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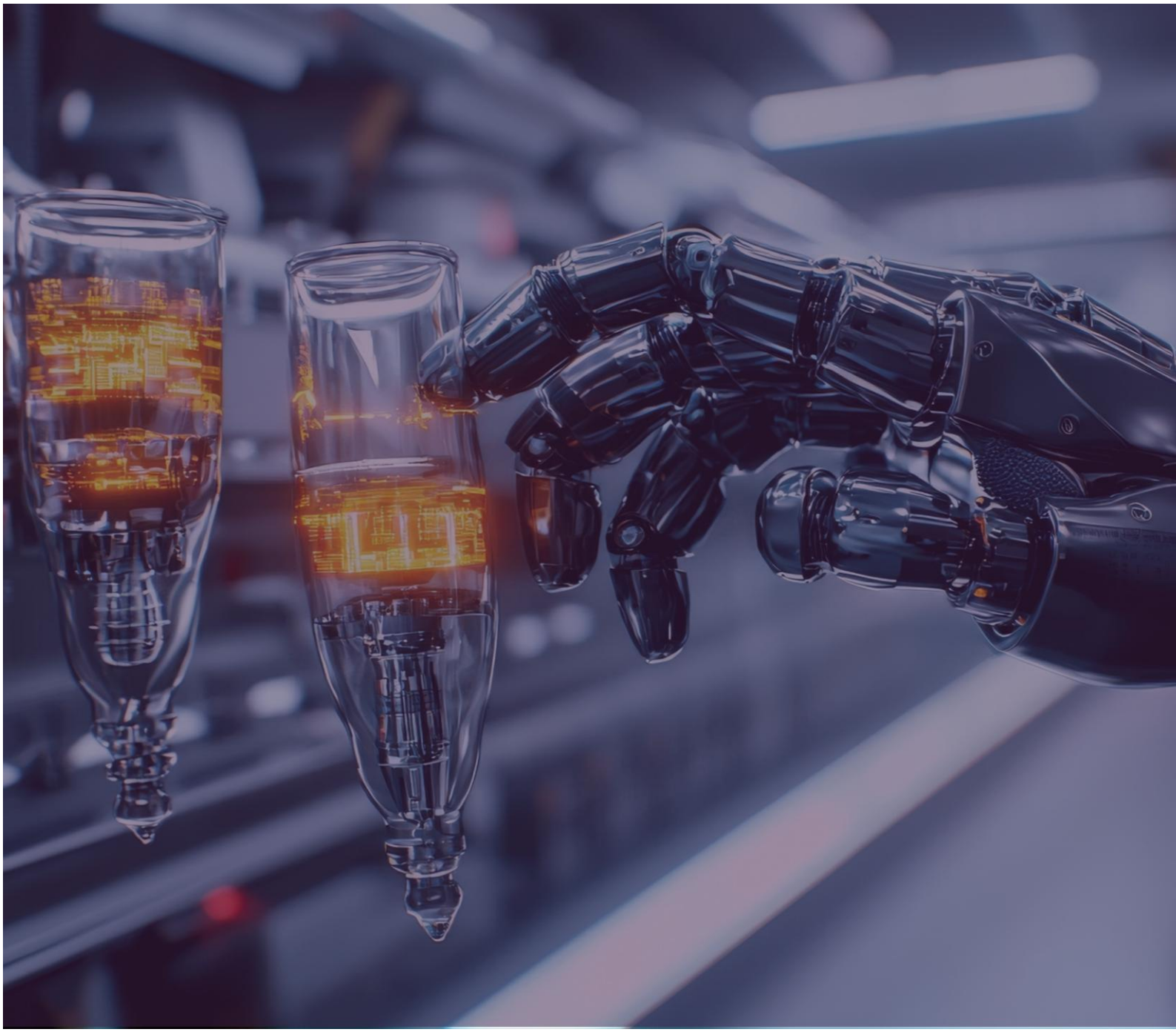


The Future of Lubricants is Intelligent: How is AI Innovating the Global Lubricants Industry?

