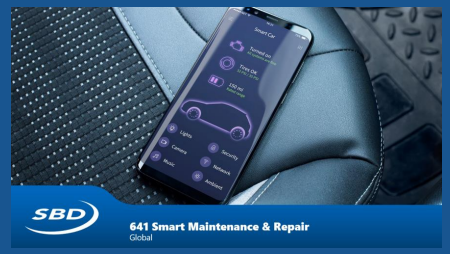

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639 – Features-as-a-Service

This report takes a deep dive into the FaaS eco-system, identifying which features are most likely to succeed while measuring its real-world success to date.

Further insights into the regulatory implications of FaaS are provided to help OEMs develop their own strategies.

#641

CON

Connected & Mobility Services

Smart Maintenance & Repair

In today's after-sales experience, connected vehicle data is already being used to optimize vehicle maintenance and assist incident response efforts. As automotive technologies advance and become more integral to the vehicle lifecycle, impacting the way vehicles are produced to how customers interact with them, a similar shift is taking place in the aftersales market.

This is because the sector is now entering its next phase through future pairings with new AI-enabled technologies and smart repair solutions. While these technologies, such as predictive maintenance, are being implemented by select OEMs today, the larger ecosystem is still in the early stages of maturity. As such, players wishing to enter the space must be equipped to build it into their broader connected service business strategy while understanding the regulations governing these solutions in different regions.

The Smart Maintenance & Repair report navigates the growing ecosystem of smart repair systems today while highlighting how it is expected to evolve in the future. In addition to outlining the market drivers and ROI potential for predictive maintenance, it evaluates how AI and AR solutions can support the wider smart maintenance and repair landscape. Early-adopter case studies work similarly to demonstrate the value and challenges of this landscape across different markets.

COVERAGE	FREQUENCY	PUBLICATION FORMAT	PAGES
GLOBAL, NA, CHINA, EUROPE	ANNUALLY, QUARTERLY, ONE-OFF	PDF, POWERPOINT, EXCEL, ONLINE	95

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Key questions answered

- What is the market driver and ROI for predictive maintenance?
- What regulatory hurdles could derail programs in different regions?
- How ready are AI and Augmented Reality solutions to support smart maintenance & repair?
- What role will insurers and regulators play in the modernization of repair processes?

This research supports

- PRODUCT PLANNERS
- IT
- MARKETING
- UX

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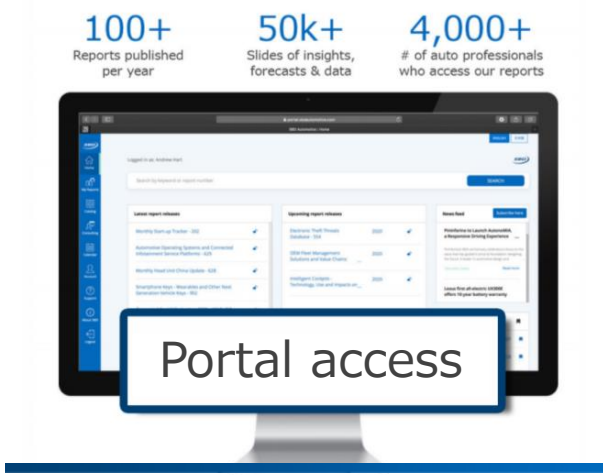

