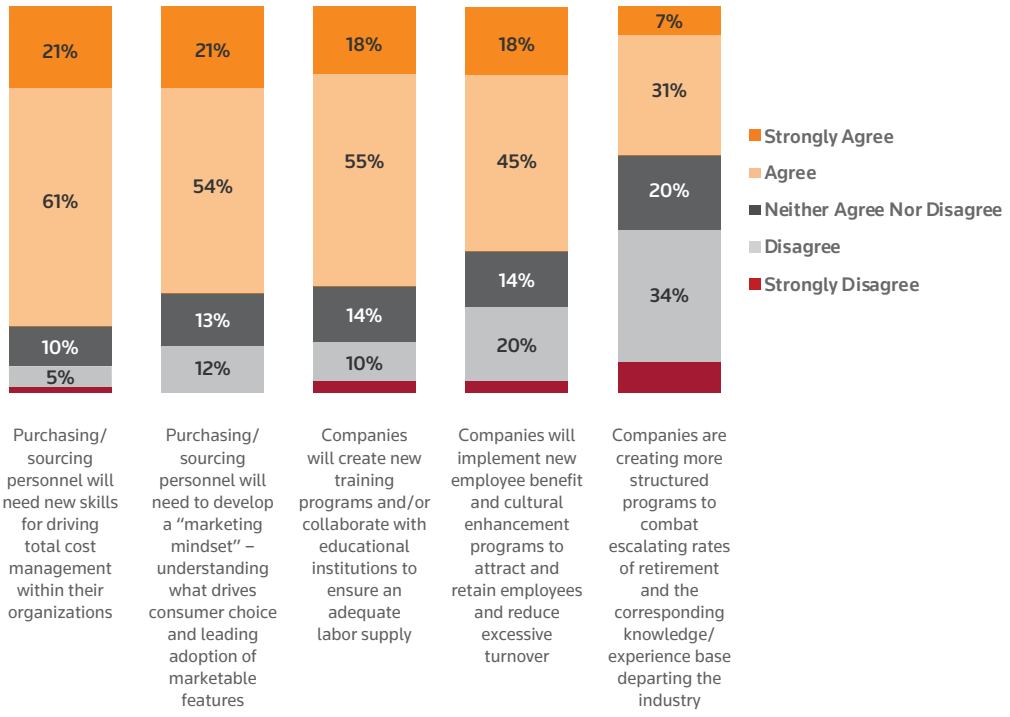
*Not enough young people are aware of the new opportunities that evolving technological development is bringing to the automotive industry.*

Feelings were mixed, however, when asked if companies were doing enough to ensure a smooth transfer of knowledge and leadership as older workers retire. Thirty-eight percent said yes, companies were taking a more structured approach to succession planning, but 42% thought they weren't, with 8% strongly disagreeing that management was doing enough to retain institutional knowledge and maintain leadership continuity.

Automakers are not the only industry affected by the human-capital problem in manufacturing, but they and their suppliers rely on a wide range of highly skilled workers all along the supply chain to maintain the consistency and quality of the vehicles they produce. And to be fair, some manufacturers are in fact taking matters into their own hands. For example, BMW has introduced German-style apprenticeship programs at its South Carolina plant, and Ford, GM, and Toyota all work with the Automotive Manufacturing Technical Education Collaborative (AMTEC) to arrange program partnerships with community colleges near their US plants.

No matter what they do on their own, however, the truth is that automakers also need governments, educational institutions, policymakers, business leaders, the media, and other stakeholders to support the very idea of a viable, long-term career in manufacturing, since many younger workers fear that automation may soon eliminate such jobs. Not enough young people are aware of the new opportunities that evolving technological development is bringing to the automotive industry, and not enough of them believe that dedicating themselves to a career in automotive manufacturing is a wise choice. This perception needs to change; otherwise, manufacturers will continue to struggle with shortages of qualified personnel.

