

**REGULATORY AND LEGAL ASPECTS OF DIGITAL
AUTOMOTIVE PLATFORMS IN THE UNITED STATES:
BARRIERS AND OPPORTUNITIES FOR SCALING**

Viktoriia Kim,

Founder of an Automotive Tech Platform, USA

| ABSTRACT | KEYWORDS |
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| <p>This article examines the scope and role of various types of digital services and platforms in the U.S. automotive sector, as well as the factors and barriers that may influence the successful scaling and development of such projects. The introductory section traces the historical development of the automotive industry and new transportation technologies. The main section describes various modern types of digital platforms, including those enabled by the digitization of telematics and vehicle data, services for autonomous driving, car-sharing, and the automation of transportation systems within the framework of “smart” cities and regions. The analysis examines relevant federal and state laws and policies, positions on liability issues related to the use of AI in vehicles, as well as intellectual property and cybersecurity issues. The main barriers affecting the scalability of services and platforms include: insufficient legal regulation in the specific area of interoperability and standards, high implementation risks and costs, and a lack of trust among consumers and investors. At the same time, a number of case studies are presented that illustrate the potential for the development and scaling of modern digital services and platforms through integration with cutting-edge technologies, partnerships with the government and private sector, the development of “smart” infrastructure, and flexible regulation in the form of soft law and smart law combined with traditional legislation and minimal government intervention. In conclusion, the authors conclude that successful business models for digital technologies in the automotive industry, including in the field of robotaxis, are generally based on a comprehensive approach utilizing the latest regulatory provisions and standards, as well as on appeal and trust among consumers and investors.</p> | <p>Digital automotive platforms, U.S. automotive industry, transportation regulation, telematics systems, autonomous vehicles, car-sharing, intellectual property, personal data protection, transportation legislation, scaling of digital platforms, smart cities, digitalization of transportation</p> |

Introduction

Scientific novelty. The scientific novelty of this study lies in its comprehensive analysis of the fundamental regulatory and legal mechanisms governing the operation of digital automotive platforms in the United States, against the backdrop of current trends in the digitalization of the transportation sector. This study systematizes federal and regional regulatory norms that influence the development of digital automotive ecosystems and identifies the characteristics of the interaction between technological innovations and the legal environment. Unlike previous studies, this research emphasizes the interrelationship between legal regulation, technological infrastructure, and the scalability of digital platforms.

The article also identifies key barriers limiting the scalability of digital automotive platforms, notably legal fragmentation between the federal and regional levels, insufficient standardization of technological solutions, and constraints related to information security and user data protection. The need to systematize the factors influencing the development of digital transportation platforms is justified, which in turn allows for a more accurate assessment of the possibilities for integrating these services into smart mobility ecosystems.

These findings offer a new perspective on the role of law in the digital transformation of the automotive sector and can be used to develop regulatory models aimed at the effective implementation and scaling of digital technologies.

Research Objective

The objective of this study is to conduct a comprehensive analysis of the regulatory and legal aspects of the operation of digital automotive platforms in the United States, as well as to identify key barriers and opportunities for their scaling amid the digital transformation of the transportation industry. The study aims to identify the characteristics of federal and regional regulation, assess the impact of the legal environment on the development of technological solutions, and establish conditions for the effective integration of digital platforms into the modern mobility ecosystem.

Introduction

The development of digital technologies has radically transformed the U.S. automotive industry over the past few decades. As early as the beginning of the 20th century, the Industrial Revolution laid the groundwork for mass automobile production, and the adoption of standardized assembly processes helped reduce vehicle costs and make them accessible to a broad audience. In the mid-20th century, with the spread of electronic components, the first automation systems began to be implemented, leading to the emergence of electronic engine management, anti-lock braking systems, and other basic digital solutions.

