material.one
powered by adesso

Whitepaper:
Protect Your Brand with Proactive Quality Management

Increasing technical complexity and global supply networks increase the risk of recalls and also threaten brand reputation. In this white paper, you will learn how digital platforms create transparency, detect failures at an early stage and proactively ensure quality.

Jens Schmidtmann | March 2025

Protect Your Brand with Proactive Quality Management

Management Summary

The automotive industry is under pressure: New technologies such as autonomous driving, electromobility, and connected vehicles are driving the speed of innovation to a new level. At the same time, technical complexity is increasing rapidly — with drastic consequences for quality and safety [see Fig. 1]. While manufacturers have been working for decades to improve product and process quality, recalls are not decreasing today, but are actually increasing. Between 2011 and 2021, 349 million vehicles were recalled in the USA alone — a terrifying number.

Automotive recalls have been increasing in frequency and intensity

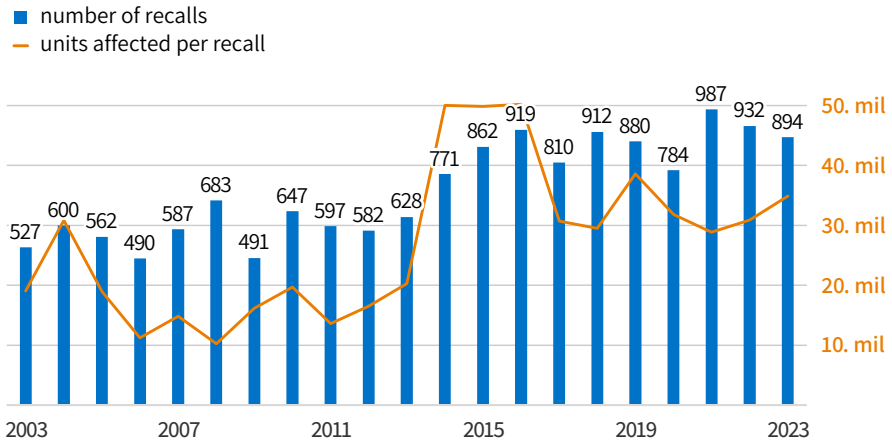

Fig. 1
National Highway Traffic Safety (NHTSA), Administration recalls in United States, number

Source: NHTSA 2023 Annual Report Safety Recalls, Published March 2024, adapted for material.one AG

Many of these problems are avoidable. Digital cloud platforms and close, highly standardized collaboration in a business network make it possible to identify sources of error at an early stage, make supply chains more transparent, and switch from reactive damage limitation to proactive quality assurance. This white paper shows how manufacturers can use modern quality strategies to avoid not only high costs, but also considerable damage to their reputation.

Why Are Recalls Increasing? The Four Biggest Problem Areas:

1. Growing Technical Complexity — Mechanical Quality as the Key to Recall Avoidance

The automotive industry is moving towards a software-defined future, but mechanical components remain indispensable. While software errors can often be fixed via over-the-air updates, a defect in the brakes, steering, or chassis requires a complex recall with spare parts production, workshop visits, and a high-cost burden. Vehicles consist of 100 % physical components and materials that are directly responsible for safety and stability. Defective components result in a long chain in the supply chain — from material procurement to manufacturing to retrofitting affected vehicles. The more software-supported functions are introduced, the more critical the reliability of the installed components becomes. For example, an incorrectly calibrated sensor can be corrected by an update, while a defective sensor must be replaced by a recall.

