

A ROADMAP TO EV COMMERCIALIZATION AND COMPLIANCE SUCCESS

A GUIDE FOR ELECTRIC VEHICLE INNOVATORS





INTRODUCTION

The global electric vehicle (EV) market has experienced rapid growth in recent years due to the introduction of legislation and various incentives aimed at reducing greenhouse gas (GHG) emissions and combating climate change.

As EVs become more mainstream and demand for more sustainable transportation modes continues to rise, manufacturers are scrambling to innovate fast and gain a competitive edge. However, many quickly realize that they are not well-equipped to deal with the increasing product complexity, stringent regulatory requirements, and rising customer demands that come with getting new products to market. Dispersed teams, manual processes, and disconnected systems make it difficult to keep everyone aligned. In addition, part shortages and other supply chain disruptions impede manufacturers from delivering products on schedule.

To achieve new product development and introduction (NPDI) success, EV manufacturers must have the wherewithal to quickly adapt and overcome these obstacles. This requires a new digital approach that brings together people, processes, and product information to help improve collaboration, optimize designs, and enhance operational efficiency.





EV MARKET CHALLENGES AND OPPORTUNITIES

CHALLENGES



Turbulent Marketplace

- Highly competitive landscape with new startups looking to gain market share and get ahead of established OEMs
- Supply chain disruptions due to pandemics and other unforeseen events



Increasing Consumer Demands

- Need for continuous innovation to deliver smart, connected products and improved customer experiences



Stringent Regulatory Requirements

- Ensuring product safety and reliability
- Restricting the use of hazardous raw materials

OPPORTUNITIES



Legislation for Net-Zero Emissions and Carbon-Neutral Transportation

- European Climate Law¹
- U.S. Bipartisan Infrastructure Law²



Rapid Market Growth

- Global compound annual growth rate (CAGR) of 26.8%³
- Projected to reach 34.8 million units and account for 7% of global vehicle fleet by 2030³



Significant Technology Investment in EV Industry

- \$400 billion over the past decade⁴

PRODUCT DEVELOPMENT OBSTACLES IN EV MANUFACTURING

Managing Greater Product Complexity

Compared to the traditional internal combustion engine (ICE) vehicle, an EV requires on average 80% fewer parts. Yet, there are key components which add to the complexity of its design, one being the battery. The battery poses several challenges, as it determines the vehicle's driving range, charging capacity, safety, and cost—key factors that greatly influence consumers' decision to purchase. Manufacturers must take these features into consideration as they look to optimize the EV design and attract new buyers.

Consumers are also wanting to accessorize their EVs with a wide range of smart, connected features such as self-driving technology, voice assistants, and adaptive cruise control with lane assist. To meet these demands and stand out from the competition, manufacturers must manage more sophisticated designs with the integration of advanced technologies such as the Internet of Things (IoT), sensors, and artificial intelligence (AI).

