

# WIPO Technology Trends

## Future of Transportation



# Executive summary: Unveiling tomorrow's journeys

This third publication in the series *WIPO Technology Trends* reports on transportation and its future. In a world driven by sustainability and digitalization, understanding the transformative changes reshaping the transportation sector is more crucial than ever. The report explores how emerging technologies and innovative approaches are revolutionizing the ways in which we move people and goods, while emphasizing the importance of sustainability. Taking for its subject the future of transportation, the report sheds light on the exciting possibilities that lie ahead – from electric and autonomous vehicles to smart infrastructure and digital logistics – and identifies which are the most innovative countries, companies and institutions by investigating the latest transportation patenting trends.

## The 2030 Agenda for Sustainable Development

As we move toward 2030, our goal is to identify and analyze the technology trends shaping the future of transportation. By focusing on sustainability and digitalization, the transportation sector can meet not only the demands of a rapidly changing world, but also contribute to the broader goals of economic growth, social inclusion and environmental stewardship set out in the United Nations 2030 Agenda for Sustainable Development.

The focus of the report is on providing tangible insights for everyone – be they an industry professional, a policymaker, researcher or enthusiast – seeking a deeper understanding of the future of transportation. Through real-world examples and forward-looking analysis, we aim to inspire action and collaboration in creating a more sustainable, efficient and connected transportation system for the global community.

The transportation sector faces the dual challenge of achieving sustainability while at the same time embracing digitalization. Addressing this challenge requires a nuanced approach that balances environmental considerations against the opportunities presented by new technologies. The report emphasizes the need for technological solutions that can navigate the complexities of modern transportation systems, delivering benefits that extend beyond efficiency to include safety, accessibility and user experience.

## The structure of the report

The report was developed using a data-driven approach, combining traditional patent searches with AI-powered topic extraction. Patents, scientific literature, press releases and CEO statements were analyzed to gather insights into the latest developments and trends within the transportation sector. The report is structured around four principal transportation modalities – Land, Sea, Air, and Space – and two overarching megatrends – Sustainability and Digitalization.

## Technology clusters within transportation

The report identifies four primary technology trend clusters within transportation: namely Sustainable Propulsion, Automation and Circularity, Communication and Security, and Human–Machine Interface (HMI). Together, these four clusters represent those critical areas of innovation crucial to the future of transportation, ensuring that digital systems remain robust and resilient, while also addressing environmental challenges.

Sustainable Propulsion is at the forefront of reducing the environmental footprint of transportation. Electric propulsion, hydrogen fuel cells and other alternative energy sources are key to this effort, driving a shift away from fossil fuels. Such technologies are critical to achieving lower emissions and fostering a more sustainable future within transportation.

Automation and Circularity focuses on streamlining production and promoting sustainability. Technologies like industrial robots, smart factories and additive manufacturing are revolutionizing vehicle production, making it more efficient and reducing waste. Circularity emphasizes the sustainable use of resources, with innovations in biopolymers and recycling processes minimizing environmental impact and aligning with broader sustainability goals.

Communication and Security technologies are essential for the safe and efficient operation of a modern transportation system. Innovations such as lidar sensors, 5G networks, connected vehicles (V2X) and smart city infrastructure enable the real-time data exchange so crucial for the development of autonomous driving, smart traffic management and enhanced safety. Such technologies ensure that transportation systems are not only more connected, but also more secure and responsive to dynamic conditions.

HMI technologies are transforming the way users interact with transportation systems. Advances in touch displays, speech and facial recognition, and extended reality are enhancing the user experience, safety and accessibility. Such innovations make transportation systems more intuitive and secure, improving how individuals interact with vehicles and other transport modalities.

Each of these four technology trends represents a vital area of innovation crucial to the future of transportation. Analysis of patent data reveals a rapid pace of development and adoption, providing insights into how the transportation sector is evolving to meet the demands of a sustainable and digitalized world. Among the key findings are the following:

- There were over 1.1 million inventions (patent families) published between 2000 and 2023 relating to the future of transportation.
- With a compound annual growth rate of 11% between 2000 and 2023, technologies relating to the future of transportation far exceed the 4% rate seen in traditional transportation technologies.
- Patenting in Sustainable Propulsion technologies is driving the Sustainability megatrend, and patents in Communication and Security technologies dominate the Digitalization megatrend.
- Land transport patents dominate, with over 3.5 times the number of patents for the Sea, Air and Space transport modalities combined.
- The top five inventor locations, namely China, Japan, the United States of America, the Republic of Korea and Germany, account for over 90% of all inventions, with recent double-digit growth seen in China, Sweden, Italy and India.
- Pockets of specialism will naturally exist around the world in such a broad industry, including Germany in Land transport, Norway in Sea transport, and France in Air and Space transport.