***More than 75% agreed that purchasing/sourcing personnel will need to develop new skills and a "marketing mindset."***




## Data Management and Predictive Analytics

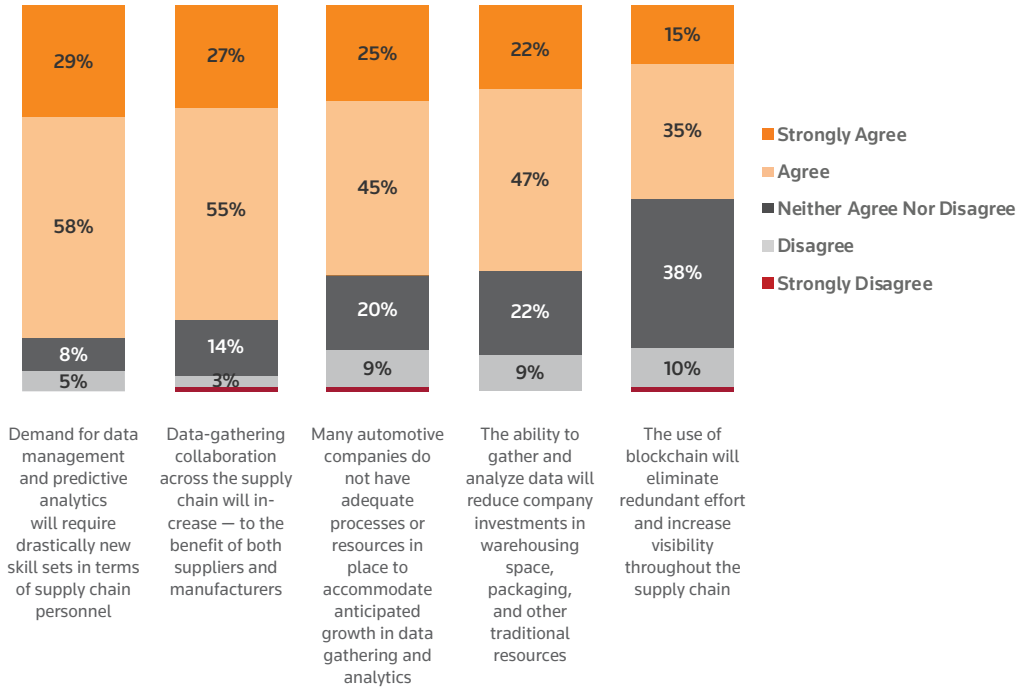
The future of supply chain management may lie in better data-gathering and analysis, but 70% of our respondents agreed (25% strongly) that many industry organizations do not understand the need for or the benefits of improved data analytics and are unprepared for this new era of data-enhanced management. And while 82% of respondents agreed (27% strongly) that better data-gathering across the supply chain would benefit both suppliers and manufacturers, an even larger majority (87%; 29% strongly) agreed that different personnel will be needed to bring more data sophistication to the supply chain — people with the proper technical training and a different mindset toward risk management and operational efficiency.

*Respondents agreed that data analytics could help companies spend less on such staples as warehousing costs, packaging, transportation, and other resources.*

In short, automotive supply chains have been slow to adopt new parts-tracking technologies and thus far have not invested enough in the systems, people, and training necessary to benefit from improved data-gathering and analysis. Understanding what data needs to be collected, what data is missing, what systems are needed to analyze it, then how to monitor, maintain, manage, and measure the data at every step in the supply process — these are all areas where, respondents say, there is a vast and urgent need for improvement.

Still, respondents were evenly split (50%/50%) on the idea that blockchain would eliminate duplication and paperwork in the process, even though that is one of the main benefits blockchain is supposed to provide. This could be due to the fact that few supply chain professionals have direct experience with blockchain and remain unconvinced of its potential. Respondents were a bit more optimistic that improved data management would introduce more efficiencies and cost savings throughout the supply chain, with 69% agreeing that data analytics could help companies spend less on such staples as warehousing costs, packaging, transportation, and other resources.

***More than 75% agreed that the demand for data management and predictive analytics will require different personnel and that data-gathering collaboration will benefit both suppliers and manufacturers.***




## Electrification

In the long term, almost no one denies that electric vehicles (EVs) will be the vehicles of the future, but how and when EVs will overtake and eventually displace internal combustion engines (ICEs) is very much in dispute. EVs currently make up only 2.1% of the world's vehicle stock, and market-growth projections for EVs are all over the map. One of the most optimistic predictions, from Bloomberg Energy News Finance (BNEF), estimates that EVs will constitute 32% of the world's passenger vehicles by 2040, but most projections are more conservative. As has already been mentioned, much needs to happen for EVs to gain more market traction — improvements in charging infrastructure, price parity, performance, battery technology, vehicle options, etc. — and not all of these factors are in automakers' control.

