# Application of Data Management Capability Maturity Assessment Model in the Automotive Industry

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**Abstract: In the era of digital economy, data has become an important production factor and strategic asset. Data governance in the automotive industry generally faces pain points such as decentralized construction of business data, multi head management of data resources, and incomplete management of data lifecycle. Data management capability maturity assessment model provides important guidance for enterprises on how to better enhance their data management capabilities by defining eight capability domains: data model, data standards, data quality, and data security. By using the data management capability maturity assessment model, this paper analyses the data characteristics, business needs and development trends of the automotive industry, focuses on data interconnection, compliance sharing, value mining and agile services, starting from four aspects: organization, management, technology, and execution. It forms a data management solution and architecture system with the characteristics of the automotive industry, including multiple fields such as data, algorithms, models, and applications, promoting data management capabilities to become a new growth point and new development momentum for enterprises' digital transformation and building competitive advantages. At the same time, this paper looks forward to the future trend of automotive big data governance and proposes that building a big data governance system in the automotive industry characterized by "integration, collaboration, intelligence, security, and openness" will become the necessary path.**

**Keywords: Data Management Capability; Dcmm, Automotive Industry; Data Governance; Data Element**

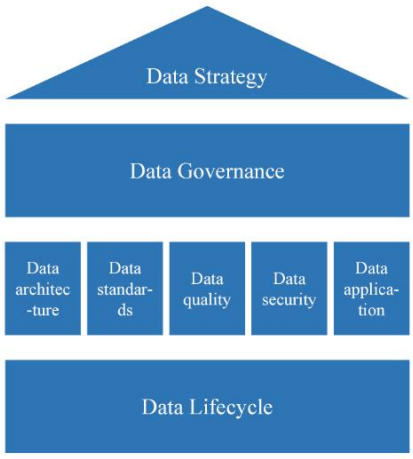
## 1. Necessity of Automotive Big Data Governance

At present, China's digital economy has entered a period of rapid growth, and the fundamental and strategic resource role of data as a core production factor is becoming increasingly prominent. Data governance capabilities have become an important support for enhancing the deep development of the digital economy and deepening the integration of industrialization and industrialization. In April 2018, the National Big Data Standardization Working Group officially released the national standard "Data management capability maturity assessment model GB/T 36073-2018" [1] (hereinafter referred to as DCMM), which was officially implemented on October 1, 2018. DCMM defines eight capability domains for evaluating data capability maturity, namely data strategy, data governance, data architecture, data standards, data quality, data security, data application, and data lifecycle management (Figure 1), providing important guidance for various organizational units nationwide to improve their data management capabilities.

As a traditional pillar industry of the national economy, the digital transformation of automobiles is imminent, and there is an urgent need for a comprehensive data resource system for the entire lifecycle of automobiles to form effective big data governance solutions. As a result, the importance of implementing DCMM standards in the automotive industry continues to be highlighted. Research and practice on automotive big data governance based on DCMM will accelerate the construction of the automotive big data governance system and data governance capabilities, provide strong support for consolidating the national automotive digital infrastructure, accelerating data application and industrial transformation in the automotive industry, accelerating the construction of a

strong automotive manufacturing country, and promoting the high-quality development of China's automotive industry.




| Capability domain | Capability item | Capability domain | Capability item |
|---|---|---|---|
| Data strategy | Data strategic planning | Data security | Data security policy |
| | Data strategy implementation | | Data security management |
| | Data strategy assessment | | Data security audit |
| Data governance | Data governance organization | Data application | Data analysis |
| | Data system construction | | Open sharing of data |
| | Data governance communication | | Data service |
| Data architecture | Data model | Data quality | Data quality requirement |
| | Data distribution | | Data quality inspection |
| | Data integration and sharing | | Data quality analysis |
| | Metadata management | | Data quality improvement |
| Data standard | Business terminology | Data lifecycle | Data requirement |
| | Reference data and master data | | Data design and development |
| | Data element | | Data operation and maintenance |
| | Index data | | Data retirement |

