Lighting Trends Towards 2030 and Beyond

Suggestions and Challenges

A2S CONSULTING
Automotive Systems Strategy

TABLE OF CONTENTS

Executive Summary

Entertainment

Styling

Safety

Communication

Personalization

- **Western carmakers**, including Japan and Korea, are at risk due to the rapid rise of new Chinese players with the accelerating shift toward EV and AV. These new entrants benefit from structural advantages: minimal legacy in internal combustion engines, huge domestic market, strong focus on electronics and software-defined vehicles, agile development models, supplier chain localization, and a focus on user experience.
- **Suppliers continue to face intense pressure**. Many have only partially offset inflation, with profitability and cash-flow recovery remaining limited since 2020. Meanwhile, the rise of new Chinese suppliers will further intensify competition.
- **However, significant opportunities in the lighting industry remain in the rising demand of customer demand shift for design differentiation, personalization, communication, entertainment, and new functions.**

- **The report develops these opportunities** in the different lighting areas, as:
  - **DRLs**, a key level for signature and now for differentiation and personalization.
  - **Front & rear position lights**, with new shapes to promote design language.
  - **Logos**, becoming an increasingly central component.
  - **Grilles and displays**, with dynamic effects, messages, animations, and personalization.
  - **Stop and turn signal lights**, improving safety with enhanced messages, road projections for VRUs.
  - **Reverse lights**, to facilitate reversing cameras and to communicate from road projections.
  - **Headlamps**, with adaptive light, either with thin or hidden optics, standardization becoming a must.
  - **Specific lights** for autonomous vehicles, a new level for signature as DRL in the current vehicles.
  - **Light communication V2X**, increasing use of light projection, from current lights and displays.

- A special chapter is focused on the future of lighting **function to avoid glare,** which will be more important with the ageing population.
- The report also develops the different technologies in **light sources, optics, electronics, software, thermal, materials**, and their evolution.
- A chapter is dedicated to the evolution of **sustainability in lighting**, with energy efficiency of lighting components, with reparability of headlamps, and with material recyclability.
- At the end, the author presents **suggestions** leveraging the lighting industry trends for OEMs, lighting suppliers, and the automotive lighting community.

Automotive Environment

The 8 Automotive Mega Trends

1. Electrification
2. Autonomous Driving
3. Software-Defined Vehicles (SDV)
4. China & Global Market Rebalancing
5. Connectivity & Data
6. Affordability
7. Sustainability & Circular Economy
8. Regulation

1. Electrification

Beyond Tesla and BYD, several new players are emerging in the EV space, mostly from China. Brands such as Li Auto, Xiaomi, and Nio are gaining strong momentum to achieve an expected worldwide market of 40% in 2030. These new entrants benefit from structural advantages: minimal legacy in internal combustion engines, strong focus on electronics, and SDV.

2. Autonomous Driving

The industry is also moving toward autonomous vehicles, shared mobility. The vehicles will be able to drive themselves with ADAS, AI, HD maps. Robotaxis and autonomous logistics pilots will be more and more used.

3. Software-Defined Vehicles

Software is going to control most key functions as safety, performance, driver assistance and infotainment, replacing fixed hardware logic. SDVs rely on centralized computing platforms, modular software layers, and OTA updates to evolve functionality throughout the vehicle's life, similar to how smartphones get new features after purchase.
Cars will be platforms powered by software, with centralized computing architectures.

4. China & Global Market Rebalancing

China's automotive industry is regarded as one of the most competitive and innovative in the world, becoming the world's largest car exporter.
It has experienced a rise in market dominance by domestic manufacturers and a shrinking market share for foreign car brands, with a growing focus on areas such as EV and AV. European suppliers continue to face intense pressure. Many have only partially offset inflation, with profitability and cash-flow recovery remaining limited since 2020.

5. Connectivity & Data

Vehicles are becoming connected to the cloud with V2X, real-time navigation, and infotainment.
Vehicle communication technologies will increasingly focus on safety (communication with other drivers and vulnerable road users), brand enhancement (static projections, logos, and in-car displays), creative and fun devices.