Because the overall adoption rate of EVs is so uncertain, and supply chains for EV technologies have not matured, most manufacturers are in the process of positioning themselves for expanded production in the future. The most significant difference between an EV and ICE is that an EV doesn't have an engine, just a battery, so there are far fewer engine components to source and track. However, because there are also fewer sources for batteries and their components — and competition for them will be increasingly fierce — 76% of respondents agreed that manufacturers would take a multi-source approach to mitigate supply risk. Seventy-four percent also agreed that

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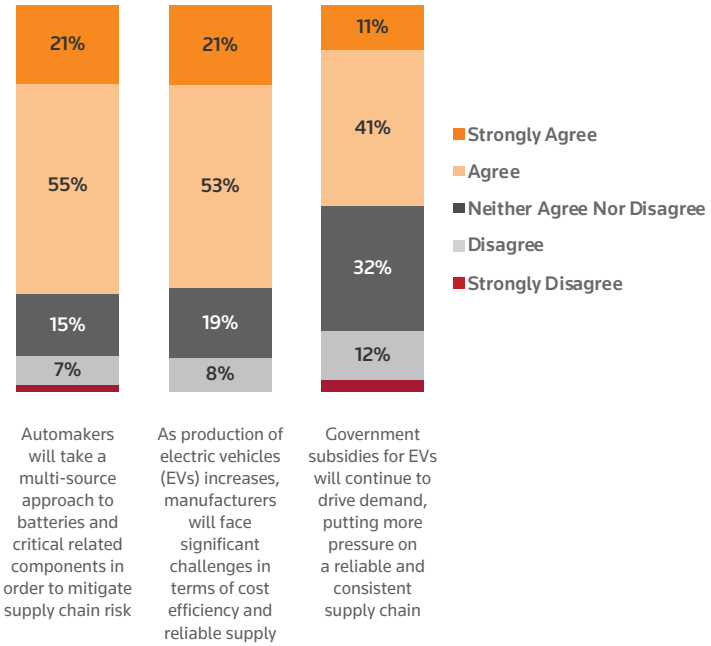
as manufacturers ramp up production, they will face significant challenges maintaining a stable supply of EV-related materials.

Another concern for manufacturers is that while they are waiting for market demand for EVs to improve, battery technologies continue to evolve as well. Most current batteries are based on lithium-ion technology, but that may not be the case ten years from now. This may explain why respondents to our survey were split (56%/44%) on the idea that limited capacity of battery manufacturers would drive prices up. Currently, there isn't much clarity on which battery technology will prevail in the long run, how much it will cost, or who will be selling it. Indeed, those questions may be unanswerable at present.

Respondents were also split (52%/48%) on the notion that government subsidies for EVs will continue to drive demand, putting more pressure on the supply chain. Subsidies, tax credits, and other incentives are only part of the EV adoption formula, and they fluctuate from country to country, and, in the US, from state to state and from administration to administration. Subsidies are certainly a useful tool for spurring demand, but they are only one factor, and their impact on the supply chain has thus far been limited. Unless the US or some as-yet unorganized coalition of countries decides to heavily subsidize EVs as a way of combatting climate change or strategically reducing its reliance on oil, adoption rates for EVs will likely rise gradually over the next few decades as the market sorts out all the competing variables.

Meanwhile, the grand project for most automakers is how to sustain the profitability of ICE vehicles while simultaneously investing in and preparing for the inevitable rise of mainstream EVs — with hybrid vehicles filling the gap in between for some time to come.

