Upstream

2025 ENABLING TECHNOLOGY LEADER

Leveraging Vital Technology to Enhance Products and Applications

RECOGNIZED FOR BEST PRACTICES IN THE EUROPEAN AI-DRIVEN VEHICLE QUALITY DETECTION INDUSTRY

FROST & SULLIVAN

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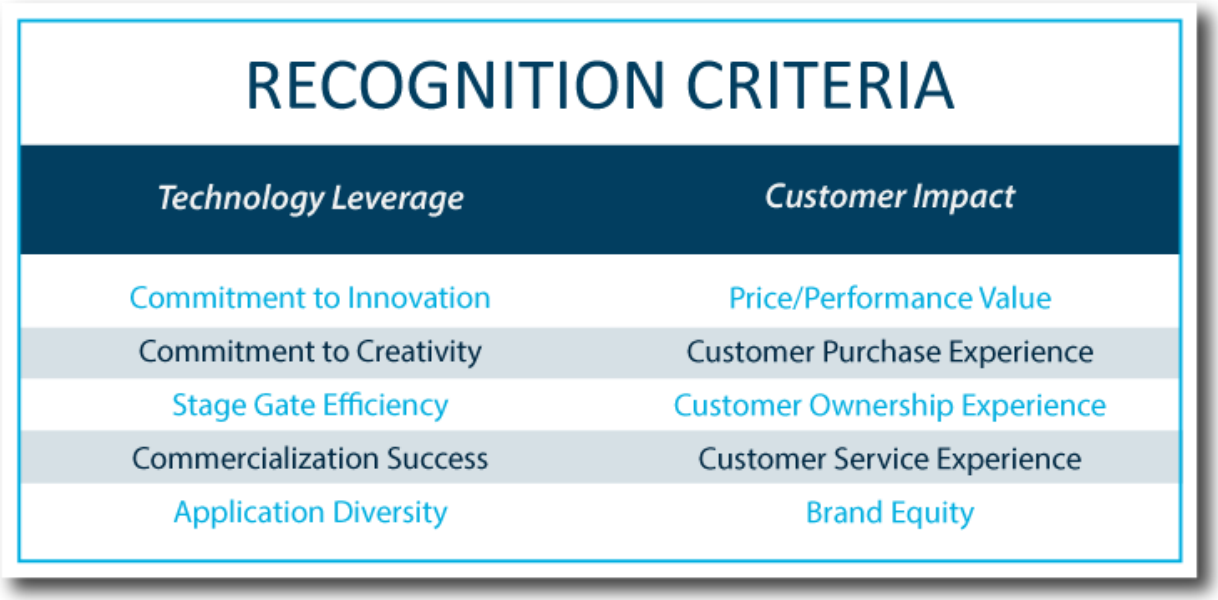
Best Practices Criteria for World-class Performance

Frost & Sullivan applies a rigorous analytical process to evaluate multiple nominees for each recognition category before determining the final recognition recipient. The process involves a detailed evaluation of best practices criteria across two dimensions for each nominated company. Upstream excels in many of the criteria in the AI-driven vehicle quality detection space.



RECOGNITION CRITERIA

Technology Leverage	*Customer Impact*
Commitment to Innovation	Price/Performance Value
Commitment to Creativity	Customer Purchase Experience
Stage Gate Efficiency	Customer Ownership Experience
Commercialization Success	Customer Service Experience
Application Diversity	Brand Equity

The Transformation of the AI-Driven Vehicle Quality Detection Industry

The automotive industry is undergoing a profound transformation, fueled by the increasing complexity of electric and software-defined vehicles. As vehicle platforms become more digitized and connected, traditional quality control methods become insufficient to keep pace with emerging risks. In this new landscape, artificial intelligence (AI) plays a pivotal role in redefining how automakers manage after-sales quality.

AI-driven vehicle quality detection leverages connected vehicle data, such as diagnostic trouble codes, sensor readings, and real-time telemetry, to identify potential faults proactively. Rather than waiting for issues to escalate into warranty claims or recalls, AI systems detect anomalies early, enabling faster root cause analysis and more precise countermeasures. This shift from reactive to proactive quality monitoring and detection is reshaping the operational priorities of original equipment manufacturers (OEM) and mobility providers.