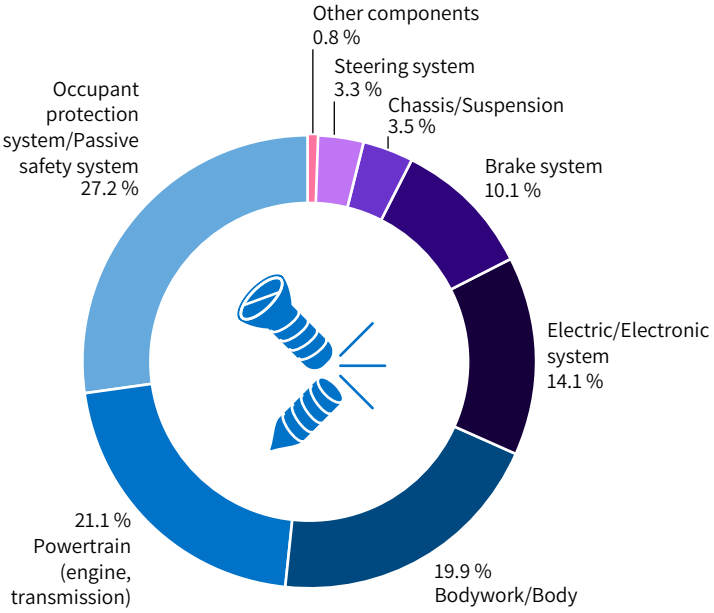

Fig. 2
Source: CAM, Distribution of safety-relevant defects on assemblies

2. Accelerated Product Development Process

Increasing competitive and time pressure in the automotive industry is forcing manufacturers to bring new models to market faster. Test cycles are shortened, resources in the development of physical components and quality assurance before the start of production are drastically reduced. This significantly increases the risk of defects. The development effort for physical components has fallen from 90 % to less than 50 % of the total effort in the past 20 years. By 2030, it is expected to fall to 30 %. At the same time, the proportion of software-based functions and technologies is increasing. However, their long-term effects are often not sufficiently tested or taken into account in the physical components — a risk for product quality and safety. The goal to be striven for: To ensure the highest possible quality as early as in the product development process in order to achieve the lowest possible error rate both in production and in the product life cycle.

3. Global Supply Chains and Cost Pressure

With up to 80 % of vehicle parts coming from external suppliers (multi-tier level, from tier 1 to the material manufacturer), the dependence on complex supply chains is high. A lack of transparency and cost-cutting strategies exacerbate the risks: Cost pressure can lead to suppliers not investing enough in quality assurance. Global procurement and the complexity of the supply chain make it difficult to control compliance with standards and increase the risk of counterfeit components or inferior materials. In this context, manufacturers report insufficient transparency, especially about the quality of supplier parts beyond the “visibility barrier” (tier 2 — tier n). See Fig. 3.