***About 75% agreed that automakers will take a multi-source approach to batteries/components and that EV manufacturers will face significant challenges in supply, encouraging them to engage in battery partnerships.***




*According to the American Trucking Association, there were 60,800 unfilled trucking positions in the US in 2018, and that number is projected to almost triple within ten years as older truckers retire and fewer young people are inclined to replace them.*

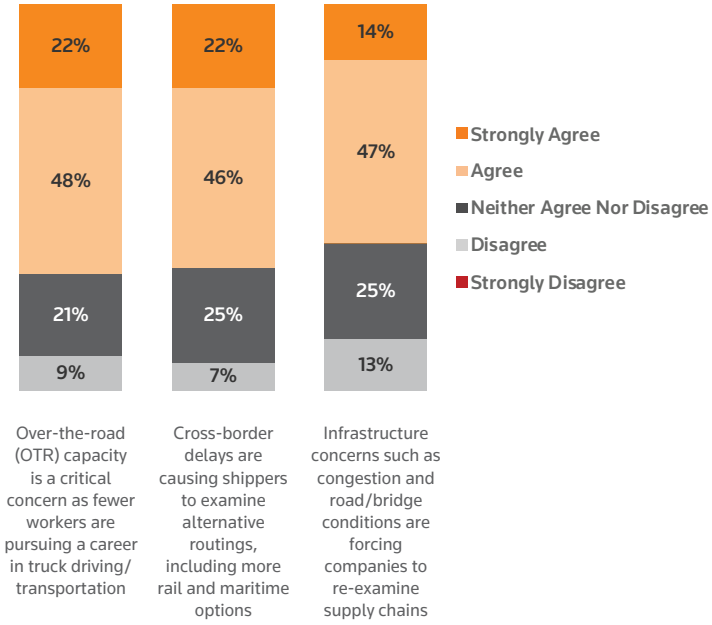
## Transportation Options and Modality Shifts

Approximately 17.2 million cars and light trucks were sold in the US in 2018, and almost all of them were shipped to their final destinations by truck. Likewise, the logistics networks required to transport parts and sub-assemblies to manufacturing plants depend almost entirely on the trucking industry. However, the industry's heavy dependence on trucking has many supply chain experts concerned — about deteriorating infrastructures (e.g., roads and bridges), chronic driver shortages, hours-of-service restrictions, unpredictable border delays, and even the ecological impact of current supply chain logistics.

Sixty-one percent of survey respondents indicated that deteriorating roads and bridges, as well as construction delays and traffic congestion, are forcing manufacturers to consider or reevaluate alternatives such as intermodal or rail transport. Likewise, 68% of respondents agreed that an increase in border delays is causing international shippers to consider more rail and maritime options, even though they are less flexible and require more inventory to be economically viable.

Seventy percent of those surveyed also agreed (22% strongly) that a chronic and increasing shortage of truck drivers represents a growing problem for the supply chain, particularly at the crucial final step of delivering automobiles to dealers. According to the American Trucking Association, there were 60,800 unfilled trucking positions in the US in 2018, and that number is projected to almost triple within ten years as older truckers retire and fewer young people are inclined to replace them. Europe has a similar shortage of long-haul drivers, though the EU has more rail options and short-haul trucking companies to fill the gap.

***Over-the-road transportation capacity was the top concern of respondents.***




*It's estimated that less than one in five small enterprises have the ability or resources to effectively defend against a cyberattack. This means that as automakers and their suppliers continue to integrate their networks for the sake of efficiency, they are simultaneously creating systems with more entry points for cyber intrusion.*