Whitepaper

April 2026

Contents

1. Global lubricant industry is a mature market leading to rise in demand for innovation

Is the Market shifting its focus from a traditional "product-selling" model?

The global lubricant industry is a high-volume, mature market projected to grow at a CAGR of approximately 1%–2% over the next decade. This modest growth trajectory underscores the need for strong differentiation strategies that can serve as true game changers in an increasingly competitive landscape. In response, digitalization has emerged as a critical growth lever, especially post-COVID-19, enabling the industry to transition from a traditional "product-selling" model to "performance-driven" and "value-added" solutions. By integrating digital tools across operations, lubricant manufacturers are improving blending efficiency, optimizing maintenance practices, and enhancing the overall customer experience.

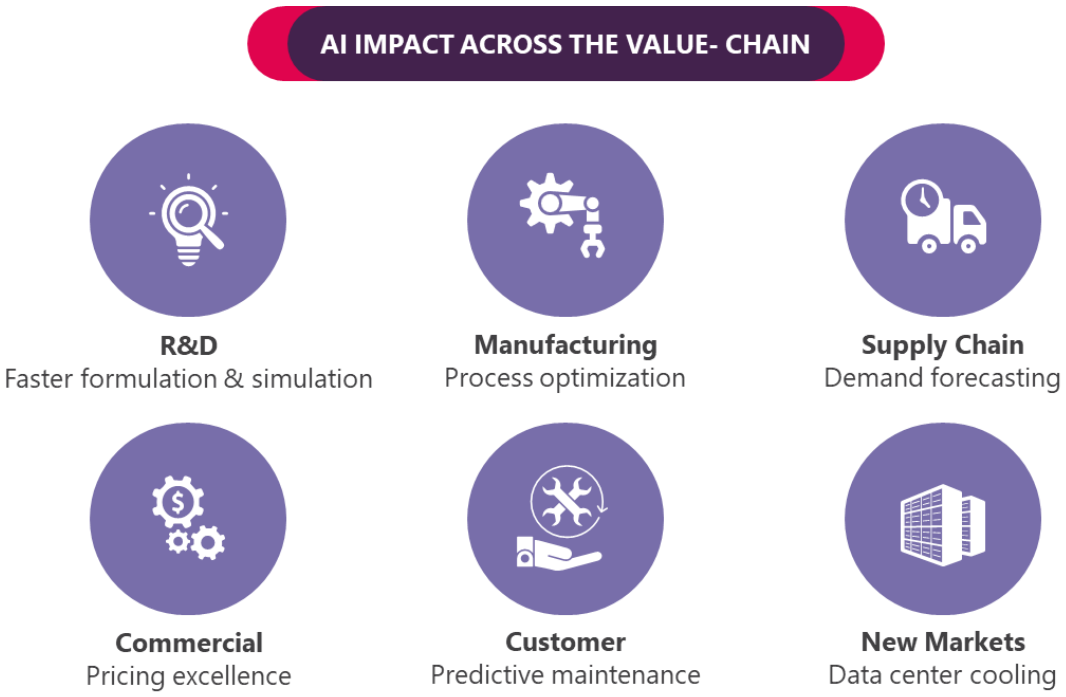
Transition from traditional digitalization to AI-enabled experiences

While the initial objective of digitalization was to streamline repetitive manual processes through automation, the rapid advancement of artificial intelligence (AI) has significantly expanded the scope of transformation. AI is now enabling new avenues for real-time analysis, enhanced predictive maintenance, and next-generation customer experiences.

This paper explores the role of artificial intelligence in the global lubricant industry and how lubricant companies are leveraging these technologies to strengthen and future-proof their growth strategies.

2. AI establishing as a Competitive Differentiator

Artificial Intelligence (AI) is increasingly strengthening the competitive positioning of lubricant suppliers, evolving from a technological experiment to a critical strategic differentiator.