In the 21st century, digitalization has reached a new level. Internet platforms for data exchange between vehicles, remote monitoring and control systems, as well as integration with mobile apps and cloud services, have emerged. Such digital automotive platforms have become an integral part of smart mobility ecosystems, connecting drivers, vehicles, urban infrastructure, and service providers.

From a regulatory standpoint, the United States presents a unique case. The federal government regulates vehicle safety, standardization, and emissions control, while individual states have their own laws governing licensing, liability for traffic accidents, and rules for the operation of digital services.

These multi-layered requirements create a complex environment for scaling digital automotive platforms.

The Digital Transformation of the Automotive Industry. The digital transformation of the automotive industry is one of the most significant technological processes of our time. It involves the integration of information technology, data analytics, cloud services, and artificial intelligence into the processes of manufacturing, operating, and managing vehicles.

Digital automotive platforms are a key element of this transformation. They connect various services into a single digital space where all road users interact [1].

One of the main areas of development for digital platforms today is telematics. Telematics systems enable the collection and analysis of data on a vehicle's condition, driving behavior, and routes. This data is used to improve safety, save fuel, and plan vehicle maintenance.

Another important area is the development of autonomous vehicles. Such systems require a complex software infrastructure, including machine learning algorithms, sensor data processing systems, and high-precision maps.

Digital platforms also play a key role in the development of ride-sharing services. Mobile apps allow users to quickly find and rent vehicles, pay for trips, and receive information about available routes.

Thus, digital technologies are shaping a new model of mobility in which transportation becomes part of a unified information system.

The U.S. Regulatory Framework in the Transportation Sector. Regulation of the automotive industry in the U.S. is based on a multi-tiered system of legal norms. The National Highway Traffic Safety Administration plays a key role in shaping federal policy on road safety. This agency is responsible for developing vehicle safety standards and conducting research on the prevention of traffic accidents.

In addition, the U.S. Department of Transportation plays a significant role by coordinating the development of transportation infrastructure and setting strategic directions for the industry.

At the federal level, laws are enacted that establish requirements for vehicle safety, emissions control systems, and vehicle technical specifications.

However, a significant portion of regulation falls under the jurisdiction of individual states. Each state has its own rules for vehicle registration, driver licensing, and insurance.

This division of authority results in a variety of regulatory requirements. For companies developing digital automotive platforms, this means they must adapt their solutions to the laws of different regions.

Legal Aspects of the Operation of Digital Automotive Platforms. The operation of digital automotive platforms involves a number of legal issues that require detailed regulation. One of the most important aspects is the allocation of liability in the event of traffic accidents.

When it comes to traditional vehicles, the driver is usually held responsible in the event of an accident. But the question is how this applies to autonomous systems, and who will be held accountable in the event of an error on the part of software developers or equipment manufacturers [2].

Another important issue is the protection of personal data. Digital platforms collect a vast amount of information about users, including where they go, when they travel, and their driving habits.

In the U.S., there are laws in place to protect user privacy. However, regulation in this area continues to evolve as the volume of data collected keeps growing.

In addition, intellectual property protection is a significant legal issue. Companies invest significant resources in developing autonomous driving algorithms and data analysis systems. These technologies are protected by patents and copyright, which creates competitive advantages for developers.

Table 1 - Key Legal Factors Governing Digital Automotive Platforms in the United States

| Direction of Legal Regulation | Characteristics of the Impact on Digital Automotive Platforms |
|----------------------------------|--|
| Federal Vehicle Safety Standards | Establishes mandatory requirements for vehicle design and digital control systems, ensuring the safe operation of platforms. |
| State-Level Regulation | Defines rules for testing autonomous vehicles, licensing mobility services, and the operating conditions for digital transportation systems. |
| Protection of User Personal Data | Restricts the use of telematics data and requires compliance with privacy standards when processing information about drivers and routes. |
| Legal Allocation of Liability | Defines the liability of the driver, vehicle manufacturer, and software developer in the event of traffic accidents. |
| Intellectual Property Protection | Provides patent and copyright protection for algorithms, software solutions, and autonomous control technologies. |
| Technological Standardization | Promotes the interoperability of digital platforms, transportation infrastructure, and communication systems. |

The table outlines the main trends in the legal regulation of digital automotive platforms in the United States and their impact on the development and scaling of technological solutions in the automotive industry.

