CONNECTED

MOBILITY

RISKS AND OPPORTUNITIES FOR SELF-DRIVING VEHICLES

Exploring Global Regulations and Security Challenges in the Future of Connected Vehicles

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INTRODUCTION

The car has long been a symbol of Western individualism, promising not only efficient and comfortable transportation but also freedom of movement, coupled with enhanced security. Although governed by traffic rules, individuals could travel wherever they pleased, at least within national borders.

The advent of connected vehicles, which communicate with external networks, has promised increased vehicle safety, driver assistance with navigation and manoeuvring, and reduced stress and exhaustion during commutes. From a public perspective, today's connected vehicles—and even more so future autonomous ones, which will truly embody the term "auto-mobile"—offer the potential for optimal use of parking spaces and smoother traffic flow, especially relevant in metropolitan areas.

However, what was intended to enhance consumers' freedom, safety, and comfort may become a tool for increased control and surveillance. The computer systems that control vehicle movements can be used for tracking, and these vehicles can collect and transmit sensitive driver and passenger data.

This shift impacts not only individual privacy and freedoms but also public safety and collective security. Certain hardware—broadly speaking, sensors—controlled by software in connected vehicles can remotely capture information about entire geographic areas or critical infrastructure. If malicious actors gain control of connected vehicles, they could disrupt traffic, communication, and the operations of vital infrastructure.

In our report, we examine how various countries and jurisdictions address this profound shift. In an increasingly connected world, we experience both the benefits of technical innovations enabled by expanded international exchange and the challenges of surveillance and potential foreign interference. Specifically, we focus on the USA, the People's Republic of China, the European Union, the United Kingdom, and Japan, while also briefly considering Taiwan and parts of Southeast Asia.

RISING U.S.-CHINA TECHNOLOGY TENSIONS MOVES TO THE AUTOMOTIVE SECTOR

As global attention remains focused on potential new tariffs in the ongoing U.S.-China trade conflict, a new regulatory front is emerging in the realm of advanced automotive technology.

On September 23, 2024, the U.S. Department of Commerce (DoC) took a significant step in what is widely perceived as an escalation in U.S.-China technology competition. Following an Advance Notice of Proposed Rulemaking (ANPR) in February, the Department's newly released Notice of Proposed Rulemaking (NPRM) outlines stringent restrictions on "connected vehicles" and specific components originating from "countries of concern", notably China and Russia.

FOCUS ON VEHICLE CONNECTIVITY AND AUTONOMOUS SYSTEMS

Under the proposed rule, the sale or import of vehicles incorporating certain technologies from China and Russia could be prohibited.

The regulation focuses on two core areas:

1. Vehicle Connectivity Systems (VCS): Technology that enables connectivity in vehicles via Bluetooth, cellular, satellite, and Wi-Fi.
2. Automated Driving Systems (ADS): Advanced systems that support highly autonomous vehicle operation, some of which await regulatory approval for driverless functions.

Given the broad definition, nearly all new vehicles may be subject to these restrictions, requiring manufacturers to avoid Chinese and Russian components to maintain U.S. market access.

This regulation would apply to various types of vehicles, including passenger cars, motorcycles, commercial trucks, and buses.

BROAD LEGAL DEFINITION

Proposed rule broadly defines what is a "connected" vehicle to include not just vehicles that communicate with each other but any vehicles that include components that use Bluetooth, cellular, satellite, and Wi-Fi technologies, as well as systems that enable vehicles to operate autonomously.

The proposed regulation potentially affects the entire automotive industry, as the DoC predicts that *all* new vehicles would be considered "connected vehicles".

"With China recently becoming the world's leading car exporter, U.S. regulations could add pressure on other significant exporters, including Japan and Germany"

DEFINING "CONNECTED VEHICLES": BROAD IMPLICATIONS FOR THE AUTOMOTIVE INDUSTRY

The Department of Commerce's Bureau of Industry and Security (BIS), which oversees technological sanctions, defines a "connected vehicle" as one that integrates networked hardware with automotive software, enabling communication through various wireless technologies. Given the BIS's broad definition, almost all new vehicles could fall under these restrictions once the regulation takes effect.

Key implementation timelines include:

- Software Components: Compliance required starting with Model Year 2027.
- Hardware Components: Compliance required by Model Year 2030, or January 1, 2029, for units without a model year designation.