**Figure 1. Framework of DCMM.**

## 2. Era Characteristics of Automotive Big Data Governance

### 2.1 Data Governance, as a Key Strategy for the Development of the Digital Economy, has become an Important Engine

In the context of increasing downward pressure on the global economy, the digital economy, with data as the core element, is leading the development of the new economy, becoming a key driving force for global economic growth and a new highland for the game of major powers. The digital economy has the characteristics of digitization, intelligence, and ecology, and its institutional requirements are completely different from traditional industrial economies [2]. With the rapid growth of data volume and the continuous deepening of the application of big data in various fields of economy and society, the role of data governance has become increasingly prominent. On the one hand, with the continuous development and integrated application of digital technologies such as artificial intelligence, big data, and cloud computing, the global data volume has shown explosive growth. Massive data "cannot be managed, cannot flow, and cannot be used well" has become a common problem faced by data applications, and new rules and systems need to be created in the fields of data standardization, data ownership confirmation [3], data quality, data security, privacy protection, circulation control, and open sharing to release data value more efficiently. On the other hand, digital technology has widely penetrated and integrated with fields such as intelligent manufacturing and new energy, accelerating the emergence of new industries, formats, technologies, and models. Emerging economic forms such as the network economy, intelligent economy, platform economy, and sharing economy are emerging one after another, bringing about new changes such as intelligent production methods, digital industrial forms, ecological industrial organizations, and platformization of resource interaction [4]. This has brought new demands for public services such as digital infrastructure construction, data element supply, digital public product (service) supply, inclusive and prudent supervision, and digital credit system construction.

### 2.2 Global Data Governance Competition is Becoming Increasingly Fierce, and Path Construction Still Needs to be Explored

At present, the discourse power game of the global digital economy governance system transformation is becoming increasingly fierce,

filling the gap in the data governance rule system and establishing a sound and orderly competitive data element market system have become the focus of attention. The European Union, the United States and other countries are accelerating the formation of their own digital economy governance systems and promoting the establishment of international rules for digital economy governance, such as the launch of the "Data Rights" movement in the UK, the implementation of the "Industrial Data Space (IDS)" project in Germany, and the release of the "Big Data Research and Development Plan" by the United States. Industry organizations in various countries are accelerating the research on data management theories and models. Currently, the most authoritative data management theoretical model in the industry is the DAMA Data Management Theoretical Framework Model released by the International Data Management Association in 2009. In addition, highly recognized data management models in the industry include the DGL data management framework model proposed by the Data Control Association in 2012, the Data Capability Maturity Model (DMM) proposed by the Software Engineering Institute (SEI) in 2014, the Comprehensive Data Quality Management Framework (TDQM) proposed by the Massachusetts Institute of Technology, and the IBM Enterprise Data Management Capability Maturity Model.

### 2.3 Focusing on DCMM, China's data governance work is being carried out in an Orderly Manner

The data governance work in China is still in its infancy. The government attaches great importance to data governance and has issued a series of policy documents to provide guidance and promote measures for the implementation of data governance work, accelerate the establishment of institutional advantages for the development of the digital economy, and safeguard the high-quality development of the digital economy. In March 2020, the State Council issued the "Opinions on Building a More Perfect System and Mechanism for Marketization of Factor Allocation", which clearly stated for the first time that "data", as a new type of production factor, has become the fifth most important production factor as land, labor, capital, and technology, and emphasized the need to accelerate the cultivation of a data factor market. In December 2022, the State Council issued the "Opinions on Building a Data Infrastructure System to Better Play the Role of Data Elements" , emphasizing the promotion of data compliance, efficient circulation and use, empowering the real economy as the main line, and emphasizing data property rights, circulation transactions, income distribution, and security governance. In February 2023, the State Council issued the "Overall Layout Plan for the Construction of Digital China", proposing the data resource system as one of the "two foundations" for the construction of digital China. By 2025, the scale and quality of data resources will accelerate, the value of data elements will be effectively released, and the ability to ensure digital security will be comprehensively improved.