One of the major advantages of AI in this context is its ability to process vast streams of data, both structured and unstructured, from diverse vehicle subsystems, identifying subtle patterns that may indicate emerging defects. This is particularly important in electric and software-defined vehicles, where many quality issues originate in software logic, firmware updates, or interactions between hardware and digital controls. AI enables a deeper level of visibility into these systems, enhancing safety, reliability, and customer satisfaction.

Moreover, as vehicles increasingly rely on remote software updates and modular electronic architectures, the integration of AI becomes essential. It helps in detecting issues before they impact the vehicle owner and supports post-fix monitoring, ensuring the effectiveness of field-deployed solutions. In doing so, AI contributes to more efficient recall management, reduced operational costs, and a stronger relationship between manufacturers and end users.

The adoption of AI-driven quality detection is also accelerating due to broader industry trends. The shift toward electrification, growing regulatory scrutiny, and the rising importance of customer experience are all pushing automakers to adopt smarter, more agile quality frameworks. AI empowers engineering and quality teams with real-time insights, helping them respond quickly to dynamic conditions and continuously refine vehicle performance after production.

In essence, AI is enhancing existing quality control processes while enabling a fundamental evolution. As automotive systems become more intelligent and interconnected, the ability to monitor, detect, and resolve issues in real time will define the next generation of competitive, resilient, and customer-centric mobility solutions.

Driving the Future of Connected Mobility

Founded in 2017 and headquartered in Herzliya, Israel, Upstream Security Ltd. (Upstream) specializes in data management and AI for connected vehicles. With a strong focus on the automotive and smart mobility industry, the company delivers cloud-based solutions that combine advanced analytics, machine learning (ML), big data, and threat intelligence to monitor modern mobility ecosystems. Upstream's expertise spans key areas such as telematics analytics, transportation security, vehicle security operations center, and automotive cybersecurity, offering manufacturers and mobility providers robust tools to protect and optimize connected fleets. Using this strong foundation in vehicle analytics for cybersecurity, the company has expanded into after-sales quality and insurance solutions. In addition to its Israeli headquarters, the company maintains a global presence with offices across the United States, the United Kingdom, Germany, France, Sweden, Italy, Japan, and Singapore, supporting its commitment to offer monitoring and detection capabilities on a global scale.

Upstream is transforming the way the mobility industry leverages connected vehicle data. Through a powerful AI-driven platform, the company enables organizations to convert raw mobility data into meaningful, actionable insights. These insights help address some of the industry's most pressing challenges, including strengthening cybersecurity and detecting quality issues early, meeting compliance requirements, and optimizing fleet performance. At a time when vehicles are becoming increasingly connected, software-defined, and data-rich, Upstream provides the intelligence and agility companies need to stay ahead.

The Upstream Platform supports the complex demands of modern mobility ecosystems. Its cloud-native architecture processes massive volumes of data, offering visibility into vehicle behavior, system health, and user interactions. This approach enables automakers to shift from reactive processes to proactive strategies. Whether the objective is to identify potential cybersecurity threats, detect anomalies before they escalate into costly warranty claims, or enable advanced data-driven analytics, Upstream provides

comprehensive software solutions delivered as a service. These capabilities help safeguard automotive assets, minimize operational risks, and uncover new opportunities for business growth.

> *"Frost & Sullivan recognizes Upstream for its visionary innovation, data-driven platform, and outstanding leadership in shaping the future of connected vehicle cybersecurity and analytics."*
>
> ***- Natalia Casanovas, Best Practices Research Analyst***

Upstream stands out for its cutting-edge technology and strong sense of purpose. The company operates on a foundational belief: everything in motion should be secure, intelligently optimized, and empowered by data. This guiding principle informs every aspect of its platform architecture, shapes internal culture, and defines how value is delivered to clients. It also underscores a broader vision, driving digital transformation across the mobility sector through insight, integrity, and high-performance solutions at scale.

At the heart of Upstream is a team anchored in core values that inspire innovation and foster genuine collaboration. The company places customer needs at the forefront, engaging with empathy, responding with agility, and developing solutions that address real-world challenges. Teamwork serves as a cornerstone of its culture, where open communication, mutual support, and shared goals drive collective success. A proactive, solution-oriented mindset fuels progress, while a strong sense of ownership ensures accountability and continuous evolution. These values extend beyond the organization itself; they shape every customer interaction, every product choice, and every strategic direction.