## Cybersecurity

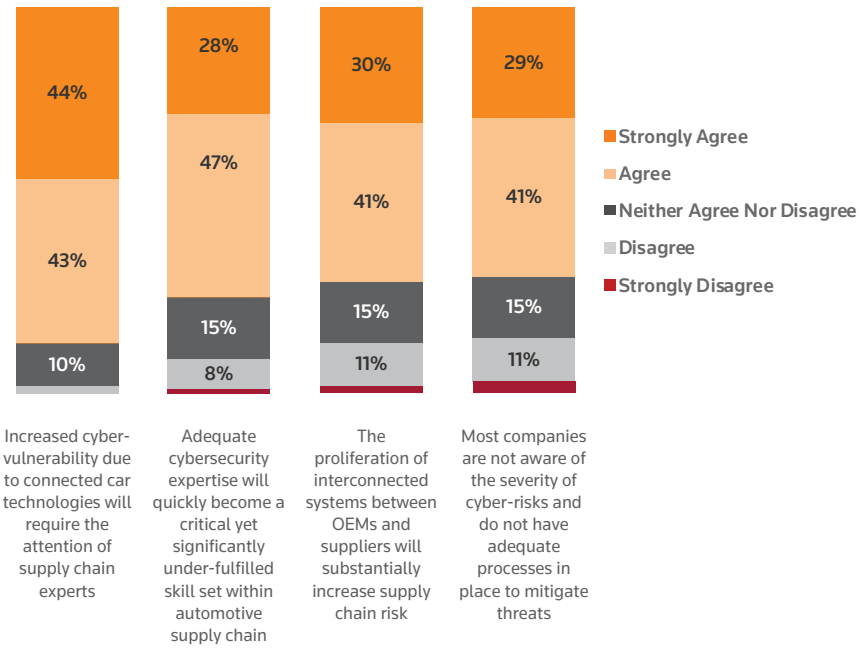
As automobiles become ever more computerized, and more cars on the road are electronically interconnected via consumers' personal devices and GPS satellites, concerns about cybersecurity are becoming a significant issue for automakers. A whopping 44% of respondents strongly agree (and an impressive 87% overall agree) that vulnerabilities created by connected-car technologies "will require the attention of supply chain experts" — though precisely what "attention" means isn't exactly clear.

For example, 75% of respondents thought cybersecurity expertise would become a critical concern for the supply chain in the next seven years, but they also agreed that automakers would have difficulty addressing these issues, given the supply chain's general lack of cyber expertise. The specter of hackers stealing consumers' personal information or disrupting navigation systems isn't the only fear either. Seventy-one percent agreed (30% strongly) that increasingly interconnected systems between suppliers and manufacturers represent a potentially significant supply chain risk, even as they provide the data and communication efficiencies upon which future supply chains will increasingly rely.

Of particular concern are computer systems used by small and medium-size suppliers. It's estimated that less than one in five small enterprises have the ability or resources to effectively defend against a cyberattack. This means that as automakers and their suppliers continue to integrate their networks for the sake of efficiency, they are simultaneously creating systems with more entry points for cyber intrusion. This is a relatively new issue, but a very serious one, which is why AIAG itself has partnered with the cybersecurity firm NQC to offer auto suppliers a virtual audit of their computer network to identify potential risks and recommend areas for improvement. (For more information on AIAG's Cyber Initiative, visit aiag.org/cyber.)

Interconnected systems have many advantages, but they don't come without risks. The ongoing challenge for the automotive industry is to maximize the advantages and minimize the risks, but that can only be accomplished if the risks are identified, and proactive steps are taken to mitigate them.

***More than 40% strongly agreed that there will be increased cybersecurity vulnerability in connected car technologies.***



*Actual adoption of autonomous vehicles will involve a slow and sometime messy process of building autonomous features into vehicles and gradually gaining the public's trust with each successive generation of autonomous sophistication.*

## Autonomous Vehicles

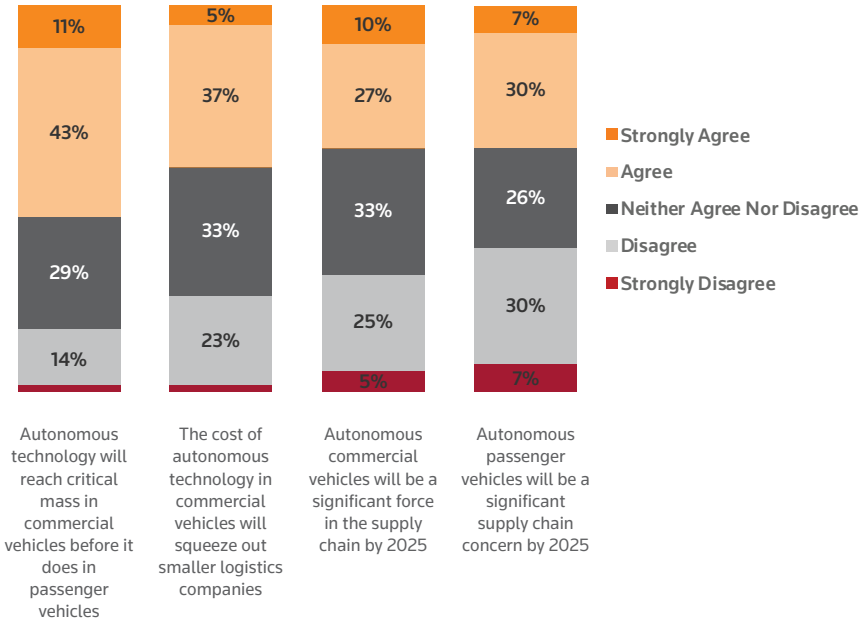
Though the projected timeline for widespread adoption of autonomous vehicles keeps getting pushed back, it's worth noting that the term "autonomous" means different things depending on the degree of driver independence one is referring to. In fact, the Society for Automotive Engineers (SAE) has broken the idea down into five separate levels of autonomy, ranging from simple adaptive cruise control (Level 1) and partial automation (Level 2 — such as Tesla Autopilot or GM's Super Cruise), with increasing levels of autonomy all the way up to Level 5, which is complete automation requiring zero human assistance whatsoever.