Achieving Regulatory Compliance

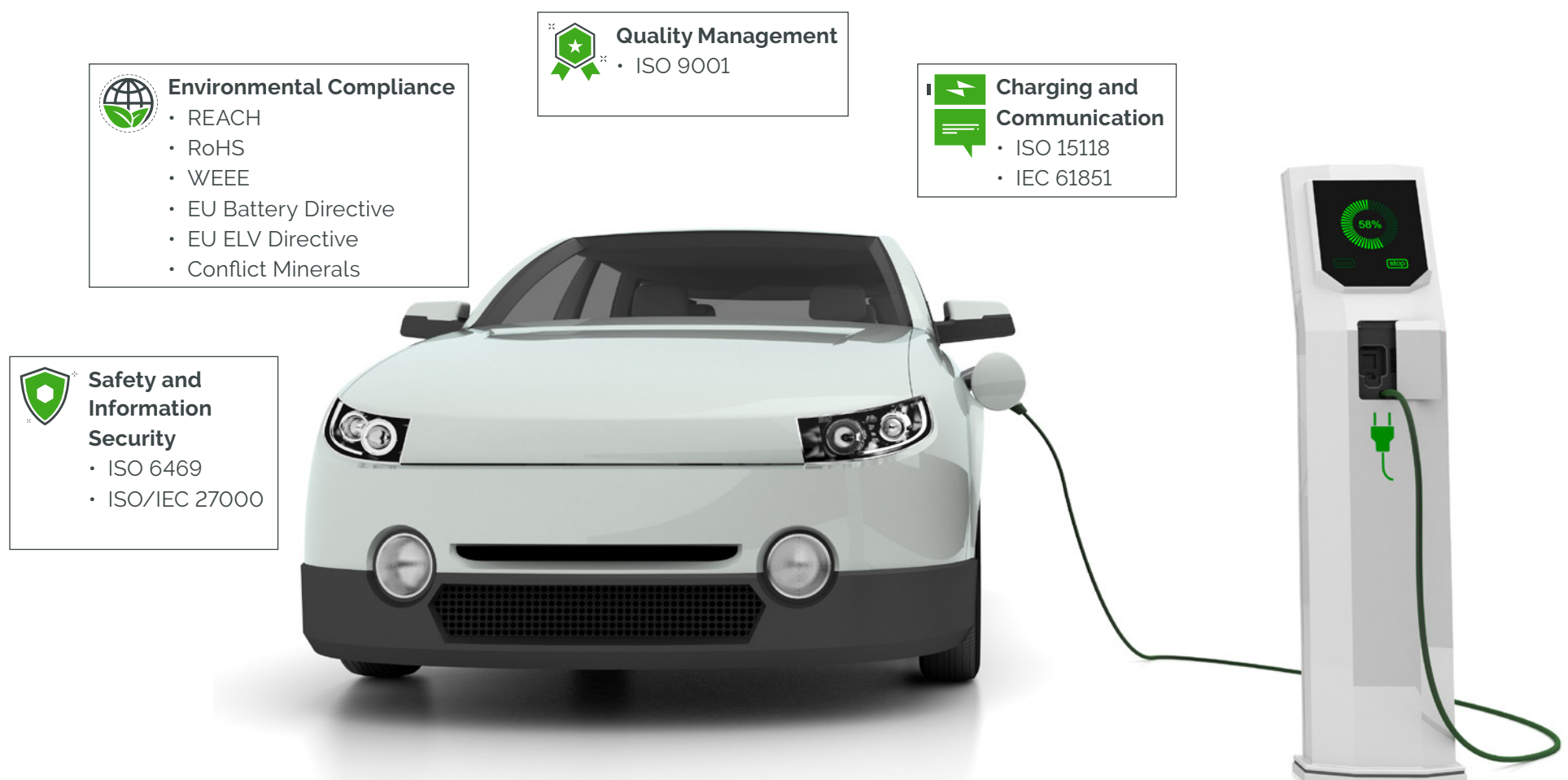
As the adoption of electric transportation becomes more widespread and new EV technologies emerge, global regulations are being established to ensure product reliability and address environmental impact.

Safety and Information Security

The [International Organization for Standardization \(ISO\)](#) and International Electrotechnical Commission (IEC) have published several standards, including ISO 6469, to enforce protection against electrical hazards and system failures. Guidelines for information security management (i.e., ISO/IEC 27000) have also been introduced to address the Internet of Things (IoT), charging infrastructure, and other underlying technologies that may pose cybersecurity or privacy risks.

Charging and Communication

ISO 15118 provides protocols for bidirectional communication between the EV and charging station so that drivers can simply plug in the vehicle and charge without having to worry about cards, apps, or PINs for authentication and billing. Additionally, the different modes for EV conductive charging systems are outlined in IEC 61851.



Quality Management

Although the ISO 9001 standard is not specific to electric transportation, companies across many industries use it as the basis for implementing a quality system to drive continuous improvement and increase customer satisfaction.

Environmental Compliance

Environmental regulations such as [Registration, Evaluation, Authorisation and Restriction of Chemicals \(REACH\)](#) and [Restriction of Hazardous Substances \(RoHS\)](#) limit the use of certain hazardous materials for the manufacture of products. Other regulations such as the EU Battery Directive, EU End of Life Vehicle (ELV) Directive, and [Waste Electrical and Electronic Equipment \(WEEE\)](#) require manufacturers to ensure proper reuse, recycling, or disposal of certain parts and materials once they reach end of life.

When it comes to environmental compliance, documentation and tracking of the components and raw materials that are used for production must occur throughout the entire lifecycle. Responsible sourcing and reporting of [conflict minerals](#) such as cobalt and lithium for battery production is also necessary to demonstrate due diligence.

Navigating Supply Chain Challenges

To accelerate time to market (TTM), EV manufacturers are having to reevaluate how they interact with and manage their supply chain.

The high demand for semiconductor chips and other critical electronic components across various sectors has forced manufacturers to contend with extended lead times and shortages. This is further compounded by the frequent supply chain disruptions that result from pandemics, natural disasters, and other unforeseen events.