With a best-in-class technology stack, a rapidly evolving product roadmap, and a strong pipeline of global customers, Upstream acts as a trusted partner in the mobility space. Leading investors across the automotive, insurance, and enterprise technology sectors actively support its vision. At the same time, the company's achievements earn recognition from media, industry analysts, and global organizations alike, affirming its role as a force shaping the future of connected mobility. As vehicles become more intelligent, the need for data-driven insight will only grow, and Upstream is uniquely positioned to lead that evolution.

Frost & Sullivan recognizes Upstream for its visionary innovation, data-driven platform, and outstanding leadership in shaping the future of connected vehicle analytics for cybersecurity and after-sales quality.

Detect Early. Resolve Faster. Drive Quality.

Upstream's Proactive Quality Detection (PQD) solution leverages advanced AI and connected vehicle data to identify emerging quality issues well before they escalate into major failures or costly warranty claims. By applying ML algorithms to vast streams of real-time data, PQD enables automakers to detect problems early, significantly reducing warranty and recall expenses through faster, more efficient field investigations, reporting up to 30% acceleration in these processes.[1] By analyzing connected vehicle data, such as telematics, diagnostic trouble codes, electronic control unit behavior, and advanced driver assistance system signals in tandem with datasets like customer complaints, service records and warranty claims, PQD uncovers anomalies long before they become widespread problems.

[1] Why After-Sales Quality Strategies Must Evolve in the Age of Connected Vehicle Data and AI, Upstream, accessed August 2025

A key innovation within PQD is the creation of a live vehicle digital twin, which integrates telematics and a wide range of vehicle signals to provide a comprehensive, real-time contextualization of each vehicle's condition and state. The Compound Impact Score strengthens this holistic view by intelligently ranking issues based on severity, scale, and potential safety impact, helping teams focus investigations where they matter most. Additionally, intelligent root-cause analysis powered by ML accelerates the detection of failure patterns across entire fleets, enabling quicker resolution of underlying problems.

> *"Frost & Sullivan is impressed by Upstream's pioneering approach to AI-powered after-sales quality monitoring, its ability to harness real-time vehicle data, and its leadership in shaping a proactive, scalable future for automotive quality assurance."*
>
> ***- Joe Praveen, Associate Director***

PQD requires no in-vehicle software installation, allowing for rapid onboarding and scalable data ingestion from millions of connected vehicles. It operates within Upstream's broader AI platform, ensuring centralized visibility into vehicle anomalies while supporting compliance with key regulatory standards such as the United Nations Economic Commission for Europe World Forum for Harmonization of Vehicle Regulations Working Party 29 R155 and the International Organization for Standardization standard ISO/SAE 21434. PQD also integrates seamlessly with quality platforms, dealership workflows, and incident response playbooks to automate remediation efforts. Operating at fleet scale, the solution has the potential to accelerate the detection of approximately 70% of all quality issues and nearly 90% of electric vehicle (EV)-related issues, much earlier than traditional methods by harnessing real-time telemetry signals.[2] By detecting issues before they escalate, PQD turns real-time data into proactive action, redefining quality management as a true competitive advantage in the connected vehicle era.

Prevent, Prioritize, Perform: The Upstream Quality Edge

At the core of Upstream's approach is advanced AI and ML technology, which analyzes vast amounts of vehicle data. Leveraging the Vehicle Quality Golden Triangle, the solution assesses the scale and severity of detected issues, allowing teams to focus resources on the most critical problems. This proactive monitoring minimizes warranty claims and recall expenditures and enhances customer satisfaction by accelerating issue resolution and minimizing vehicle downtime.

Upstream's Platform integrates seamlessly within the automotive ecosystem, supporting streamlined workflows that connect quality engineers, forensic experts, and operational teams. Its use of live digital twins for vehicles and components, followed by generative AI-enhanced investigations, delivers a comprehensive and precise quality monitoring and detection system. The platform automatically categorizes detected anomalies, triggers predefined workflows, and provides a unified, real-time view of vehicle after-sales quality.

Upstream's PQD serves a wide array of vehicle verticals, from consumer cars to commercial and service vehicles, offering scalable, AI-powered monitoring that optimizes the performance and reliability of any connected vehicle. By enabling early intervention and efficient root cause analysis, the solution helps

[2] Ibid.

automakers and fleet operators reduce warranty claims, improve operational efficiency, and deliver safer, more reliable mobility experiences.