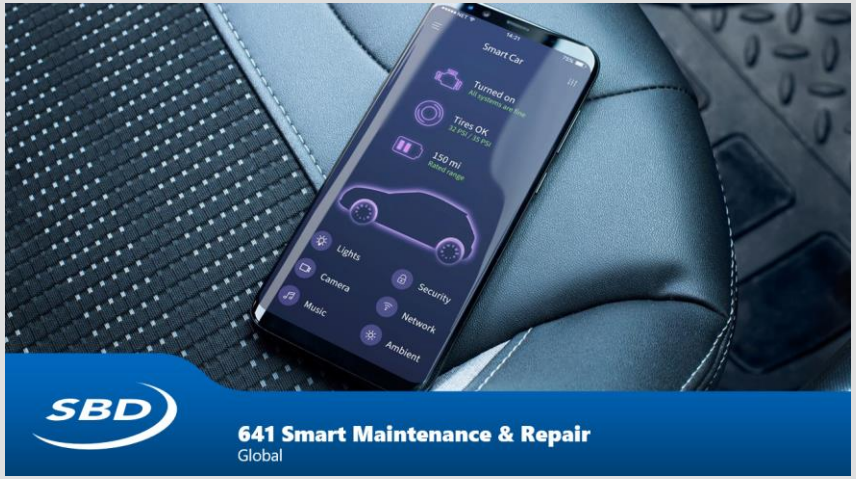

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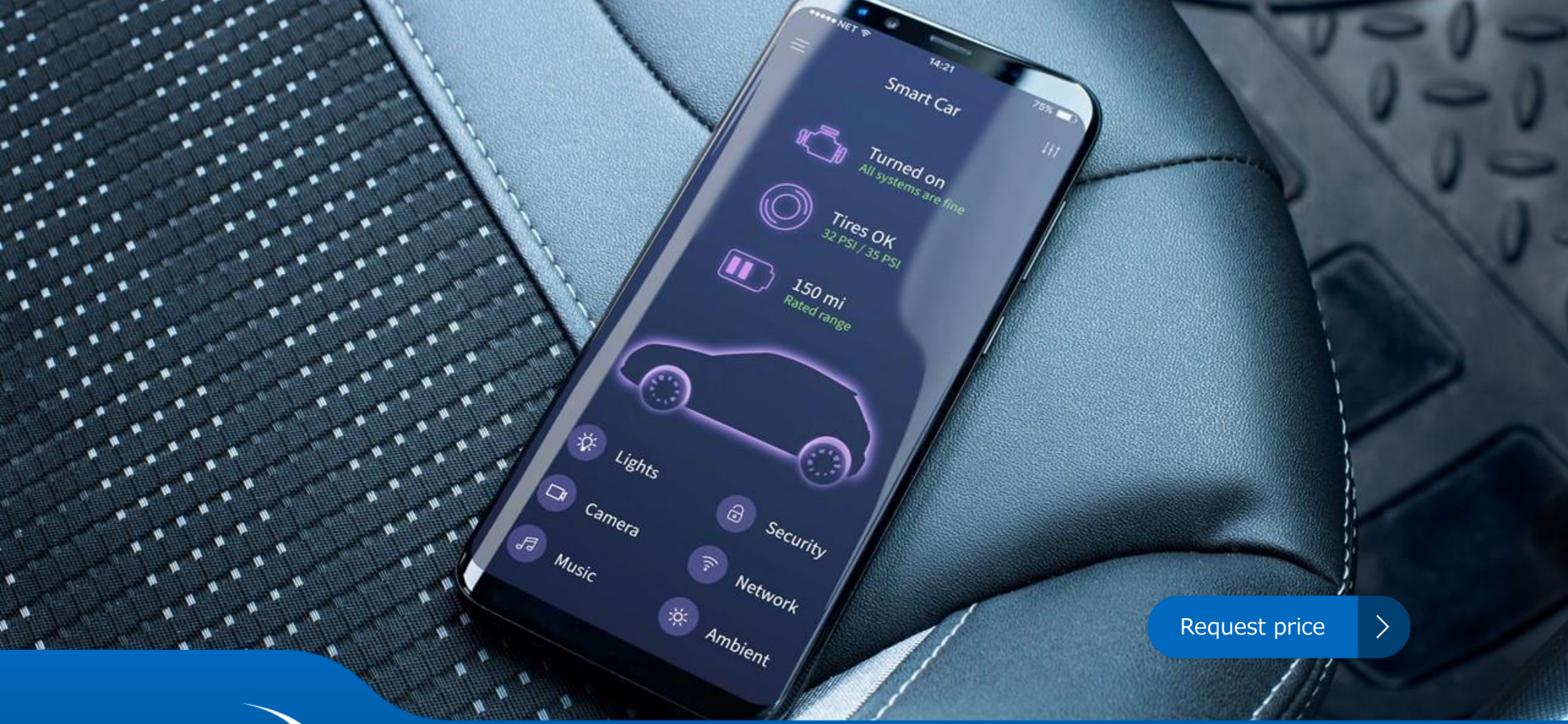

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641 Smart Maintenance & Repair

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Introduction

Introduction

Vehicles are becoming increasingly intelligent, particularly in recent years with the development in advanced technologies such as IoT, Big Data, Data Analytics, AI, cloud computing. As a result, modern cars have become safer, more autonomous, and **data-driven**. They can be **connected** to a wide variety of things in their surroundings including other vehicles, pedestrians, devices, infrastructure, grid, and smart homes.