In essence, for vehicles connected to external navigation systems or similar technologies, manufacturers would need to eliminate any reliance on Chinese or Russian components to access the U.S. market.

The rule is expected to impact a wide range of vehicle categories, including passenger cars, motorcycles, light and medium trucks, commercial trucks, recreational vehicles, and buses.

LIMITED EXEMPTIONS AND INDUSTRY IMPACT

The proposed regulation provides few exemptions, allowing only certain small-scale producers to receive waivers. These exemptions aim to limit disruptions within the industry while national security interests are prioritised.

RATIONALE BEHIND THE REGULATION: PRIVACY, NATIONAL SECURITY, AND COMPETITIVE EDGE

The stated rationale for the import ban is primarily focused on privacy and national security concerns. The U.S. government asserts that adversarial nations could exploit embedded technologies in vehicles for surveillance or even sabotage, thereby posing threats to both users' individual privacy and national security".

U.S. Secretary of Commerce Gina Raimondo highlighted the risks, stating, "Cars today have cameras, microphones, GPS tracking, and other technologies connected to the internet. It doesn't take much imagination to understand how a foreign adversary with access to this information could pose a serious risk".

Beyond the stated reasons for new regulation, there is a deeper structural concern. For the first time in recent history, an adversarial global power's technological advancements are rivalling U.S. capabilities, posing a potential challenge not only to American industry in the near future, but also to internal security of the country.

GLOBAL IMPLICATIONS FOR AUTOMOTIVE TRADE AND U.S. MARKET DEPENDENCY

While technically limited to the U.S. market, the regulation is expected to ripple across the global automotive supply chain due to the U.S.'s centrality. The then world's first German car exports in 2022 amounted to $149 billion, with the U.S. as its second-largest market at $17 billion.

Japan, the world's second-largest car exporter, sent $32.9 billion of its $89 billion export total to the U.S. in 2022. Compliance with the new regulation would thus significantly impact global automotive exports.

Since then China has become the biggest car exporter in the world, affecting Japanese and German output not only at home, but on many third countries' markets. Squeezed between Chinese competition and American regulation, both traditional automotive behemoths may experience unprecedented turbulence.

NEXT STEPS: REGULATORY CONSULTATION AND POTENTIAL VARIABILITY BY ADMINISTRATION

Although the regulation's goals are unlikely to change, the U.S. administration has expressed a willingness to conduct further consultations with industry stakeholders, including allied nations, to mitigate unintended consequences.

In contrast, a potential Trump-Vance administration might introduce adjustments; while bipartisan support for a hawkish stance on China is strong, close ties between Republican-aligned industry leaders—like Tesla—and the Chinese market could prompt surprising revisions to the proposal.
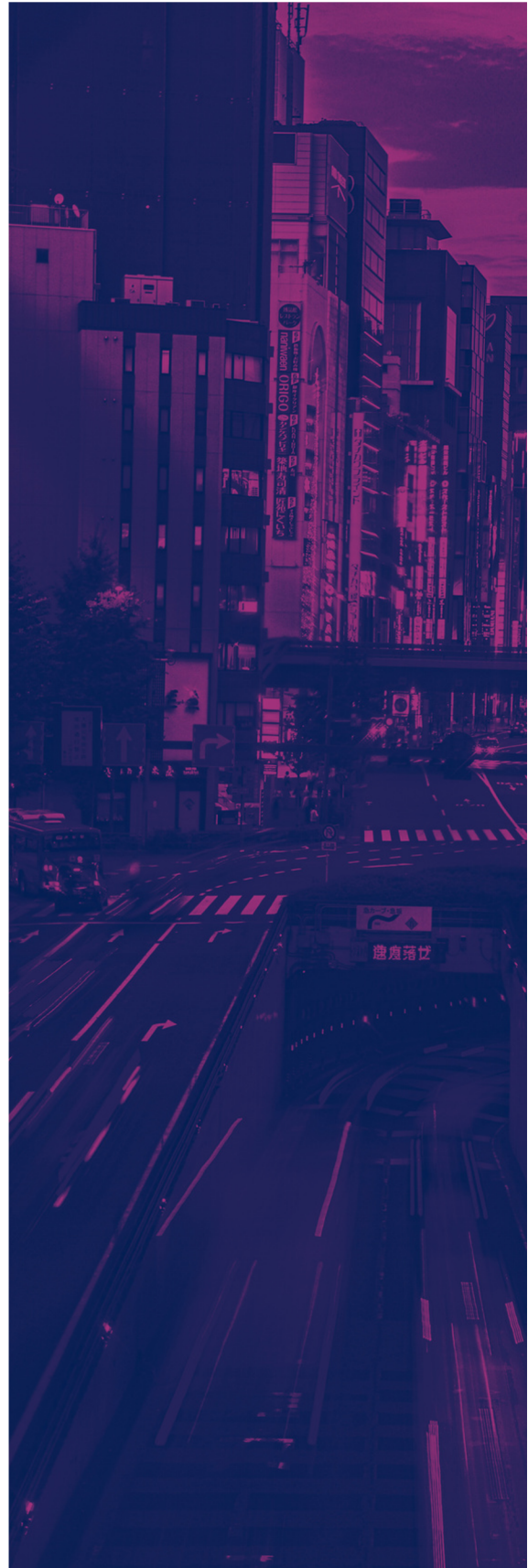
POSITION