Powering the Future of After-Sales Quality with Intelligent Automation

Although internal combustion engine vehicles continue to generate the majority of complaints, EV-related issues have more than tripled since 2020, closely mirroring the rapid growth in EV adoption. Recent data shows that 68% of EV complaints in 2024 could have been detected early through connected vehicle signals, underscoring the increasing importance of leveraging real-time field data to improve quality assurance and intervene before small issues become major failures.[3]

The future of automotive after-sales quality is moving toward agentic AI, autonomous, goal-directed systems that continuously monitor vehicle behavior, detect anomalies, and initiate corrective actions in real time. Unlike traditional analytics, this approach integrates structured and unstructured data from telematics, service records, diagnostic trouble codes, over-the-air update logs, and consumer feedback to create a closed-loop feedback system. This enables dynamic intervention, root cause identification, parts demand forecasting, and continuous validation of repairs, all with minimal human oversight.

In a landscape where software increasingly defines the vehicle experience and customer trust is vital, these intelligent solutions deliver operational efficiency and a strategic advantage in delivering safe, reliable, and future-ready mobility.

Frost & Sullivan is impressed by Upstream's pioneering approach to AI-powered quality monitoring and detection, its ability to harness real-time vehicle data, and its leadership in shaping a proactive, scalable investigations and countermeasures for automotive after-sales quality teams.

Real-World Use Cases: How Upstream Powers Proactive Quality Detection

The following real-world use cases show how automotive manufacturers use Upstream to uncover hidden patterns, accelerate root-cause analysis, and take early, effective action. By combining connected vehicle telemetry with structured enterprise data, these examples illustrate how OEMs evolve from problem-fixing to data-driven quality strategies that prevent issues at scale.

1. Inverter Power Supply Failure in EVs[4]

Electric and hybrid vehicles experienced sporadic loss of propulsion, especially under sudden acceleration. Traditional diagnostics failed to uncover the root cause, leading to repeated service visits and frustrated customers. Upstream's PQD identified a pattern of torque discrepancies aligned with sharp inverter temperature spikes, revealing an intermittent electrical fault in the power supply. By enabling early detection, PQD helped prevent component damage, reduce warranty claims, and improve fleet-wide reliability.

[3] Why After-Sales Quality Strategies Must Evolve in the Age of Connected Vehicle Data and AI, Upstream, accessed August 2025

[4] *Case Studies: How AI Helps Detect Vehicle Quality Issues Earlier*, Upstream, accessed August 2025

2. Active Grille Shutter (AGS) Malfunctions[5]

Multiple internal combustion engine vehicles showed signs of inefficient thermal regulation, stemming from stuck AGS units. These failures resulted in overheating or suboptimal engine temperatures, degrading performance and fuel economy. PQD linked the issue to specific AGS production batches, allowing OEMs to target replacements precisely. The result: faster root-cause analysis, reduced warranty claims, and averted potential large-scale recalls.

3. Recurring Fuel Pump Sensor Faults[6]

Despite being a known defect, faulty fuel temperature sensors embedded in the fuel pump assemblies caused drivability issues across several model years. PQD implemented a two-pronged detection system: one targeting individual vehicles with relevant fault signatures, and another scanning the fleet for similar patterns. This dual-layered approach enabled OEMs to act swiftly, minimizing disruptions, avoiding unnecessary part replacements, and protecting their brand reputation.

Together, these examples underscore Upstream's role in helping OEMs detect issues sooner, act faster, and drive continuous quality improvement across the vehicle lifecycle. By embedding AI-driven detection and analysis into everyday operations, PQD empowers manufacturers to act on insights the moment they emerge, taking swift, targeted measures that prevent issues from impacting safety, performance, or brand reputation. Through its combination of advanced analytics, intelligent automation, and deep industry expertise, Upstream is redefining how automakers and mobility providers manage vehicle quality in the connected era.

Conclusion

As vehicles become increasingly connected, electrified, and software-defined, traditional approaches to after-sales quality can no longer meet the demands of modern mobility. Upstream is leading the transformation with a proactive, artificial intelligence (AI)-powered platform that equips manufacturers and mobility providers with the tools to detect, prioritize, and resolve quality issues at scale, long before they escalate into costly warranty claims or customer satisfaction concerns. By leveraging real-time connected vehicle data and intelligent automation, the company enables a shift from reactive to proactive strategies, driving greater operational efficiency, enhanced safety, and stronger customer trust. In doing so, Upstream is not just improving how quality is monitored; it is shaping the future of intelligent mobility and setting a new standard for excellence in the automotive industry.