Barriers to the Scaling of Digital Automotive Platforms. Although digital technologies hold great potential for the development of automotive platforms, innovation in this area is often hindered by various obstacles [3]. One of the main barriers is the imperfection and fragmentation of the current regulatory framework.

Differences in the rules and laws of individual states mean that organizations must adapt to the requirements of each specific region. This affects the cost of developing services and creates serious problems with scaling them across broader territories [4].

Another barrier is the lack of unified technological standards. For digital platforms to operate effectively, it is necessary to ensure the compatibility of software solutions, sensor systems, and communication protocols.

Another important aspect is the high capital costs. Developing and building autonomous control systems, as well as the infrastructure for data processing, is a rather expensive undertaking.

And perhaps one of the key barriers is public trust. Many users are skeptical of new technologies, especially when it comes to autonomous transportation systems [5].

Table 2 - Major Barriers to Scaling Digital Automotive Platforms in the U.S.

| Type of barrier | Barriers content | Impact on platform development |
|------------------------|--|--|
| Legal barrier | Fragmentation of legislation between the federal level and individual states | Complicates the scaling of services and requires platforms to be adapted to regional regulations |
| Technological barrier | Insufficient standardization of software solutions and communication protocols | Reduces the interoperability of various digital systems and infrastructure |
| Economic barrier | High cost of developing software, sensor systems, and data processing | Slows the adoption of innovations and limits the participation of small companies |
| Infrastructure barrier | Insufficient development of intelligent transportation infrastructure | Limits the effective use of digital services |
| Social barrier | Low user confidence in autonomous and digital transportation management systems | Reduces demand for new technological solutions |
| Organizational barrier | Complexity of coordination between government agencies, technology companies, and automakers | Slows the development of uniform standards and regulatory rules |

The table outlines the key categories of barriers that companies face when introducing and expanding digital automotive platforms in the U.S. market. It details the types of constraints, their characteristics, and their impact on the development of platform solutions in the transportation industry.

Scaling Opportunities for Digital Automotive Platforms. Digital automotive platforms have tremendous potential for growth, despite significant current limitations [6].

A key factor in expansion is infrastructure development. With the development of communication networks, the advent of 5G, and the emergence of smart transportation systems, the conditions for the successful operation of digital services are being created [7].

Cooperation between the government and the private sector plays an important role. Joint projects allow for the testing of new technologies and the development of optimal regulatory models.

In addition, the development of data exchange standards facilitates the integration of various transportation systems. This enables the creation of unified digital ecosystems that connect vehicles, urban infrastructure, and users [8].

Another promising area is the use of artificial intelligence to analyze traffic flows and predict road conditions.

Conclusion

Digital automotive platforms have become an integral part of the modern U.S. transportation market. They enable more efficient use of existing vehicles, the development of new mobility services, and the implementation of innovative technologies [9].

However, for digital automotive platforms to develop, a comprehensive set of regulatory measures must be established [10]. In particular, it is important to strike a balance between creating conditions for innovation and ensuring the safety of vehicle users.

The analysis showed that the key barriers to scaling are legal fragmentation of regulation, the lack of uniform standards, and high investment costs.

At the same time, opportunities for scaling are linked to infrastructure development, the adoption of new communication technologies, and expanded cooperation between government agencies and private companies.

Thus, the further development of digital automotive platforms in the United States will depend on the effective interaction between technological innovation and legal regulation. Creating a flexible and adaptive regulatory environment will ensure the industry's sustainable growth and enhance the competitiveness of the transportation system in the digital economy.

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