Actual adoption of autonomous vehicles will involve a slow and sometime messy process of building autonomous features into vehicles and gradually gaining the public's trust with each successive generation of autonomous sophistication. That said, the technology for introducing Level 3 to Level 5 autonomous driving in commercial vehicles is farther along in the development cycle, and expectations are that the technology will be introduced in some freight, construction, and mining vehicles much sooner than it will be available in consumer vehicles. For example, Volvo Trucks recently announced that a Level 5 Lidar-based system it has been developing with two companies, Ouster and NVIDIA, will be available as early as 2022.

Considering the variables associated with autonomous technology, it is perhaps understandable that so many respondents to this survey were noncommittal when asked about it. For each of the questions about autonomous vehicles in this survey, roughly a third chose to remain neutral, and opinions about the degree to which autonomous vehicles would impact the supply chain by 2025 were more or less evenly split. Fifty-four percent did, however, agree that autonomous technology would reach critical mass in commercial vehicles before it does in passenger vehicles. Responses were also split on whether the introduction of autonomous technology into the supply chain would squeeze out smaller logistics companies, with 42% saying yes, but everyone else either saying no or remaining neutral.

But again, this survey only asked supply chain experts to look ahead five to seven years, so perhaps their clear ambivalence on the matter of autonomy is the most significant takeaway.

***Over 50% of respondents agreed that autonomous technology will reach critical mass by 2025.***



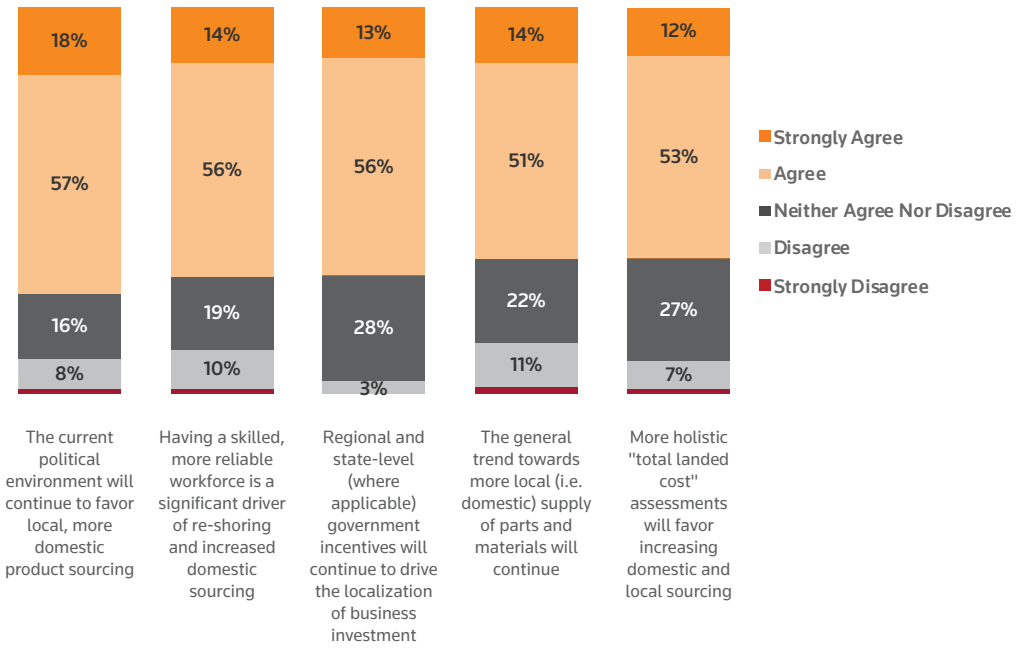
*Shifting trade policies and increasingly stringent regulations, especially in Europe, have fueled a general trend toward sourcing materials closer to home.*