In 2016, the European Commission launched the European Strategy on Cooperative Intelligent Transport Systems (C-ITS), which aimed to harmonise investments and regulatory frameworks for connected and automated mobility (CCAM) across the EU.

C-ITS promotes the exchange of information between road users and traffic managers to improve road safety and traffic efficiency.

REGULATORY FRAMEWORK

The EU's ITS Directive (2010/40/EU) authorises the European Commission to establish specifications to ensure compatibility, interoperability, and continuity across the EU transport sector.

Updated in 2023, the ITS Directive now addresses new challenges and mandates the implementation of certain ITS services across the EU, promoting better data-sharing and standardised performance indicators.

DATA AND SECURITY INNOVATIONS

With the integration of 5G in connected vehicles, the EU is focused on the secure exchange of data between vehicles and the broader digital economy.

Major automakers like Volkswagen and BMW are investing in connected and electric vehicle technologies to advance mobility and energy efficiency. However, the issues of data privacy and the need for technician training to manage advanced software and diagnostics remain critical considerations.

THE UK'S POTENTIAL AS A LEADER IN CONNECTED VEHICLES

The United Kingdom is well-positioned to lead in the connected vehicles market, supported by its advanced automotive, technology, and security sectors.

After several years of strained political relations between Britain and Europe, which saw disruption in supply chains supporting the UK manufacturing sector, the newly elected Labour government in May 2024 has prioritised rebuilding UK-EU relations. This renewed focus on cooperation is expected to improve supply chain operations and data sharing, leading to greater efficiency and alignment in the years ahead.

REGULATORY AND INDUSTRIAL LANDSCAPE

Established in 2015, the Centre for Connected and Autonomous Vehicles (CCAV) is a joint initiative between the Department for Business, Energy & Industrial Strategy (BEIS) and the Department for Transport (DfT).

Since its inception, the UK has made significant progress in connected and autonomous vehicle (CAV) technology.

CCAV's objectives:

- Make the movement of people and goods in the UK safer, fairer, greener, and more efficient.

- Set strategic direction and provide investment certainty through policy and other interventions, for example through the Connected and Automated Mobility 2025 paper and the Future of Mobility: Urban Strategy.

- Develop and implement the legislative and safety frameworks necessary to enable the safe commercial deployment of self-driving vehicles.

- Provide joint investment with industry through 2025 to overcome the barriers to commercial deployment thereby attracting, de-risking, and anchoring global investment, creating jobs, and strengthen supply chain so that the UK is a maker of these technologies and services, not just a taker.

- Engage with the public to gain an insight into public opinion and to increase the public's understanding of emerging technologies.

In 2020, the UK government launched the Connected and Automated Mobility (CAM) initiative, aimed at supporting startups and SMEs in developing innovative autonomous vehicle services. Central to this effort is Zenzic, a collaborative organisation working to establish the UK as a global leader in connected vehicle technology, with support from CCAV.

The market for CAVs is expected to be substantial; by 2035, 40% of new cars sold in the UK may have self-driving capabilities, contributing an estimated £41.7 billion to the economy and creating around 40,000 skilled jobs. CCAV's mission is to advance safe, sustainable, and responsible CAV adoption, working closely with industry and academic partners to enhance the safety, sustainability, flexibility, and reliability of transportation.

The Automated Vehicles (AV) Act, enacted in May 2024, prepares the UK for the deployment of self-driving vehicles on British roads by 2026.