Similarly, user experience has become a focus of all OEMs, from a service design perspective, the maintenance and repair contribute a big portion of experience and this part has been missed in many OEMs' radar but is very crucial to consumers.

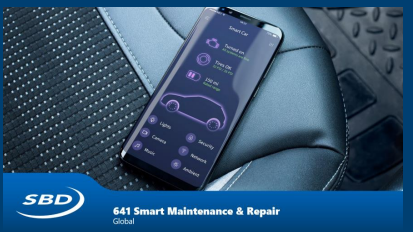
Given all this, routine car maintenance is not enough for modern vehicles that include millions of lines of code and are equipped with a variety of sensors and devices. Thus, automotive businesses are now increasingly moving from preventative maintenance to **predictive** maintenance, also called **Smart Maintenance & Repair** in this study.

But how should predictive maintenance in the automotive industry be implemented? What benefits does it have? And what technologies are used? What are the key success factors and barriers for those major players?

Here, you will discover what the race ahead looks like for smart maintenance and repair, with the current competition in the automotive industry identified along with the hurdles which must be jumped.

Section	Content
Executive Summary	The new age for automotive maintenance and repair is ready technically, but not in reality. Some pioneers are already taking the advantage of Smart Maintenance and Repair service to enhance customer experience, operation efficiency and getting new revenue from redesigned aftersales services, but the nirvana is going to need huge over hall and collaboration.
What? **The Basics**	Throughout the race to smart maintenance and repair, a range of different hurdles will be encountered and must be jumped to reach the end goal. The main body of this chapter will show these hurdles in more detail and give examples industry examples of where we are today, and the industry is headed.
Why? **Motivation**	The potential benefits of Smart Maintenance & repair along with an explanation of motivations behind each player in the ecosystem.
Who? **Leading Competitors**	Which players are offering current generation Smart Maintenance & repair services and who is pushing the state of the art and beyond. OEM groups are listed along with their current global offerings and recently announced services.
How? **Jumping the Hurdles**	Deep dive into more detail surrounding each of the hurdles identified. Hurdles are explained in greater detail and how they can be jumped to enable progress towards a smart maintenance and repair model.
When? **The Race Ahead**	Issues of feasibility are addressed with the jumping of hurdles, and these are considered against time to drive the timing of Smart Maintenance & repair use case introduction.
Next Steps	Can SBD help you with any unanswered questions?