## Re-shoring/Localization

Foreign automakers operate 19 automobile assembly plants within the US, and one of the reasons why is that it puts them in closer proximity to a larger number of component manufacturers at both the tier one and sub-tier levels. Locating in the US also helps minimize the hassles inherent in transporting parts across international borders, significantly reducing the impact of international trade policies and regulations on the supply chain.

Indeed, shifting trade policies and increasingly stringent regulations, especially in Europe, have fueled a general trend toward sourcing materials closer to home. Sixty-five percent of our survey respondents agreed that this trend is likely to continue, and an even higher percentage — 75% — agreed that continuing political instability around the world would likely result in continued domestic product sourcing. Sixty-nine percent also agreed that government incentives designed to encourage local business investment would reinforce this trend as well.

***Seventy-five percent of respondents agreed that the political environment will continue to favor local product sourcing.***




## Societal and Generational Changes

Much has been made of changing generational attitudes towards the traditional vehicle ownership model as ride-sharing and other mobility options have proliferated. Seventy percent of those surveyed expect the trend away from private car ownership to continue, and this is a societal megatrend that has far-reaching implications for the supply chain.

Consider: A significant decline in private ownership of motor vehicles means less diversity of demand, which means fewer market-viable vehicle models, which means diminishing creativity in automobile design, which means (among other things) a supply chain involving fewer custom parts and an entirely different demand calculus. A broad societal shift in this direction would mean a production shift toward more standardized fleet cars and would cascade through the supply chain in a number of important ways. Demand forecasting, factory and distribution capacity, supply-base commitments, dealerships, engineering, design, employment, marketing — all of these elements and more will be impacted if a steady decline in private automobile ownership persists.

Fortunately, this decline in private ownership is expected to happen slowly over many years, which should give automakers time to adapt. In the meantime, millions of vehicles are still being bought, and consumers are just as demanding as ever in their desire for more features at a lower price point. Indeed, for those who are still purchasing automobiles — the majority, that is — an equally

*Consumers are just as demanding as ever in their desire for more features at a lower price point.*

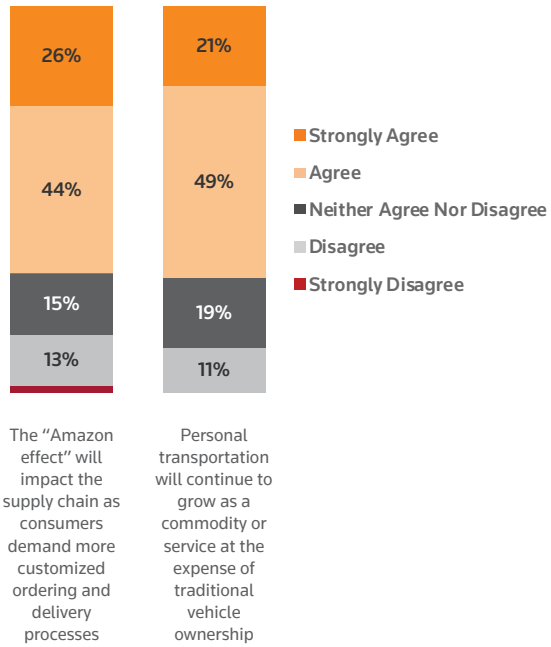
significant change is taking place in terms of what features consumers want, the degree of customization they desire, the speed with which they expect their desires to be met, and the price they are willing to pay for it all.

In general, 72% of survey respondents agreed that yes, consumers are going to continue to demand more features and customization in lower-end vehicles. To put it another way, consumers want more standard and even some luxury features on lower-priced vehicles to begin with, and more available features to choose from — all at a lower cost. Responses were mixed regarding the degree to which luxury vehicles — which have become increasingly popular in the US — would displace mainstream brands in the future. When asked if entry-level economy vehicles would continue to lose market share to luxury brands, more than a third of respondents chose not to commit one way or the other, and other responses were more-or-less evenly split.