SECURITY CONCERNS

The UK remains alert to concerns that an over dependence on Chinese-made vehicles and components could pose a risk to national security.

Concerns persist that autonomous vehicles—in particular vans and trucks—could be remotely controlled or disabled, disrupting critical logistics chains, such as those for medical supplies requiring cold (chain) transport and storage.

As a key member of NATO and the Five Eyes intelligence-sharing alliance, there are ongoing concerns that cameras and other instruments within connected vehicles could be remotely activated to capture and share sensitive data. This could involve the capture of images and other critical information from within military or other secure facilities by hostile states or non-state actors.

KEY PLAYERS IN THE UK MARKET SPACE

Nissan—among others—is playing a significant role in the UK's introduction of autonomous vehicles, which has seen it invest £2 billion in its Sunderland plant focused on the production of electric vehicles. Collaborating with key partners such as Connected Places Catapult, Humanising Autonomy, SBD Automotive, and TRL, as well as a network of startups aligned to expand the UK's autonomous vehicle ecosystem. This collaboration is illustrative of the growth of self-driving technology and the UK's broader ambitions in the automotive sector.

LEADERSHIP IN CONNECTED VEHICLE (CV) DEVELOPMENT

China is spearheading the global development of Connected Vehicles (CVs), with central and local governments driving this initiative. China's use of the term ICVs—Intelligent Connected Vehicles—reflects its emphasis on the role of autonomous driving technology within the broader CV framework.

This is part of a broader effort to promote modern mobility and achieve technological self-sufficiency. The government's strategy includes a holistic approach to regulation, infrastructure, and industrial growth, emphasising the development of a robust ecosystem for CVs.

COMPREHENSIVE LEGAL AND INDUSTRIAL FRAMEWORK

The Chinese government aimed at creating an all-encompassing framework for the CV industry. This involves not only regulatory oversight but also the establishment of a legal, technological, and industrial ecosystem.

The approach includes standardising practices and fostering conditions for innovation, particularly in semiconductor production for CVs.

This model ensures the Chinese Communist Party (CCP) maintains control over key sectors, including Big Tech, while enhancing its surveillance capabilities.

NATIONAL STRATEGY AND POLICY DOCUMENTS

China's first national CV development strategy was launched in 2020 by the National Development and Reform Commission, the Ministry of Industry and Information Technology (MIIT), and 11 other ministries.

This strategy targets the advancement of EVs and autonomous vehicles, focusing on technical issues like standards and connectivity. Key milestones include the 2025 goals for Levels 3 and 4—meaning most advanced—autonomous vehicles. MIIT has issued crucial documents on market access for Intelligent Connected Vehicles (ICVs) in July 2021 and on ICV standardisation in July 2023.

ROLE OF MAJOR PLAYERS

Leading domestic companies, including automakers BYD and Geely, and tech giants Huawei and Xiaomi, play critical roles in China's CV development. These firms are heavily invested in the sector, aiming to offset losses from U.S. sanctions while contributing key technological innovations.

Shenzhen became the first Chinese city to allow driverless Level 3 cars in August 2022, and it has initiated testing for Level 4 vehicles on specific routes.

The Chinese government is acutely aware of the risks associated with CVs, highlighted by concerns over Tesla vehicles being used for espionage. However, Tesla's cooperation with Chinese authorities has allowed it to remain the only foreign EV brand with government market access.

FUTURE OUTLOOK AND STRATEGIC GOALS

Looking ahead, MIIT plans to introduce a support system for Level 3 and 4 autonomous vehicles by 2025. A more comprehensive safety assurance system and standards for autonomous driving are expected by 2030. China's broader strategic goal is not only to gain a competitive edge but also to develop a resilient CV ecosystem capable of withstanding sanctions from the U.S. and its allies.

OVERVIEW

Japan has been one of the pioneering nations in addressing the development and regulation of connected vehicles (CVs). The country has adopted an all-of-government approach, with the Ministry of Economy, Trade, and Industry (METI) leading these efforts. In February 2015, METI, alongside the Ministry of Land, Infrastructure, Transport, and Tourism (MLIT), established the Panel on Business Strategies for Automated Driving.