Example slides from the report



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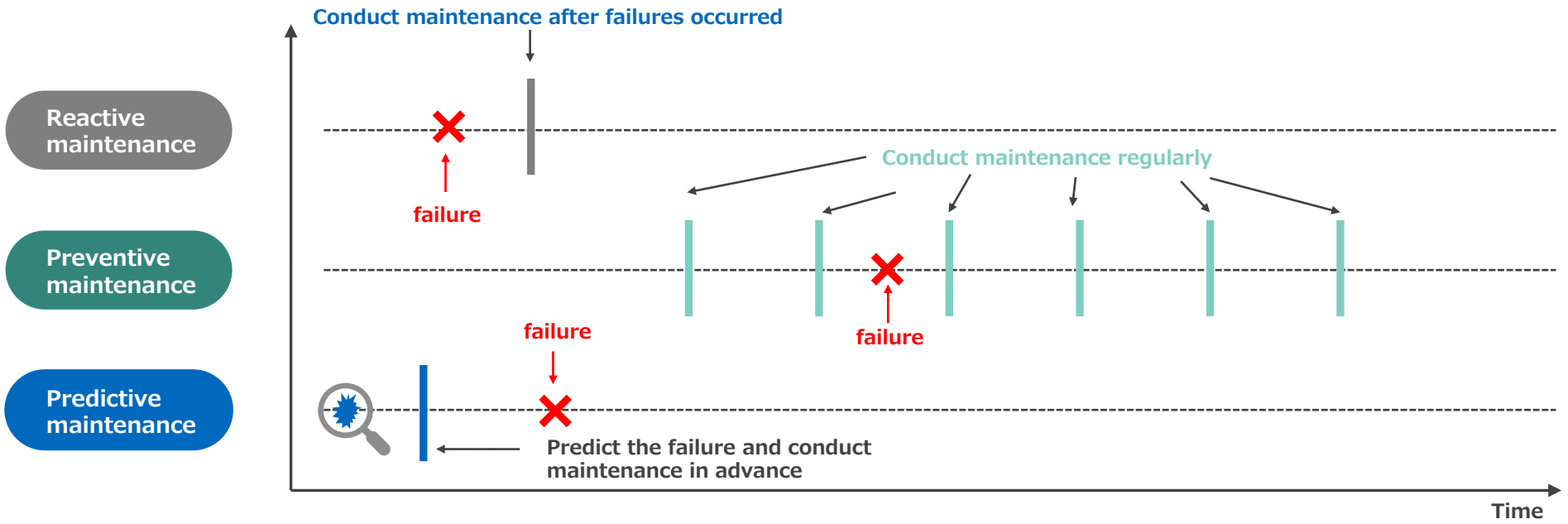
Different Maintenance Strategies



Reactive maintenance (Run-to-Failure)

where maintenance interventions are performed only after the occurrence of failures. This approach is common when equipment failure does not significantly affect operations or productivity.

Preventive maintenance

Time-based maintenance or scheduled maintenance, which involves taking the necessary precautions and actions to reduce the likelihood of equipment failure and prevent accidents or failures before they occur. It is performed regularly while the equipment is still running so that it does not fail unexpectedly. Therefore, in terms of complexity, this maintenance strategy lies between run-to-failure and predictive maintenance.

Predictive maintenance

which employs condition-monitoring technology to measure equipment performance through IoT systems that allow the connection of electronic devices to mechanical and digital machines and the collecting of a significant amount of data. Data are collected over time to monitor the state of equipment and construct models that can help prevent failures.

Vehicle life is extended via smart maintenance & repair

Identifying faults and their causes early can prevent unnecessary further damage to the vehicle and its components as well as mitigating the risk of terminal failures. With a predictive approach to maintenance, overall vehicle lifespans can be increased. The consumer can enjoy increased levels of reliability over a longer period, getting more up-time from their vehicle.

Longer vehicle life

\+

Longer period of ownership

=

$

Greater utilization of vehicle as a return on initial purchase investment

With vehicles lasting longer, comes the opportunity for OEMs to push a greater number of OTA updates and potential feature upgrades to the vehicle. For example, monetizing infotainment upgrades for older vehicles, especially those purchased from private dealers and not directly from the OEM.

Longer lasting vehicles, Especially EVs may have a positive effect on the environment.

OEM Motivation

Longer vehicle life spans means OEMs can provide more OTA updates to deliver mid-life updates and feature offerings creating extra revenue. Increased value of product to customer allows for higher prices and more competition against competitors.

Consumer Motivation

Consumer receive more return on their invest in the form a more durable and longer lasting product.

After-Market Motivation

Longer vehicle life results in a greater opportunity for maintenance and repair via aftermarket repair shops.

Supply Chain Motivation

As overall vehicle life is extended, this presents opportunity for a greater number of replacement parts to be supplied to dealers and repair shops.

Software & Ecosystem Motivation

Who is doing what?