6. Affordability

Cars are becoming increasingly expensive, and Western carmakers that must redesign vehicle architecture and rebuild supply chains are at risk due to the rapid rise of Chinese competitors and the accelerating shift toward electric vehicles (EVs).
Carmakers will pursue efficiency through high-volume platform strategies, R&D optimization, component cost reduction, and consolidation or mergers.

7. Sustainability & Circular Economy

OEMs increasingly require lamp makers to quantify and reduce the embedded CO_2 of every component. This drives the adoption of low-carbon materials, recycled technical polymers with verified traceability, green aluminum, and low-energy coating processes.

8. Regulations

Europe regulations will raise vehicle costs, shift demand toward lighter and more efficient models, and accelerate the transition to EVs, while Chinese imports will add competitive pressure. U.S. tariffs will raise vehicle prices, drive supply chain restructuring, and shrink overall market demand.

Suggestions leveraging lighting industry trends

❖ Main suggestions to OEMs concerning lighting

Strengthen Collaboration with Lighting Suppliers

- OEM Purchasing, Engineering, and Quality, to define technology roadmaps, drive cost and development time reductions, with selected suppliers.
- OEM Studio and Engineering to develop design creativity with selected suppliers.

Foster Affordable Innovations

To use adaptive lighting, projections, and personalization, possibly from OTA update technology. The future is not in lighting performance, already at a good level.

Search Standardization

Of non-seen components as optic modules and ECUs.

Integrate Sustainability in all Developments

To improve the energy efficiency of lighting components, the reparability of headlamps and their components, and the recyclability of materials.

Optimize Lighting Electronic Architecture towards Vehicle Electronic Architecture

Plan for all vehicle models that will be set up on a new electronic architecture to introduce a new optimized lighting electronic architecture.

❖ One main suggestion to the lighting community

Establish lighting industry associations

To create associations that bring together OEMs, Tier-1 and Tier-2 suppliers, universities, research centers, and regulatory bodies to improve and promote safety (visibility, glare), enhance communication to dealers and end-users, and facilitate regulatory harmonization.

Suggestions leveraging lighting industry trends

❖ Main suggestions to lighting suppliers

Strengthen Collaboration with OEMs

- Lighting suppliers to work closely with OEM Purchasing, Engineering, and Quality to optimize technology roadmaps, specifications, cost, and development time.
- Lighting suppliers to develop design creativity with OEM Studio, engineering.

Foster Business Development between Tier-1 and Tier-2 suppliers

To encourage stronger collaboration between Tier-1, Tier-2, and other industries to capture new opportunities driven by safety requirements, enhanced design, and increased functionality, all of which will raise the value of lighting systems per vehicle.

Develop Strategic Partnerships and Transformation Initiatives

To organize around key technology domains, accelerating innovation through partnerships, particularly Chinese players, with the target of remaining competitive and addressing industry transformation challenges.

Develop Affordable Technologies

Emphasizing perceived quality, entertainment, safety (projections), differentiation, personalization, dynamics, even grilles and displays, searching not expensive solutions.

Optimize the ADB HD Cost

Privilege 20kµLED and reduce cost by standardization and simplification.

Find Solutions to Reduce Glare drastically

Developing and using fully automatic aiming and adaptive lighting depending on areas and the environment.

Prepare for the Proliferation of Autonomous Vehicles

To integrate lighting systems into the evolution of autonomous mobility by optimizing lighting patterns, exploring new lighting functions specific to AVs, and conducting joint regulatory and field studies.

Conclusion : Challenges to Lighting Industry

Considering the several trends emphasized in the report,
the automotive lighting industry is in front of 6 challenges.

- **Cost and development time reductions, mainly in Europe**
  Strong relationship OEM-suppliers, Standardization, use of advanced engineering tools, and affordable innovations will be the main levers to succeed.

- **Design signature and differentiation**
  Body light and use of position light, DRL, logo, grilles, and headlamps with thin appearance will be the levers to succeed.

- **Light communication and Personalization**
  Strong need of marketing with the demand shift..

- **Electronic/Software proliferation**
  Centralized replacing distributed architecture and centralization of application software and electronics.

- **Endless standardization**
  Standardization on components and ECUs standardization on ADB, Matrix segment and µLED cost to be reduced by the volume.

- **Glare decrease**
  To find solutions to reduce glare, even headlights don't dazzle in static conditions.