This body has played a central role in shaping Japan's autonomous driving strategy, resulting in the "Action Plan for Realising Automated Driving". Version 2.0 of this roadmap was published on March 30, 2018, outlining critical issues, technologies for research, and a timeline for the introduction of autonomous vehicles on Japanese roads.
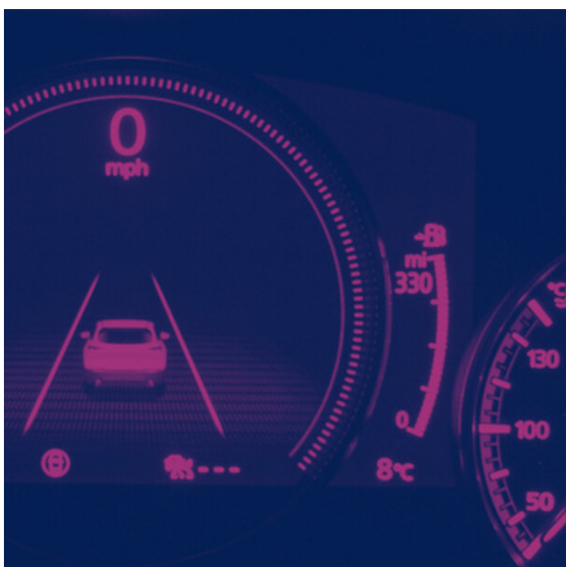
REGULATORY FRAMEWORK

Currently, the Road Traffic Act serves as the key legal framework for the use of autonomous vehicles in Japan. The Act, amended in March 2023, introduced regulations governing Level 4 (fully driverless) vehicles, though their deployment remains limited.

In May 2023, the town of Eiheji, located in Fukui Prefecture, became the first in Japan to launch a driverless transportation service, albeit as part of a pilot program designed to inform future regulatory frameworks. In Eiheji, Yamaha's driverless carts operate under strict conditions, including non-rush hour use and a maximum speed of 48 kilometers per hour.

ADDRESSING KEY NATIONAL CHALLANGES

Chinese companies like BYD, Geely, Huawei, and Xiaomi are heavily invested in developing new technologies to mitigate the impact of U.S. sanctions. China's focus on autonomy and cybersecurity is evident in its regulatory and industrial policies, aimed at achieving self-reliance in key technologies.

INDUSTRIAL ENGAGEMENT

Japan's automotive sector has fully embraced the potential of CVs. Leading the charge is Toyota, which is transitioning from a traditional car manufacturer to a general mobility company. The company's smart city project, Woven City, situated at the base of Mount Fuji, serves as a testing ground for various mobility solutions, including CVs and autonomous buses.

Similarly, Honda and Sony have established a joint venture, Sony Honda Mobility, to develop autonomous vehicles equipped with artificial intelligence. These are just two examples of how the Japanese automotive industry views CVs as a crucial component of its future, both to stay ahead of global competition and to address the growing challenge posed by emerging Chinese rivals.

CYBERSECURITY

While policymakers have been slower to address CVs as a broader category, both the government and private sector recognise the cybersecurity challenges that accompany autonomous vehicles. In 2017-2018, the Cabinet Office released guidelines to bolster defences against cyberattacks, with a particular focus on the automotive sector.

Following a series of cyberattacks, collaboration within the industry has intensified, though much work remains to be done to ensure robust cybersecurity, an area in which Japan still lags behind.

This is part of a broader problem of conceptualising counterintelligence, foreign interference and information security among Japanese business and political decision-makers. However, the situation is slowly changing, with the establishment of the Economic Security Ministry as an example.

OUTLOOK

Japan is expected to align, at least in part, with U.S. regulatory standards for CVs, a practical move aimed at facilitating access to the U.S. market. Such harmonisation would support Japanese manufacturers in maintaining their competitive edge on the global stage while ensuring that domestic innovation continues to thrive.

GROWTH OF THE INDO-PACIFIC CONNECTED VEHICLE INDUSTRY

As the world's most populous and fastest-growing region, the Indo-Pacific is witnessing rapid expansion in the connected vehicle sector. High growth rates in this industry are fuelled by 5G technology integration in vehicles and substantial government support for connected vehicle installations. Both natively connected vehicles and retrofit solutions are contributing to a dramatic rise in market share, signalling a major shift in how transportation is experienced.

This sector represents the intersection of urbanisation, digitisation, and innovation, fundamentally transforming the relationship between individuals, their vehicles, and the cities they inhabit.