## Future of Transportation

**1.1M+**

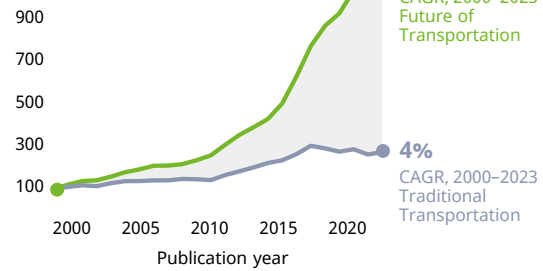
Inventions (Patent families) published, 2000–2023

**11% ↑**

The number of patents related to the future of transportation has grown at a compound annual growth rate (CAGR) of nearly **11%**.

In comparison, patents in traditional transportation have grown at a rate of only **4%** over the same period.

Indexed development of patent families



## Two megatrends and four technology trends

**Sustainability**  
**Sustainable Propulsion** is driving the Sustainability megatrend.

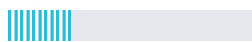
**Sustainable Propulsion**

**98%**  
Proportion in Sustainability megatrend



**Automation and Circularity**

**26%**  
Proportion in Sustainability megatrend



**Digitalization**  
**Communication and Security** is driving the Digitalization megatrend.

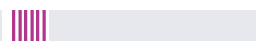
**Communication and Security**

**78%**  
Proportion in Digitalization megatrend



**Human-Machine Interface**

**15%**  
Proportion in Digitalization megatrend



## Modes of transportation

**Most patents related to Land transportation.**

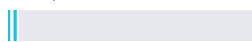
**Land**

**82%**  
Proportion in future of transportation



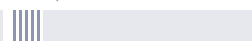
**Sea**

**4%**  
Proportion in future of transportation



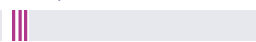
**Air**

**12%**  
Proportion in future of transportation



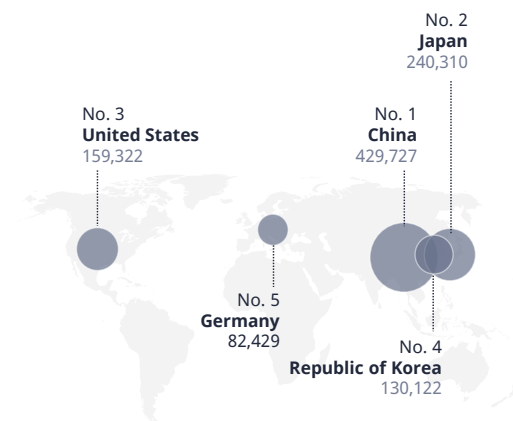
**Space**

**7%**  
Proportion in future of transportation



## Leading locations

Number of patent families invented in the location



## Specialized locations

Notable locations with a high Relative Specialization Index



Source: WIPO, based on patent data from EconSight/IFI Claims, October 2024.

## The future of transportation and intellectual property

Intellectual property (IP) plays a crucial role in supporting innovation within the transportation sector. IP rights encourage investment in research and development, fostering the creation of new technologies and solutions. WIPO plays a vital role in this process, by providing support for innovators in making the most of their inventions. Through its various programs and services, WIPO helps inventors navigate the complex world of IP, ensuring that they can protect and commercialize their innovations effectively. By doing so, WIPO hopes to contribute to the growth and development of the transportation sector, helping to drive the transformative changes shaping its future.

## Imagining tomorrow, today

This WIPO Technology Trends report on the Future of Transportation offers a forward-looking perspective on what transportation might become by 2030 and beyond. Through envisioning various potential futures, we seek to motivate innovators and inventors in addressing regulatory and standards-related obstacles and developing the groundbreaking technologies needed to bring those visions to life. Our objective is to inspire progress toward a more sustainable, efficient and seamlessly connected transportation network to the benefit of the entire world.

The *WIPO Technology Trends* report on the Future of Transportation focuses on the sustainability and digitalization of the transport sector. It highlights key innovations across Sustainable Propulsion, Automation and Circularity, Communication and Security, and Human–Machine Interface.

The report analyzes patent data and emphasizes the role of intellectual property in fostering technological progress and envisions transformative futures.

By inspiring action, the report aims to drive the development of sustainable, efficient, and connected transportation systems aligned with the UN's 2030 Agenda.