EV battery supply chains especially are negatively impacted due to the environmental and ethical concerns associated with sourcing key raw materials such as cobalt and lithium. Cobalt mining is concentrated in the Democratic Republic of Congo (DRC), which accounts for 65% of the global supply⁵. Various reports link the DRC's mining industry to hazards such as forced labor and poor working conditions⁶.

In light of these supply chain obstacles, EV manufacturers must adopt new sourcing strategies and supply chain communication methods to help mitigate risks.

Sourcing Strategies to Consider

- Diversify your supply chain**
 Having multiple suppliers across different geographical locations enables you to secure critical parts when faced with sudden disruptions. In addition, choosing suppliers that are in proximity of the EV production site helps you avoid supply chain logistics issues stemming from natural disasters and other regional incidents.
- Bring production processes in-house**
 By leveraging robotics, automation, and other advanced platforms to assemble some EV components in-house, you'll gain greater control over production planning and product quality.
- Partner with manufacturing specialists**
 Building alliances with electronic manufacturing service (EMS) providers and other EV production experts gives you access to the dedicated facilities, equipment, and processes that are needed to accelerate product launches and set yourself apart from the competition.
- Adopt more sustainable sourcing practices**
 In lieu of cobalt, consider more sustainable and ethically sourced raw materials such as manganese and iron for EV battery production. Also look at recycling old batteries to help reduce the cost and environmental impact of mining or importing raw materials.



[View Full Infographic](#)

Enhancing Visibility Across the EV Supply Chain

Because OEMs are relying more heavily on global contract manufacturers and multitiered suppliers to fulfill their EV sourcing needs, it becomes difficult to keep everyone connected and on the same page. Many OEMs are accustomed to using ad hoc systems such as email and spreadsheets to communicate and exchange product information. Since these systems are not tied directly to the product record, they make it difficult for teams to identify the latest design changes or have complete visibility into production errors, part shortages, and other issues that cause product delays. Consequently, EV manufacturers need a centralized system for internal teams and external supply chain partners to collaborate in real time and drive greater transparency.



LEARN MORE

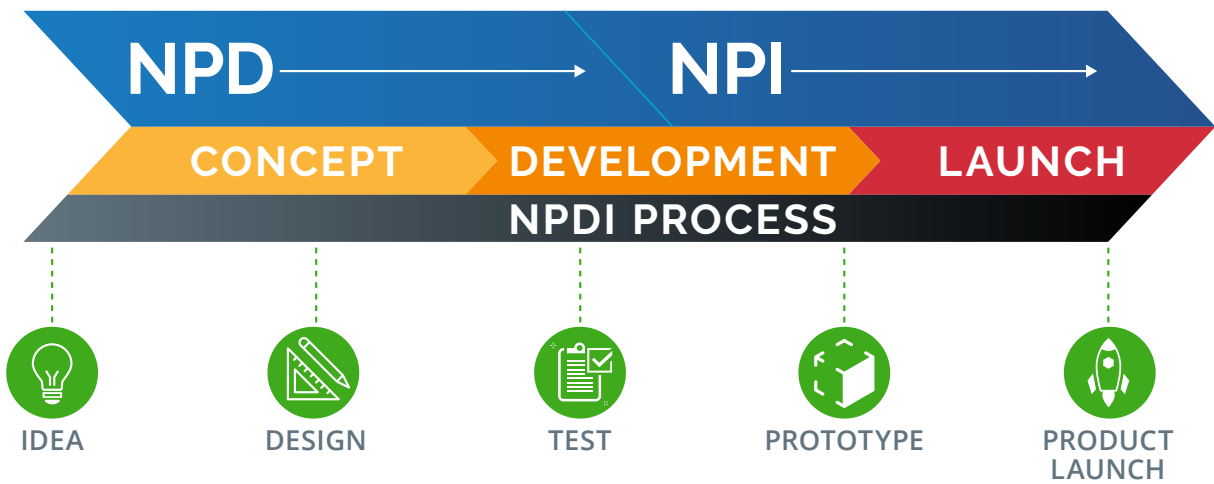
- [Overcoming Product Development Challenges in EV Manufacturing](#)
- [5 Tips to Improve Supply Chain Collaboration](#)
- [How EV Manufacturers Can Navigate Supply Complexity](#)
- [Regulatory Compliance Essentials for EV Manufacturers](#)



GAINING GREATER CONTROL WITH PRODUCT LIFECYCLE MANAGEMENT

As EV companies now deal with increased product complexity and compressed timelines, they are looking for a better way to manage and execute their product development processes.