Status Quo: Workload, compliance, and document quality

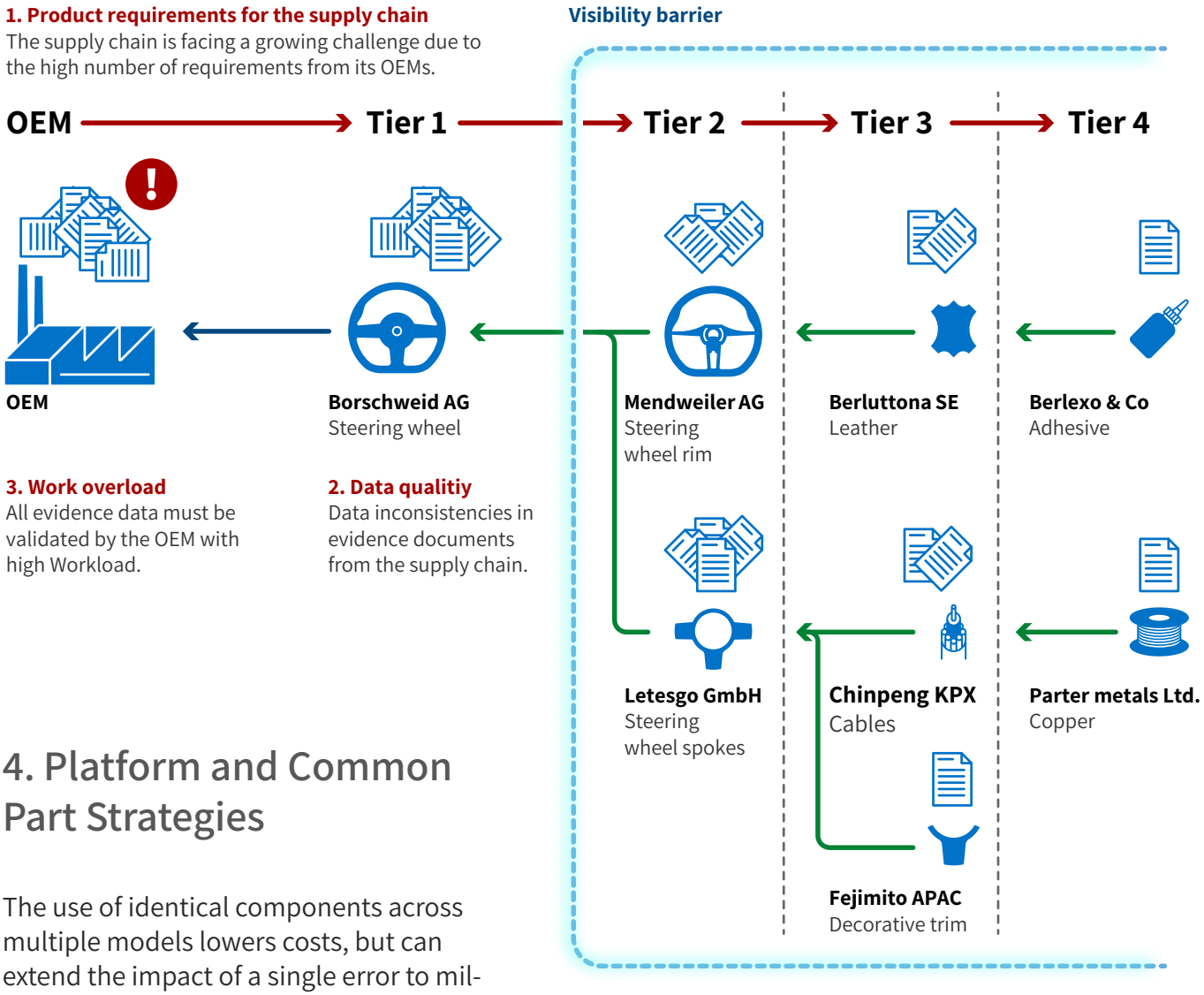

Fig. 3
Source: material.one AG

4. Platform and Common Part Strategies

The use of identical components across multiple models lowers costs, but can extend the impact of a single error to millions of vehicles. A small defect in a module can extend across many different models and even several brands, drastically increasing the impact of potential recalls.

The Consequences of Increasing Recalls — Billions in Losses and Damage to Reputation

Recalls have a negative impact on the finances, reputation, and legal situation of companies:

1. Financial Losses

Recalls represent a significant financial burden for companies and can cause immense costs. Costs for repairs and the replacement of defective components, which can quickly add up to billions. Workshop visits, warranty services, and potential penalties consume considerable resources and burden the company's earnings. Indirect financial losses due to declining sales, falling share prices, and rising insurance costs. Uncertainty about the quality and safety of a product can deter investors and significantly impair the long-term value of the company.

2. Damage to Reputation

A recall can permanently damage customer confidence in a brand. Consumers expect the highest safety and quality standards from automobile manufacturers. If a manufacturer is characterized by numerous recalls or serious quality problems, not only the image suffers, but also brand loyalty. Negative media reports, increased attention from consumer protection organizations, and social media campaigns can further increase the damage. In the long term, such events can lead to customers switching to competitors and a massive reduction in brand value.

3. Legal Risks

Safety defects that lead to accidents or personal injury can trigger liability lawsuits worth millions. Regulatory authorities worldwide are increasingly imposing stricter penalties for negligent quality controls or delayed recall campaigns. In particularly serious cases, there is even the threat of criminal consequences for responsible managers, especially if it is proven that quality issues or safety risks were negligently overlooked. Compliance with international safety and quality standards is therefore not only a question of business ethics, but also a decisive factor in avoiding legal disputes.

The Takata Case: A Lesson in Risk Management

The Takata airbag recall is one of the most serious examples of the consequences of inadequate quality controls and processes and poor risk management in the automotive industry. Between 2002 and 2015, over 67 million vehicles from 34 brands were recalled worldwide after it was discovered that defective airbags could, in some cases, deploy explosively and hurl sharp metal parts into the vehicle interior. This problem led to at least 28 deaths and more than 400 injuries in the USA alone (Fig. 4). The global extent goes far beyond 100 million vehicles. The cause was a faulty design of a component in the airbag.

The economic and reputational damage was enormous: Takata filed for bankruptcy in 2017, and numerous automobile manufacturers who installed these airbags faced billions in recall and damage costs. Thus, they also suffered heavy damage. The case shows the need for proactive measures, such as better quality assurance even before the start of production (Supplier Quality Management, PPAP), real-time data monitoring, and traceability in the supply chain, to prevent similar incidents.