In a mature market, lubricant companies traditionally compete across four key pillars: product performance, customer value, pricing, and brand reputation. AI capabilities are now enhancing each of these pillars by enabling data-driven innovation and decision-making. For instance:

- **Product performance -** AI-based formulation modeling and advanced simulation
- **Customer value -** chatbots, predictive maintenance and equipment intelligence
- **Pricing -** dynamic pricing, advanced analytics and real-time price tracking
- **Brand reputation -** innovation leadership and digital services

AI moving beyond pilots to deliver measurable value

AI in the global lubricants industry is promptly transitioning from just "experiments" and "pilots" to "measurable" and "scalable" solutions implemented across the value-chain. This is in line with industry's increasing demand for continuous and real-time insights rather than on-demand or one-time optimization.

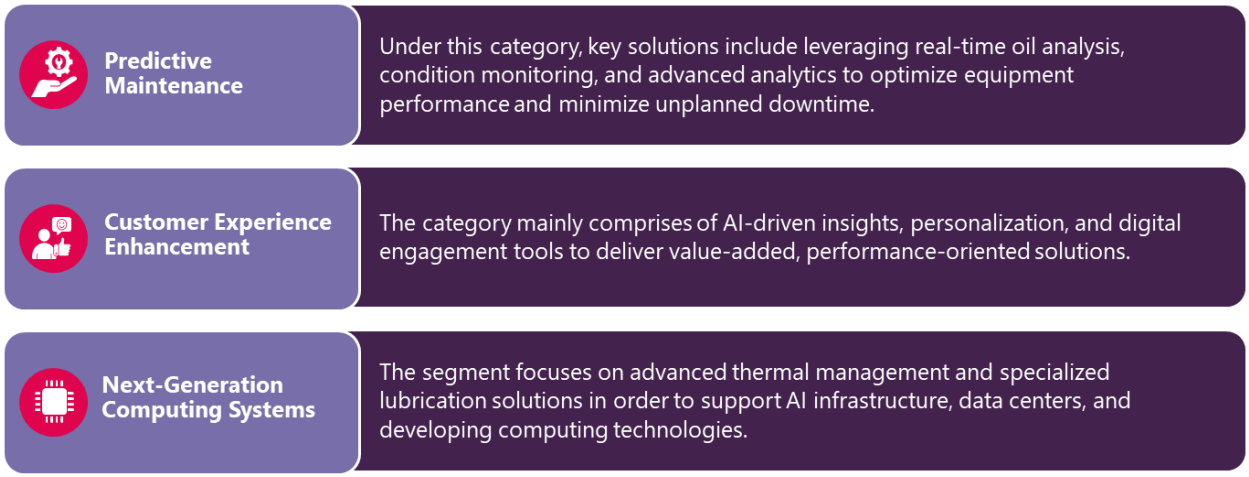
AI SOLUTIONS	MEASURABLE IMPACT as of March'2026
Predictive Maintenance	As per a report by McKinsey, AI enablement in predictive maintenance is able to cut maintenance downtime by around **30%-50%.** This could lead to an increase in machine life by **20%-40%** and decrease in maintenance costs by **10%-40%.**
AI in R&D	According to EY report, early adopters implementing AI solution in R&D in chemical industry are able to reduce R&D time by 80% and significant cost savings. While lubricant industry is still processing the measurable impact in this area, it is estimated that AI in R&D could lead to ***a) Reduction in cost per formulation b) Increase in product development processes c) Lower no. of trial-and-error leading to decrease in lab/testing costs***
AI in Supply Chain	According to McKinsey's report, early adopters implementing AI in Supply Chain are able to lower *around **10%-15%** logistics costs, around **20%** inventory costs, **up to 15%** reduction in procurement costs and some level of demand planning costs.*
Customer Experience	Lubricant suppliers using AI for enhancing customer experience can increase customer satisfaction level by **15%-20%.** In addition, it can also lead to ***a) Lower investment in call centers and support teams b) Reduction in number of customer care tickets c) Lesser manpower***
Immersion Cooling in Datacenters	Around **35%-37%** reduction in energy cost leading to significant operating cost savings

Source: Evalueserve Insights, McKinsey, EY.