		Generation 2.0 *Serving the Connected Vehicle*			Generation 3.0 *Serving the Updateable Vehicle*	
OEM Group	**Brand**	**Diagnostics to Service Center / OEM**	**Diagnostic Customer Alert**	**Proactive Alert**	**Launched or launching activities**	**Case Study Included**
SAIC Motor (Continued)	Roewe		✓	✓		
	SAIC R		✓	✓		
	Wuling		✓			
Stellantis	Alfa Romeo	✓	✓	✓		
	Chrysler		✓	✓		
	Citroen		✓	✓		
	Dodge		✓	✓		
	DS	✓	✓			
	Fiat		✓	✓		
	Jeep		✓	✓		
	Opel	✓	✓	✓		
	Peugeot	✓	✓			
	RAM		✓	✓		
Subaru Corporation	Subaru		✓	✓		
Suzuki Group	Suzuki					
Tata Motors Group	Jaguar		✓	✓		
	Land Rover		✓	✓		
Tesla Motors	Tesla	✓	✓	✓	Predictive Maintenance (Gen 3.0)	✓

Powertrain noise detection system from Hyundai

The Company ▶ Hyundai

When ▶ 2019

The Solution ▶ KSDS（Knock Sensor Detection System）

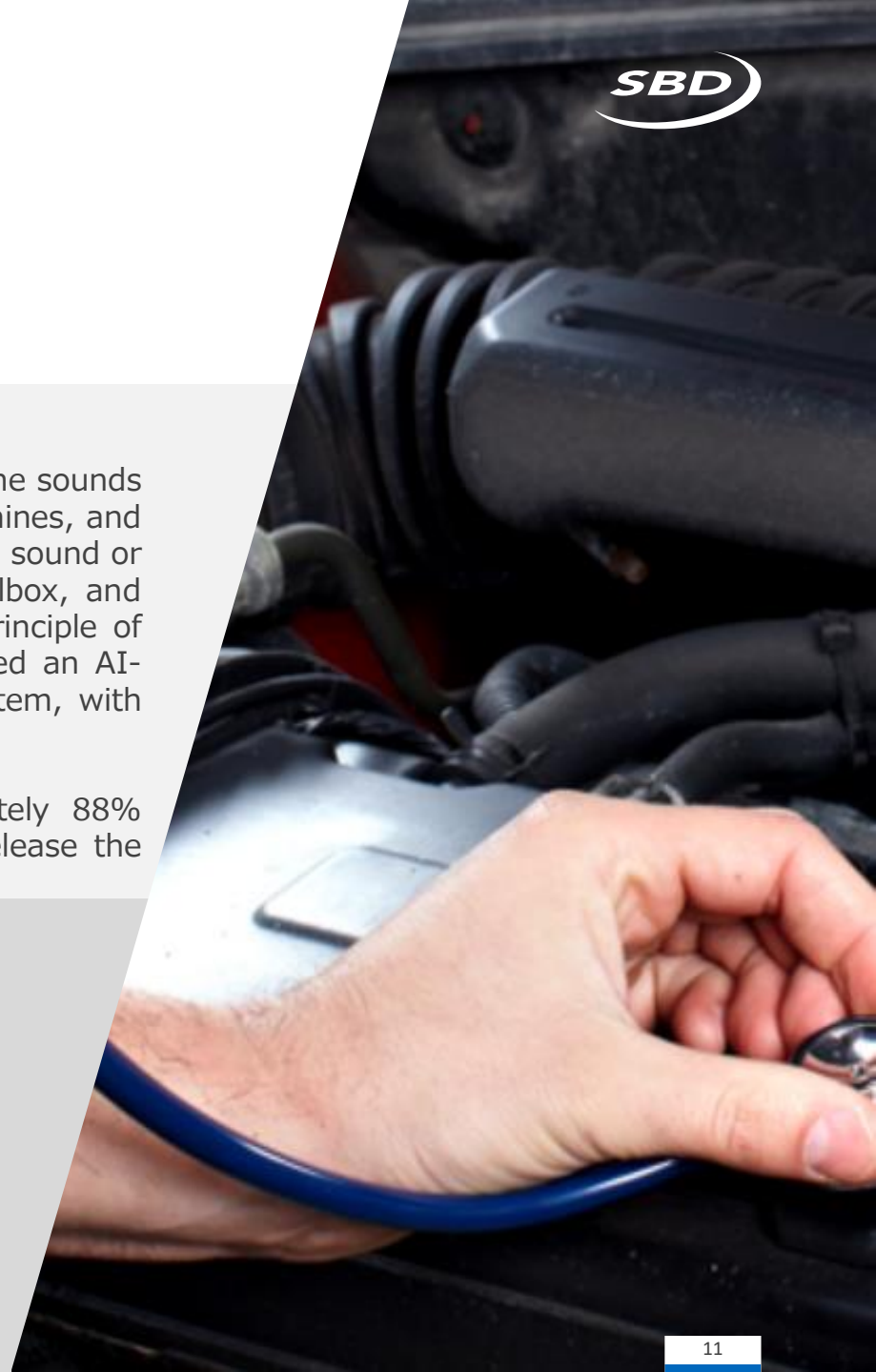
The Story

Experienced mechanics are often capable of identifying very specific faults in the car, just from the sounds of an idling engine. Essentially, they are attuned to the baseline sounds of well-maintained machines, and abnormal sounds among those sounds are identifiable by ear. The practice of identifying faults by sound or vibrations is rather common. Automobile sound scope is a staple in the auto-mechanic's toolbox, and when one is not available, long flat screwdrivers are used to similar effect. Based on that principle of identifying specific sounds, Hyundai and Kia Motors Namyang R&D Center has nearly perfected an AI-powered fault detection and diagnosis system. Finishing touches are being put on the AI system, with plans to deploy it into the frontlines of automobile service.

This AI-based powertrain fault detection and diagnosis technology works with approximately 88% accuracy as of now. The lab engineers aim to surpass 90% accuracy within the year and release the technology to automobile service centers.

Insights

- The solution is focused on powertrain noise detection, whereby the powertrain is the most expensive and complicated part of a traditional vehicle.
- Accuracy exceeding 90% is seen as a critical breakthrough in automobile maintenance industry
- The service announced in 2019 was not only reducing car maintenance costs but also boosting consumer confidence and brand image.