The Takata Case

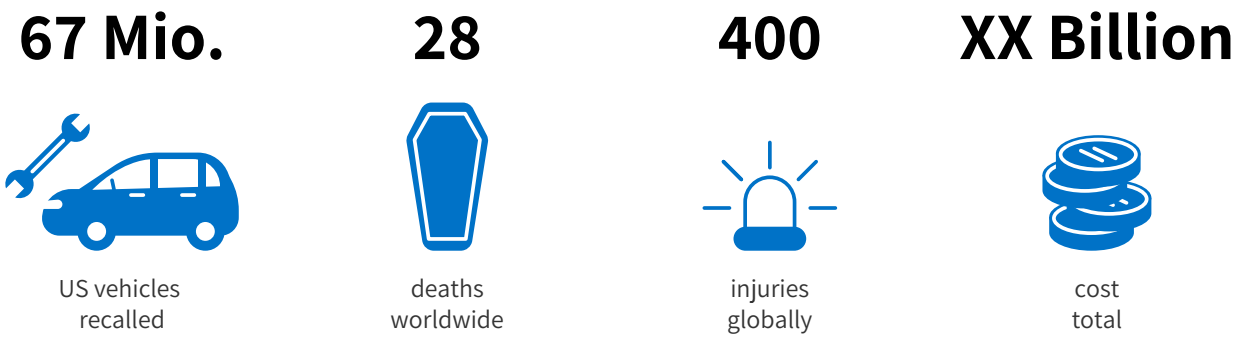

Fig. 4
Sources: NHTSA (Jan. 2021), Reuters (Sept. 2024), Repairer Driven News (Sept. 2024)

Please note that these numbers may change over time as additional incidents are reported or new information becomes available.

Strategies for Proactive Quality Management

1. Digitization of Quality Processes, Approval, and Verification Management

The digitization of quality processes enables efficient, transparent, and error-free collaboration along the entire supply chain. Platforms such as material.one, as the operator of a multi-business network, offer comprehensive options for optimizing approval and verification processes:

- Seamless integration of CAD models and quality requirements: Development and quality data are directly linked to avoid errors at an early stage.
- Real-time monitoring and traceability: Up to 20,000 parts and materials can be tracked and analyzed across all tier levels.
- Uniform database for all participants: A central platform eliminates misunderstandings in communication and prevents quality gaps due to missing documentation.
- Automated workflows to reduce manual errors: Digital processes replace error-prone, paper-based processes and ensure accelerated, standardized documentation of evidence.
- Scalable cloud solutions for global collaboration: Digital quality management systems enable cross-location approval processes with full compliance.

These digitization measures not only make approval and verification processes more efficient, but also more robust against sources of error and regulatory requirements.

2. Strengthening Supplier Relationships through Digital Collaboration and Data-Driven Quality Assurance

Modern supplier management relies on digital collaboration, data-driven processes, and close networking between OEMs and suppliers to optimize transparency, quality, and speed of reaction along the entire supply chain. Classic quality inspections alone are no longer sufficient — instead, real-time data, automated workflows, and digital platforms are necessary to identify and proactively solve quality problems at an early stage. Modern digital solutions improve collaboration between OEMs and suppliers:

- Early quality inspections according to international standards such as IATF PPAP and VDA PPF guarantee a standardized evaluation of mechanical components even before series production. Real-time feedback and digital workflows enable an immediate response to quality deviations before they spread throughout the entire supply chain.
- Data-driven transparency across all tier levels ensures the traceability of mechanical components, which, unlike software updates, cannot simply be corrected later.
- Automated supplier scorecards and digital audits continuously monitor supplier quality based on real-time data.
- Platform-based collaboration eliminates media breaks and improves access to approval and verification documents for all participants.

This data-driven quality assurance is not only a basis for more efficient collaboration, but also a bridge to predictive quality assurance: AI-supported analyzes and machine learning (see point 3) can use this structured data to predict quality problems even more precisely and minimize risks in the supply chain at an early stage.

3. Use of Predictive Analytics for Predictive Quality Management

Modern IT systems make it possible to identify and prevent quality issues at an early stage before they lead to costly recalls or production downtimes. By using big data, artificial intelligence (AI), and machine learning (ML), companies can proactively minimize risks and put their quality strategy on a predictive basis. Data-driven technologies are revolutionizing quality assurance:

- Data-driven risk analysis: Historical quality and recall data are systematically evaluated to identify patterns, anomalies, and recurring sources of error.
- Predictive error avoidance: Machine learning algorithms predict potential defects based on production and test data, so that corrective measures can be initiated at an early stage.
- Real-time monitoring of critical components: Sensor-based diagnostic systems in vehicles and production lines detect deviations at an early stage and trigger automated warning mechanisms.
- Simulation and digital twins: Simulation-based tests allow potential quality problems to be analyzed and rectified virtually before they occur in physical production.
- Use of digital agents: AI-supported digital assistants take over automated quality assurance tasks, support error diagnosis, and optimize workflows in real time.