3. Key AI solutions widely adopted in the global lubricant industry

Currently, AI applications in the global lubricant industry can be bucketed into three different areas.

Figure 1: AI solutions adopted in global lubricants industry

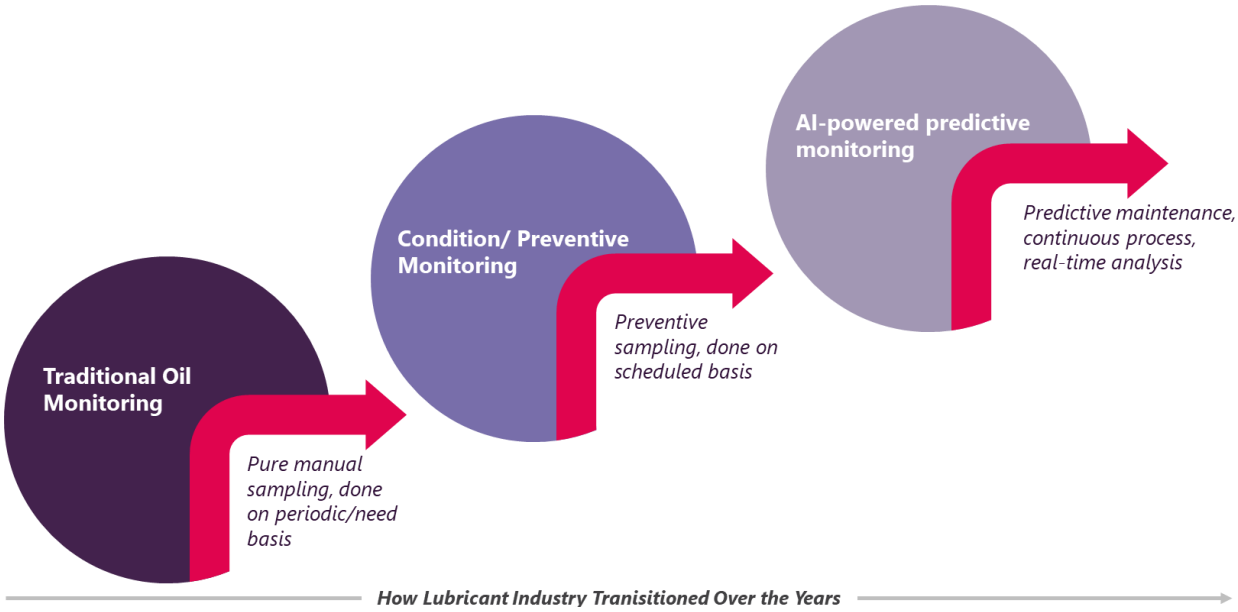


Source: Evalueserve Insights

4. How is AI enhancing predictive maintenance tools offered by lubricant companies?

1. While traditional oil monitoring and maintenance denoted manual sampling and periodic analysis, AI-powered oil condition monitoring enables **real-time streaming** and **predictive maintenance**. This entails combining sensor data, oil sample analysis, and equipment conditions to simultaneously monitor oil health and machine operating parameters, which in turn provide early alerts prior to any failure or wear and tear, thereby lowering overall costs.

Figure 2: Transition of lubricant industry over the years



Source: Evalueserve Insights

2. With the help of AI-based monitoring, end-customers can recognize patterns that can help in identifying any kind of **early warnings** of **unusual oil conditions or machine health**. This is achieved by analyzing historical oil condition and equipment behavior datasets. As this is conducted on a real-time basis, the detection accuracy is higher compared to traditional monitoring, which was performed on a periodic or need basis.
3. Estimating **Remaining Useful Life (RUL)** of oil and equipment s another crucial benefit of using AI-based monitoring. Through advanced AI models, one can study degradation trends of oil and machine conditions, which in turn helps in predicting overall oil life. Through RUL, oil can be replaced as required, i.e., instead of changing oil at fixed drain intervals, end customers can replace or refill oil in case of any issue in machine performance. This not only helps predict lubricant life but also minimizes any form of waste.