THE RISE OF SMART CITIES AND DIGITAL INFRASTRUCTURE

Across the Indo-Pacific, cities are evolving into smart urban centres, spearheading advancements in digital infrastructure, including 5G network deployment, and reshaping the automotive industry.

This transition aims to incorporate innovative urban solutions, with semiconductors playing a crucial role in the process. Taiwan, a leader in this area, also dominates over 90% of the global AI server market, excelling across the entire value chain in design, development, and production. Taiwan's robust smart city ecosystem, powered by innovation in both software and hardware, is supported by ITS technology that combines IoT and AI, giving the island a distinct competitive edge.

TAIWAN'S ROLE IN REGIONAL COOPERATION AND TECHNOLOGY EXCHANGE

Despite diplomatic challenges, Taiwan has leveraged its strong ICT industry foundation, advanced manufacturing capabilities, and technological expertise to forge cooperative ventures with countries in the Indo-Pacific and beyond. Through its semiconductor dominance and AI innovation, Taiwan has engaged in smart cities collaboration with Southeast Asian countries, including Thailand, Indonesia, and Vietnam.

These initiatives encompass a range of sectors, from net-zero transition and automation to smart healthcare and transportation, showcasing Taiwan's role as a regional partner in technology-driven urban development.

THAILAND'S AMBITIONS IN SMART CITY AND EV MARKETS

Thailand is actively advancing its smart city goals, aiming to develop at least 100 smart cities by 2027. The country has also become a leader in the regional EV market, with EV registrations in 2023 nearly quadrupling to 90,000. Government incentives, including subsidies for domestic battery manufacturing and reduced import taxes, along with a growing presence of Chinese car manufacturers, have fuelled this expansion.

Chinese EV giant BYD established its first Southeast Asian production facility in Thailand in July, with an annual capacity of 150,000 vehicles, positioning the country as an EV export hub for ASEAN and beyond.

INDONESIA'S NEW SMART CAPITAL AND TAIWAN'S ROLE

Indonesia's plan to move its capital and build a green and smart city has opened doors for Taiwanese companies to contribute innovative solutions.

Through the New Southbound Policy, Taiwan seeks to strengthen its industrial ties with ASEAN countries, helping integrate its industries into the broader Asia-Pacific market.

The policy aims to reinforce Taiwan's position in global supply chains while supporting the industrial growth of both its diplomatic allies and regional partners.

VIETNAM'S PATH TOWARD CARBON NEUTRALITY AND SMART MOBILITY

Vietnam presents a promising new market for Taiwanese companies focused on smart mobility. Committed to achieving carbon neutrality by 2050, Vietnam is experiencing growth in smart mobility solutions, with increasing government support for EVs and intelligent transportation systems.

Despite being in the early stages compared to regional counterparts, Vietnam's government is advancing the green transition with coordinated efforts at both national and local levels. This shift creates opportunities for Taiwanese companies to tap into Vietnam's emerging market for green and smart mobility solutions.

CONNECTED VEHICLES AND THEIR IMPACT BEYOND MOBILITY

The arrival of connected vehicles marks a significant technological leap, promising enhanced safety, efficiency, and convenience for citizens everywhere. However, while this latest revolution presents opportunities it also delivers challenges extending far beyond the realm of mobility.

While players such as the United Kingdom, United States, China, and the European Union have fought to position themselves at the forefront of connected vehicle developments, they are now dealing with a range of issues resulting from such a rapid technological advancement. Concerns around cybersecurity, privacy, and the issue of data manipulation and intercept are posing enormous challenges which can only be addressed through regulation and international cooperation. Universal standards are essential to ensure the seamless cross-border operation of connected and autonomous vehicles.

Moreover, the integration of connected vehicles into urban infrastructure is raising questions for planners and traffic management, while simultaneously creating opportunities within the business sector. As vehicles evolve with greater capabilities, they have the potential to drive a genuine revolution in public transport, supply chains, and personal mobility.

However, this transformation will require significant investments in infrastructure, secure and reliable maintenance arrangements and widespread access to 5G networks.

The geopolitical implications of connected vehicles are profound. The development and control of this rapidly evolving technology could reshape the global balance of power, with nations vying for dominance in various aspects of the connected vehicle ecosystem.

In conclusion, the future of connected vehicles is both exciting and uncertain. By addressing the challenges and capitalising on the opportunities, countries can harness the potential of this technology to create a safer, more sustainable, and equitable future.

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