The use of these technologies reduces error costs, increases process reliability, and enables early control of quality risks along the entire value chain. The combination of data-driven analyses, AI, and digital automation will play an even more central role in quality assurance in the future and help companies make their processes even more efficient, secure, and proactive.

4. Integration of International Standards for Consistent Quality Conformity

Compliance with globally recognized quality standards is essential to ensure uniform processes, the highest safety requirements, and smooth cooperation in international supply chains. Particularly relevant are:

- IATF 16949:2016: This automotive standard defines requirements for quality management systems in the supply chain and is crucial for manufacturers and suppliers.
- ISO 9001: The globally recognized standard for quality management ensures clear processes and continuous improvement.
- VDA-PPF / AIAG-PPAP: Standardized approval processes for components ensure that suppliers worldwide work according to the same quality guidelines.
- Cybersecurity & software quality: With increasing digitization, standards such as ISO/SAE 21434 (Cybersecurity Engineering) and ASPICE for software quality are gaining in importance.

Advantages of Standard Conformity

- Increased customer satisfaction and market acceptance: Certifications facilitate market entry and improve the trust of OEMs and suppliers.
- More efficient quality processes: Uniform specifications reduce sources of error and increase efficiency in complex, multinational supply chains.
- Risk minimization: Standards help to meet legal requirements and reduce liability risks.

By consistently implementing these standards, companies ensure that their processes remain scalable, compliant, and future-proof worldwide.

Players should move from ‘firefighting’ to prevention in quality management.