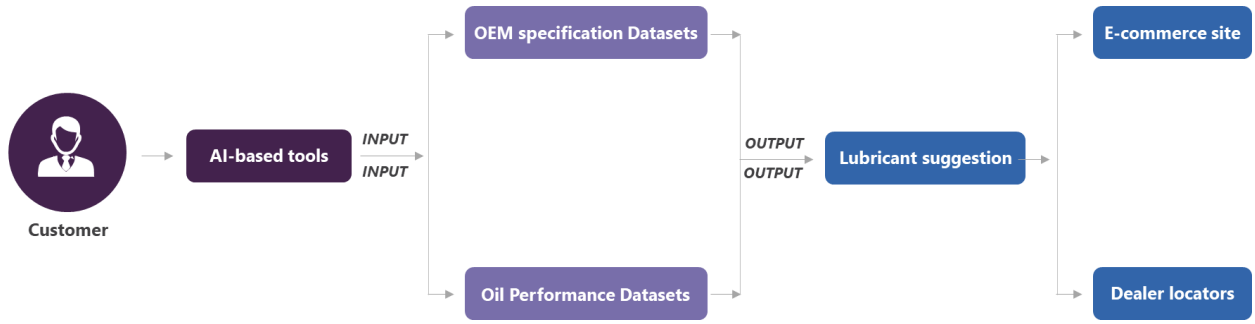
A range of digital maintenance tools that have deployed AI in recent years include:

- **Shell**: Lube Analyst, LubeMonitor, Remote Sense, Machine Max, Lube Video Check
- **ExxonMobil**: Mobil Serv Oil Analysis, Mobil Serv Cylinder Condition Monitoring
- **TotalEnergies**: LubAnac, TIG 6, MyLubmarine monitor, LubDiag
- **Chevron**: LubeWatch
- **Castrol**: Castrol Intelligent Lubrication Solutions (CILS), Castrol SmartMonitor, Castrol SmartOil, Castrol SmartControl
- **FUCHS**: FUCHS OilAnalyzer, FluidsConnect

5. Is AI capable of improving end-customer experience in the long-run?

- Finding the right oil for a vehicle is still a challenge for many vehicle owners. Through AI-based tools, vehicle owners can choose a perfect product solution instantly keeping in mind multiple variables such as vehicle make/model, mileage, engine and OEM specifications.
- For instance, Shell's LubeMatch, ExxonMobil's Mobil Product Selector, TotalEnergies's LubAdvisor / LubConsult, FUCHS' Oil Chooser, Castrol's Oil Selector, Valvoline's Vehicle Oil Finder.

Figure 3: AI tools enhancing customer-experience



Source: Evalueserve Insights

- AI-based conversational **chatbots** provide **24X7 support to vehicle owners**. Nowadays, most lubricant companies have enabled chatbots on their websites, applications, and other platforms. This means a vehicle owner can use these AI-based chatbots at any time to seek assistance or answers related to product grades and viscosities, product features and benefits, alternate options, and retailers and workshops available in nearby locations. These chatbots are interactive in nature, available at all times (not limited to business hours), and capable of providing instant responses. For example: **Shell's LubeChat**
- Lubricant companies are also exploring the use of AI-based models in **e-commerce**. This includes enhancing product recommendations and suggesting personalized choices on e-commerce platforms based on historical purchase data, user location, browsing patterns, and vehicle data.