Seventy percent of respondents also agreed (26% strongly) that the so-called "Amazon effect" would exert more pressure on the automotive supply chain in the coming years as customers come to want — and expect — to be able to order fully customized automobiles online and to have them delivered to their driveway in a relatively short timeframe. Currently, online automobile shoppers can identify a specific vehicle online and have it delivered in a matter of days, but ordering directly from a factory can take months, and the transaction must typically still go through an authorized dealer.

In short, the supply chain is not currently set up to deliver motor vehicles the way it delivers shoes and Insta-pots and other consumer goods. (Then again, Amazon's supply chains have been completely revolutionized in the past ten years, so anything is possible.) Still, meeting Amazonian-style customer demand in the automotive industry would require some major restructuring of supply chains, plant designs, distribution networks, and more. In the meantime, some deft management of customer expectations is the more reasonable course of action.

***Nearly 75% agree that consumers will demand greater customization in lower-end vehicles.***




## Environmental Protection and Safety Regulations

Government regulations requiring automakers to build safer, more fuel-efficient cars are forcing automotive designers and engineers to innovate in many different ways. And for the supply chain, a separate layer of regulations applies to the transportation of parts to manufacturers around the world. Failure to comply with environmental and safety regulations can cause slowdowns and bottlenecks, so supply chain experts do everything they can to avoid such problems.

One way to increase gas mileage, for instance, is to build lighter vehicles. And with regulations in many parts of the world requiring that vehicles average more than fifty miles per gallon by 2025, 84% of survey respondents agreed that demand and competition for lightweighting materials will become an important factor in the supply chain over the next several years. A strong majority (78%) also agreed that manufacturers will need to be more proactive about educating sub-tier suppliers about environmental compliance in order to prevent costly slowdowns and stoppages. A similarly large majority (76%) indicated that supply chain personnel will be exploring new approaches to logistics network design in order to contain costs related to these same compliance issues.

## Conclusion

*In the coming five to seven years, the only thing supply chain professionals can be certain of is that the automotive industry will continue to be shaped by a wide variety of social, political, economic, and technical forces, all of which have their own momentum and consequences.*

As we mentioned in the beginning of this report, the automotive industry as a whole is wrestling with a variety of challenges on several different fronts in a world where stability and predictability are in short supply. The rise of EVs, autonomous vehicles, ride-sharing, less automobile-centric lifestyles, and a host of other factors are affecting the demand side, exerting unprecedented pressure on the overall supply chain to adapt. Meanwhile, supply chain leadership and front-line professionals are also dealing with the need to learn and apply new data and logistics technologies, navigate an ever-shifting landscape of trade rules and regulations, and prepare for a future whose contours are fluid and uncertain.

For this report, Thomson Reuters and AIAG partnered to survey 97 high-level supply chain professionals in the Americas and Europe about the challenges and developments they foresee in their regions between now and 2025. The results are significant, not only because the US is the largest car market in the world, but also because the US's relationships with Mexico, Canada, China, and Europe have a disproportionately large impact on the global market for motor vehicles overall.

The broad takeaway is that the production of an automobile involves some of the most complex supply chain dynamics in modern industry, and the interconnected web of partnerships and alliances around the world that make it possible are extremely vulnerable to destabilization by a variety of outside factors. Political instability may be one obvious source of uncertainty, but the rapid march of technological development and accompanying societal expectations are arguably a more disruptive force, one that is both complicating and assisting supply chain professionals in their quest to deliver predictability, speed, efficiency, and quality each and every day on the job.

In the coming five to seven years, the only thing supply chain professionals can be certain of is that the automotive industry will continue to be shaped by a wide variety of social, political, economic, and technical forces, all of which have their own momentum and consequences. Maintaining reliable supply chains in this environment is essential and represents a significant strategic advantage for those who do it well. The future of the industry is far too important to leave to chance. That's why AIAG and Thomson Reuters are dedicated to making sure industry leaders have the information they need to remain competitive in the global marketplace.

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