- Key steps to develop the system include: collection of data samples (sounds), analysis of sound signatures, extraction of specific vectors, AI learning and finally field Diagnosis.



Identified Hurdles in the Smart Maintenance & Repair race

In the chapter ‘The Basics’ the following hurdles were identified against a series of shifts occurring in the industry.

Shifting from Yesterday…

Identified Hurdles

…to Tomorrow

Shifting from Yesterday…	Identified Hurdles	…to Tomorrow
Onboard Diagnostics	Vast majority of carpark to be connected	**Connected First**
Reactive	Continuously improving algorithms	**Preventative**
Updateable	Updateable to the ‘corners’	**Software Defined**
Functional Defined Cloud	Collaborative Interconnected Platforms	**Continuous Cloud**
Dealer Led Servicing	Health Ready Components	**Open Transformed Market**
Linearly Scaled Teams	Maintenance Robots	**Optimized Tech Led Skills**

Large amounts of real data

Digital Twin

Skilled Human Resources

The race ahead for OEMs

2020 | 2022 | 2024 | 2026 | 2028 | 2030 | 2032

Diagnostic Customer Alert

Large amounts of real data

Health Ready Components

Updateable to the 'corners'

Predictive Maintenance (Gen 3.0)

Collaborative Interconnected Platforms

Opportunities present in the aftermarket industry by providing data and tool to other service providers

Vast majority of carpark to be connected

Continuously improving algorithms

Diagnostics to Service Center / OEM

Proactive Alert

Vehicle Health Monitoring

Tailored Actuation

Digital Twin

Maintenance Robots

Quicker job completion results in high throughput.

Optimized testing and configuring method can be utilized to validate the products' robustness on sub-set vehicles before full roll-out on wider fleets, which can mitigate the risk of recall and minimize the cost during warranty period

Fully Managed Service Networks

A lower ownership cost can encourage customers to increase their budget in other areas.

By providing a more reliable vehicle the brand image will be improved

Key

Use Case

Hurdle
When can hurdle be Jumped?

Stakeholder Motivation

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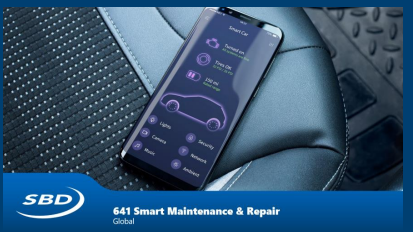

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