With its strong overall performance, Upstream earns Frost & Sullivan's 2025 European Enabling Technology Leadership Recognition in the AI-driven vehicle quality detection industry.

[5] Ibid

[6] Ibid

What You Need to Know about the Enabling Technology Leadership Recognition

Frost & Sullivan's Enabling Technology Leadership Recognition is its top honor and recognizes the market participant that exemplifies visionary innovation, market-leading performance, and unmatched customer care.

Best Practices Recognition Analysis

For the Enabling Technology Leadership Recognition, Frost & Sullivan analysts independently evaluated the criteria listed below.

Technology Leverage

Commitment to Innovation: Continuous emerging technology adoption and creation enables new product development and enhances product performance

Commitment to Creativity: Company leverages technology advancements to push the limits of form and function in the pursuit of white space innovation

Stage Gate Efficiency: Technology adoption enhances the stage gate process for launching new products and solutions

Commercialization: Company displays a proven track record of taking new technologies to market with a high success rate

Application Diversity: Company develops and/or integrates technology that serves multiple applications and multiple environments

Customer Impact

Price/Performance Value: Products or services offer the best ROI and superior value compared to similar market offerings

Customer Purchase Experience: Purchase experience with minimal friction and high transparency assures customers that they are buying the optimal solution to address both their needs and constraints

Customer Ownership Excellence: Products and solutions evolve continuously in sync with the customers' own growth journeys, engendering pride of ownership and enhanced customer experience

Customer Service Experience: Customer service is readily accessible and stress-free, and delivered with high quality, high availability, and fast response time

Brand Equity: Customers perceive the brand positively and exhibit high brand loyalty, which is regularly measured and confirmed through a high Net Promoter Score®

Best Practices Recognition Analytics Methodology

Inspire the World to Support True Leaders

This long-term process spans 12 months, beginning with the prioritization of the sector. It involves a rigorous approach that includes comprehensive scanning and analytics to identify key best practice trends. A dedicated team of analysts, advisors, coaches, and experts collaborates closely, ensuring thorough review and input. The goal is to maximize the company's long-term value by leveraging unique perspectives to support each Best Practice Recognition and identify meaningful transformation and impact.

		VALUE IMPACT	
STEP		WHAT	WHY
1	**Opportunity Universe**	Identify Sectors with the Greatest Impact on the Global Economy	Value to Economic Development
2	**Transformational Model**	Analyze Strategic Imperatives That Drive Transformation	Understand and Create a Winning Strategy
3	**Ecosystem**	Map Critical Value Chains	Comprehensive Community that Shapes the Sector
4	**Growth Generator**	Data Foundation That Provides Decision Support System	Spark Opportunities and Accelerate Decision-making
5	**Growth Opportunities**	Identify Opportunities Generated by Companies	Drive the Transformation of the Industry
6	**Frost Radar**	Benchmark Companies on Future Growth Potential	Identify Most Powerful Companies to Action
7	**Best Practices**	Identify Companies Achieving Best Practices in All Critical Perspectives	Inspire the World
8	**Companies to Action**	Tell Your Story to the World (BICEP*)	Ecosystem Community Supporting Future Success

*Board of Directors, Investors, Customers, Employees, Partners

About Frost & Sullivan

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The Growth Pipeline Generator™

Frost & Sullivan's proprietary model to systematically create ongoing growth opportunities and strategies for our clients is fuelled by the Innovation Generator™.

Learn more.

Key Impacts:

- **Growth Pipeline:** *Continuous Flow of Growth Opportunities*
- **Growth Strategies:** *Proven Best Practices*
- **Innovation Culture:** *Optimized Customer Experience*
- **ROI & Margin:** *Implementation Excellence*
- **Transformational Growth:** *Industry Leadership*

The Innovation Generator™

Our 6 analytical perspectives are crucial in capturing the broadest range of innovative growth opportunities, most of which occur at the points of these perspectives.

Analytical Perspectives:

- Megatrend (MT)
- Business Model (BM)
- Technology (TE)
- Industries (IN)
- Customer (CU)
- Geographies (GE)