6. AI's accelerating role in R&D and formulation

Simulation-based innovation is emerging as a key trend in R&D and formulation as the industry shifts from trial-and-error experimentation to predictive performance. For instance, **NobleAI**, a US-based technology provider, is now offering AI-driven predictive tools to lubricant suppliers that help in testing new formulations by analyzing historical formulation data while meeting regulatory requirements.

Speed and accuracy are crucial requirements in lubricant formulation testing, and AI is helping the industry achieve these necessary conditions. Through AI, large datasets of base oils and additives can be analyzed efficiently, resulting in a reduction of development cycles by almost 50%. **Shati Chemicals FZCO**, a UAE-based supplier and distributor of base oils, additives, and private-label lubricants, is using AI-based innovative tools for faster formulations and reduced development cycles.

With the rising demand for application-focused lubricants such as immersion coolants and e-fluids, the need for enhanced lubricants is continuously increasing. This means the lubricant industry is demanding a **faster rate of discovery** coupled with **shorter time-to-market** from lubricant suppliers. With the help of AI, lubricant formulations can be rigorously tested via virtual screening under various environmental conditions.

Currently, some of the most common AI models widely used in the global lubricants industry for testing and development are **fuzzy logic, artificial neural networks (ANNs), and convolutional neural networks (CNNs).** ANNs were among the first AI models used for testing in the 1990s. The first step is to predict lubricant performance based on the input data used. Then, the deviation between the predicted results and the actual performance is calculated. The next step is to understand the gap and, in order to reduce the loss, adjust the parameters to derive more accurate results.

CNN models, on the other hand, use images to detect contamination through discrepancies in shapes or textures. The model is integrated into real-time machinery to capture, understand, and analyze images. Fuzzy logic helps in predicting lubricant performance under different conditions by translating data into smaller fuzzy sets. These sets are further used to interpret and understand input variables by utilizing if-then conditions to derive the output. For example, if the input is temperature, then the output should be the desired viscosity.

Going forward, **hybrid AI-led techniques** are an area being explored by the global lubricants industry. This involves combining AI tools and models with regulatory frameworks and chemistry principles.

Another key area is the use of AI for nanoparticle size prediction to ensure accuracy and reduce error levels in formulation and testing.

7. AI in Manufacturing and Supply Chain

Proper demand planning, efficient logistics management, and inventory optimization and forecasting are the three key requirements in manufacturing and supply chain operations. Real-time analysis through AI supports faster decision-making and enhanced planning across manufacturing and supply chains.

For example, **Castrol** partnered with Aera Technology with the objective of implementing AI solutions in its supply chain to address day-to-day inventory challenges and foster effective demand planning at each stage.

AI is driving production efficiency and enabling early ROI in manufacturing and supply chains. An article by Global Chemical News stated that a major lubricant supplier was able to increase its manufacturing efficiency by almost 20%, along with a significant reduction in waste generation. It also mentioned that a major grease supplier was able to lower its inventory holding costs by almost 30% through effective inventory management and demand planning.

Artificial intelligence is also contributing significantly to **advancements in commercial operations and pricing strategies**, where AI-led solutions support lubricant suppliers and distributors in enhancing their pricing strategies based on evolving customer requirements, location, and distribution channels. Major lubricant suppliers, including Shell, ExxonMobil, Castrol, and TotalEnergies, are already using AI-based digital models to enhance their pricing strategies.

8. What are the various strategies adopted by lubricant suppliers supporting next-gen computing systems?

With the increasing demand for AI, data centers are being upgraded to manage and process significant volumes of digital data. This, in turn, is leading to a continuous increase in power densities, creating additional thermal management requirements. Immersion cooling has emerged as an advanced solution to address thermal management challenges associated with large-scale AI infrastructure and next-generation computing systems.