Product lifecycle management (PLM) helps manufacturers and their supply chain partners streamline new product development and introduction (NPDI) and drive continuous improvement. By linking all of the product development, quality, and engineering change activities, PLM provides teams greater control and visibility over the entire product record. In turn, they can work together more efficiently and accelerate product launches.



Digital Transformation With Cloud PLM

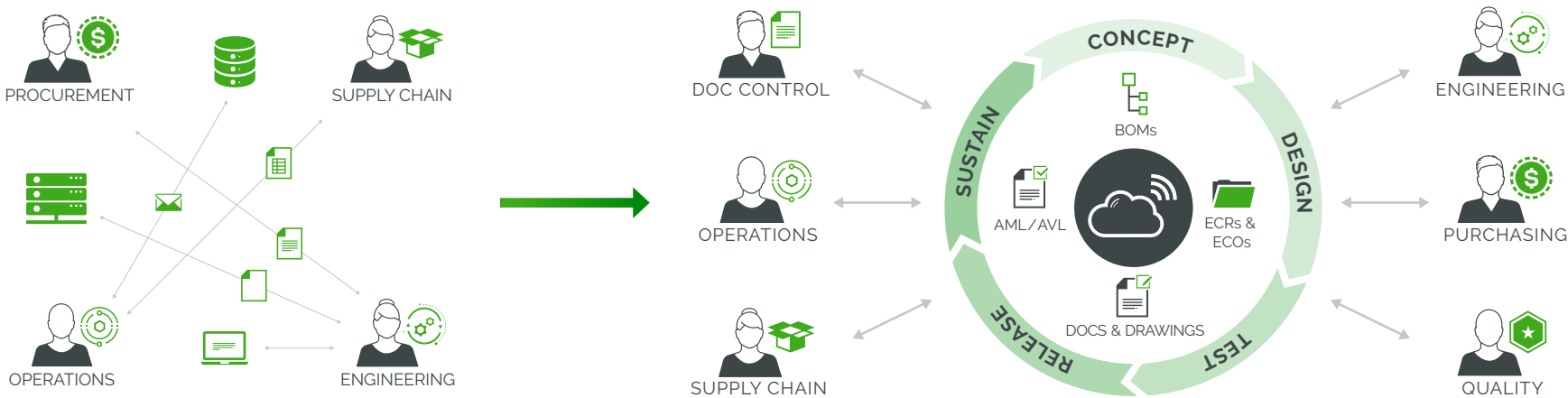
Reliance on manual processes or point software solutions can create data silos and communication gaps, thus preventing distributed product team members from staying on track with key deliverables.

Enterprise cloud-based PLM solutions address these challenges by providing a single source of truth for internal and external teams to access the latest product information and collaborate in real time from anywhere in the world. Using this approach, teams can better manage design changes, quality issues, regulatory mandates, and other critical processes throughout NPDI.



LEARN MORE

- [It's Easy to Migrate to the Cloud](#)
- [7 Steps to Jump-start Your Digital Transformation](#)
- [Identifying the Value of Digital Transformation](#)



Making the Switch From Manual, Disconnected Systems to Cloud PLM

ACHIEVING EV COMPLIANCE AND NPDI SUCCESS WITH ARENA

Cloud-native solutions like Arena PLM bring the essential product development processes into a single platform. From design files and bills of materials (BOMs) to engineering changes, quality records, and employee training—everything is connected so that teams can collaborate and work more diligently to meet their NPDI targets.

How Arena PLM Helps:

✔ **Streamlines product development**

Automated processes and revision controls are applied to BOMs and documents to ensure that everyone is always accessing the latest product information. The ability to easily manage and track design changes, product requirements, compliance information, and team deliverables enables manufacturers to address issues quickly and launch products on schedule.

✔ **Enhances supply chain collaboration**

With direct, permissions-based access to the latest product information, suppliers are empowered to provide input and share cost-saving alternatives to help OEMs optimize designs and stay on budget.