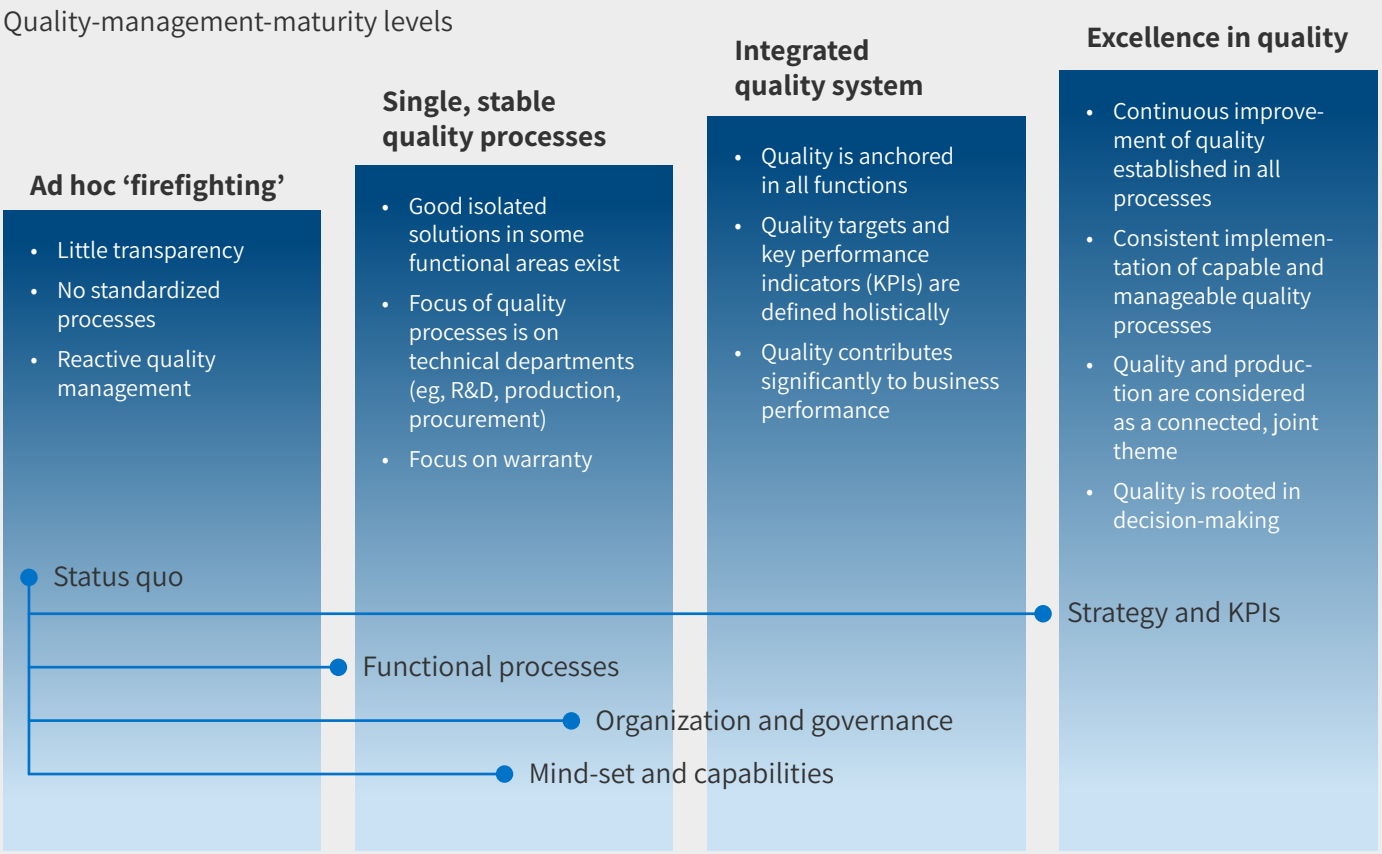

Fig. 5
Graphic by McKinsey&Company, adapted for material.one AG

Cross-Industry Applications

The strategies and technologies described are not only relevant in the automotive industry (VDA, AIAG IATF 16949, etc.), but can also bring significant advantages in other industries, for example:

- Aerospace: Compliance with safety-critical standards such as AS9100 can be improved by digital platforms.
- Commercial vehicles (freight, agricultural, construction): Components that have to withstand extreme conditions benefit from proactive quality strategies.
- Medical technology: Strict regulatory requirements such as ISO 13485 require precise traceability of components and materials.
- Rail: High number of strict requirements and standards, according to EN and DIN, railway standards and VDE and VDI guidelines.
- Forklifts/intra logistics/industrial trucks (FFZ): Ensuring safety and efficiency in warehouse and transport applications requires robust quality management processes, among others based on ISO and CEN standards.

The Potential of a Multi-Business Network

The future of industry lies in networked supply chain collaboration platforms. A multi-business network enables:

- Efficient collaboration between OEMs, suppliers, and testing-in-spection-certification providers.
- Integration of existing systems for seamless data transmission.
- Use of digital twins to improve process monitoring and quality control.
- Optimization of resource use and logistics through central data systems.

Conclusion and Recommendations for Action

The challenges of the automotive industry and other sectors require a radical rethink in quality management. By digitizing processes, strengthening supplier relationships across all levels of the supply chain, and using innovative platforms such as material.one, companies can:

- Minimize recalls and their consequences.
- Improve transparency and collaboration in the supply chain.
- Protect brand value in the long term.

Those who focus on preventive quality assurance not only reduce costs, but also protect their brand sustainably. A proactive approach combined with state-of-the-art technologies is the key to meeting the increasing demands of the industry and being successful in an increasingly networked world.

The Whitepaper was conducted by material.one AG.

Author: Jens Schmidtmann, Marketing Director, material.one AG

material.one AG is a company within the adesso Group, one of the leading IT service providers in the German-speaking region. material.one operates a supply chain collaboration platform for product and process approvals as well as an industrial Multi-Business-Network.

The solution supports globally operating manufacturers and suppliers in quality management, sustainability, and product certification. material.one eliminates process and company boundaries, digitizes product requirements, and provides all participants in the supply network with access to digital proof plans and evidence – enabling seamless collaboration.

*TIC = Testing Inspection Certification

For more information, visit: www.material.one

Imprint:

©material.one AG
Martini Park, Provinostr. 52/ Building V1_1 (Villa 1)
86153 Augsburg | Germany
Tel.: +49 821 899 496-0 | Email: info@material.one
Executive Board: Bernd Löhle | Chairman of the Supervisory Board: Thomas Gasber
Commercial Register at the District Court of Augsburg, No. HRB 2077
VAT Identification Number: DE 21 19 96 424