Major lubricant suppliers have already entered the immersion cooling space in data centers and are now enhancing their strategies to expand their presence in this segment. Key strategies undertaken by major suppliers include:

- **Product innovation & portfolio expansion**: While lubricant suppliers have already introduced immersion cooling products for data centers, they are now gearing up to develop products for extremely heavy workloads due to increasing AI usage. For example, **Shell Immersion Cooling Fluid S3 X, S5 X and S5 LV, ExxonMobil's EM DC series, Castrol ON immersion cooling fluids**. In addition, lubricant suppliers are also increasing their product portfolio to meet both direct cooling as well as immersion cooling requirements.
- **Expanding from "just immersion cooling" to end-to-end liquid cooling solutions**: Lubricant suppliers are also partnering with data center companies and thermal management design and engineering companies to provide complete thermal solution to its customers. For example, Shell collaborated with Intel for immersion cooling solutions for its data centers, ExxonMobil's partnership with Infosys, Intel and UNICOM.
- **Investments in R&D**: Lubricant suppliers are opening liquid cooling technology laboratories to develop advanced immersion cooling product solutions. For example, Castrol, in collaboration with Schneider Electric, recently opened a liquid cooling technology laboratory in China.

9. The Road Ahead: Strategic Imperatives for Lubricant Suppliers

The global lubricants industry is increasingly embracing AI across multiple stages of its value chain. While early adoption has largely focused on areas such as predictive maintenance, customer support, and next-generation computing systems, the scope of AI integration is rapidly expanding. Companies are now exploring AI-driven solutions to optimize lubricant blending processes, improve supply chain efficiency, enhance pricing strategies, and enable more accurate demand forecasting. These advancements are helping lubricant suppliers transition toward more data-driven and agile operational models.

Key strategic imperatives for future pathways are as follows:

- **Accelerating AI-led transformation in the value chain:** Lubricants must move beyond isolated AI projects and scale AI across the entire value chain—from R&D and formulation to manufacturing, supply chain, and customer engagement. The focus should be on building integrated, real-time ecosystems enabling continuous optimization rather than one-time improvements. **AI serves as a key enabler, driving autonomous decision-making, real-time insights, and self-optimizing operations that traditional digital systems cannot deliver.**
- **Transition to a performance-driven and solution-based business model**: The market dynamics are shifting from product-selling to performance and outcome-based offerings. Companies need to embed AI-enabled services such as predictive maintenance, equipment intelligence, and digital monitoring platforms to enhance operational equipment and reliability. **AI acts as the core differentiator by enabling predictive and prescriptive capabilities, facilitating a shift from reactive support to proactive, outcome-driven solutions.**
- **Building advanced commercial and pricing capabilities**: AI-driven pricing will be critical for margin expansion. Suppliers should invest in dynamic pricing models, real-time analytics, and advanced customer segmentation to reduce leakage and optimize value-based selling. **AI enables continuous price optimization and demand sensing through real-time analysis of large, complex datasets—far beyond the capabilities of traditional analytics.**
- **Broadening ways to strengthen digital customer engagement and experience:** Growth will depend on delivering seamless and personalized customer experiences through AI-powered tools such as recommendation engines, chatbots, and e-commerce platforms. **AI differentiates by enabling hyper-personalization and intelligent, context-aware interactions based on real-time behavioral and usage data.**
- **Invest in next-generation technologies and adjacent growth areas:** With rising demand from AI infrastructure and next-gen computing, suppliers must expand into segments such as immersion cooling and e-fluids, supported by R&D and strategic partnerships. **AI accelerates innovation in these areas by enabling faster formulation discovery, performance optimization, and design of advanced fluids for high-performance computing environments.**

AI is no longer an option; it is a core competitive differentiator that will define enhanced capabilities, operations, and products. Winners will be those who successfully scale AI across the value chain, monetize through services and pricing strategies, and capture emerging growth opportunities such as AI infrastructure and electric vehicles.

Looking ahead, the successful implementation of a comprehensive AI-enabled ecosystem across the value chain will be critical for the industry. By leveraging AI to enhance decision-making, streamline operations, and deliver greater customer value, lubricant companies can strengthen long-term customer relationships while unlocking new growth opportunities in an increasingly competitive market.

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