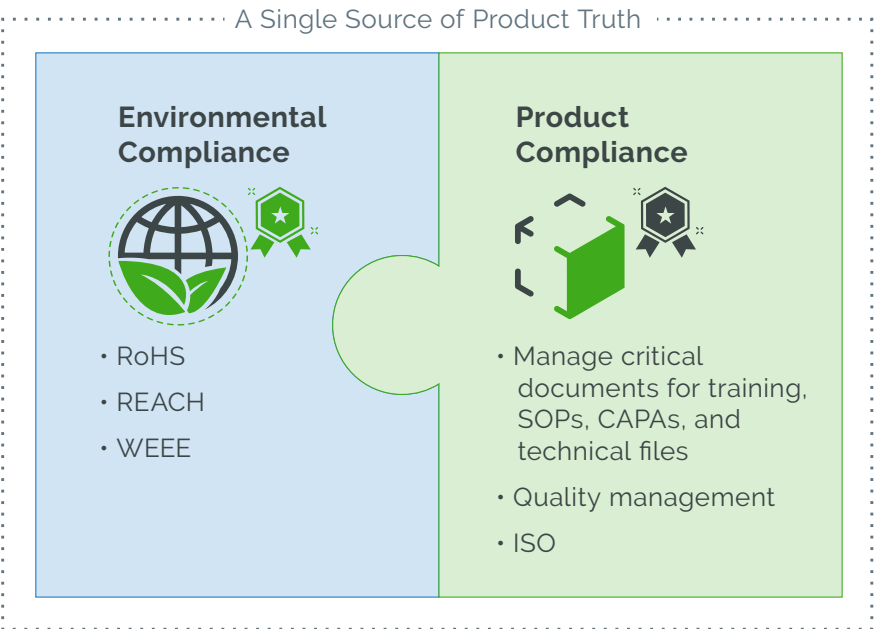
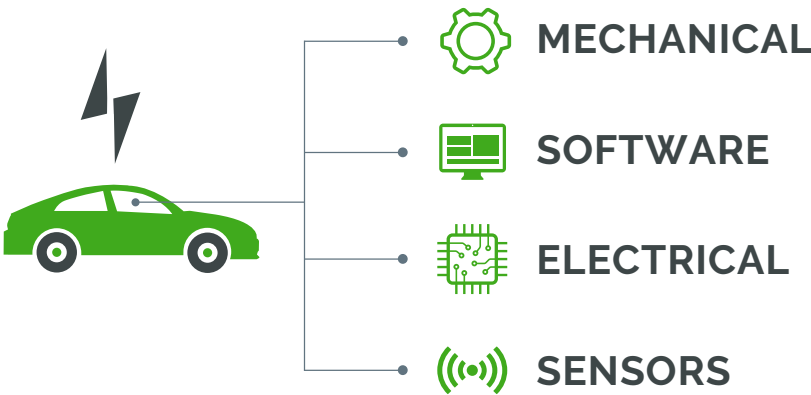
✔ **Aggregates entire product design**

By combining sensors, software, mechanical, and electrical components into one shared system, everyone on the team can detect design errors or quality issues early on. This helps drive interoperability and ensures that customer requirements are being met prior to commercialization.

✔ **Simplifies environmental and product compliance**

Teams can electronically manage and track compliance evidence of their components for environmental regulations such as RoHS, REACH, WEEE, and conflict minerals. Integration with online component databases provides current information for electronic component market availability and compliance status.

To ensure compliance with quality systems, like ISO, Arena connects the product design and quality record in a single unified system to easily manage corrective actions, customer complaints, standard operating procedures (SOPs), employee trainings, and other quality processes while keeping product and quality teams on the same page.



“

Arena is now part of the product design culture at FreeWire and acts as the brain of our product development infrastructure with other systems working around it. As people become more comfortable with the solution and stop relying on shared drives and other older silos of information, Arena becomes the answer and single source for finding all product information. If information is in Arena, we know it can be trusted.

—Scott Bartlett, Director of Mechanical Engineering, FreeWire Technologies



Resources

1. https://ec.europa.eu/clima/eu-action/european-green-deal/european-climate-law_en
2. <https://www.cnbc.com/2021/08/05/biden-pushes-for-evs-to-make-up-40percent-or-more-of-us-auto-sales-by-2030.html>
3. <https://capital.com/ev-market-trends>
4. <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/why-the-automotive-future-is-electric>
5. <https://www.theglobalist.com/batteries-mining-cobalt-democratic-republic-of-congo/>
6. <https://www.amnestyusa.org/inside-the-drcs-artisinal-mining-industry/>

**SEE ARENA PLM
IN ACTION**

> [SCHEDULE A DEMO TODAY](#)



121 Seaport Blvd, Boston, MA 02210 : [ptc.com](https://www.ptc.com)