China's data governance work has formed major sectors such as data governance and standard development. In terms of the development of big data standards, progress has been rapid. Under the coordination of the Big Data Standards Working Group of the National Information and Standardization Commission, more than 30 provinces and cities have issued local standards for big data. The next step will continue to promote the development and implementation of national and industry big data standards for big data. Next, DCMM will focus on standardizing data evaluation, applying data standards in the industry, and enhancing industry data management capabilities, and carry out five aspects of work, including: (1) continuously building and improving the DCMM evaluation system, conducting nationwide promotion activities for the DCMM standard series, and conducting evaluation pilot demonstrations for manufacturing, energy, finance, and other fields; (2) Improve the data governance standard system around DCMM, actively involve local enterprises and institutions in the development and experimental verification of data governance standards; (3) Encourage pilot areas to increase policy support for DCMM, guide local enterprises to do a good job in implementing DCMM standards, and further improve the level of data governance; (4) Encourage evaluation institutions to accelerate the development of DCMM

evaluation and consulting service tools, providing accurate and beneficial evaluation conclusions and improvement plans for enterprises; (5) Encourage evaluation enterprises to simultaneously carry out data governance capability evaluation and construction, and improve data governance capabilities. DCMM will be the first to be implemented and applied in pilot cities and industries, forming a group of replicable, replicable, and promotable experiences, and promoting the establishment of a data standard system with Chinese characteristics and an effective data classification and grading management mechanism.

### 2.4 The Automotive Big Data Governance based on DCMM is of Great Significance

Driven by the integration of digital technologies such as artificial intelligence and big data, the transformation process of electrification, intelligence, networking, and sharing of automobiles is constantly accelerating [5]. The rapid growth of industry data is driving the increasing urgency of data governance. The DCMM based automotive big data governance work is of great significance and the task is arduous. Firstly, compared to industries such as energy, finance, and consumption, industrial data governance faces challenges such as large data volumes, numerous data systems, dispersed data standards, strong data correlation between various links, and high-frequency changes in real-time data [6]. It is urgent to build an industrial data governance system that combines the characteristics of each industry, enhance the ability of enterprises to manage data hierarchically, and promote full use, global flow, and orderly sharing of data. Secondly, the automotive industry has the characteristics of a large industrial volume, a long and dispersed supply chain, high correlation between various links, numerous node enterprises, and precise production processes [7]. It is urgent to strengthen the construction of a mechanism for integrating, circulating, and sharing massive data, establish a data system covering various links such as automotive research and development, manufacturing, products, sales, replacement, and scrapping, and promote the digital upgrading of research and development and manufacturing. Once again, with the rapid development of new formats such as new energy vehicles, intelligent connected vehicles, shared vehicles, vehicle road collaboration, and the automotive aftermarket, cars are becoming more and more equipped with mobile intelligent terminal attributes [8], generating new functions such as in vehicle intelligent function implementation, full attribute vehicle condition tracking, full lifecycle maintenance, and full industry chain traceability. The automotive big data system will be expanded to related data fields such as personnel, road conditions, environment, energy, finance and insurance, There is an urgent need to update institutional design and management tools in areas such as data standardization, data analysis, and data security, in order to provide strong support for the development of new models and formats in the automotive industry.

## 3. Research on Automotive Big Data Governance Framework Based on DCMM

The increasingly complex business innovation needs and urgent digital transformation needs are driving the construction of the big data governance ecosystem, and how to do a good job in big data governance has become a new research hotspot in the big data industry. As an important part of the manufacturing industry, the automotive industry is facing opportunities for digital infrastructure construction. The research on the governance framework of automotive big data based on DCMM is of significant necessity (Figure 2), driving the transformation and upgrading of the automotive industry.

From the perspective of the entire life cycle of automobiles, from product design, technological research and development, testing and evaluation, to production and manufacturing, sales and maintenance, and then to application experience and recycling, a large amount of data information is generated at each stage, and there are many types and spans of data, especially in the integration and sharing of core data such as operational data, circulation data, and product data, which poses significant challenges. With the continuous improvement of data volume and complexity in the automotive industry, massive, multi-source, and heterogeneous data has problems such as data dispersion, inconsistent standards, lack of mining, security risks, and low

utilization. At the same time, there is a lack of comprehensive data management mechanisms, making it impossible for underlying data resources to drive upper level business decisions. Data "cannot be managed, flowed, or used well" has become a common problem faced by the automotive industry in data applications.

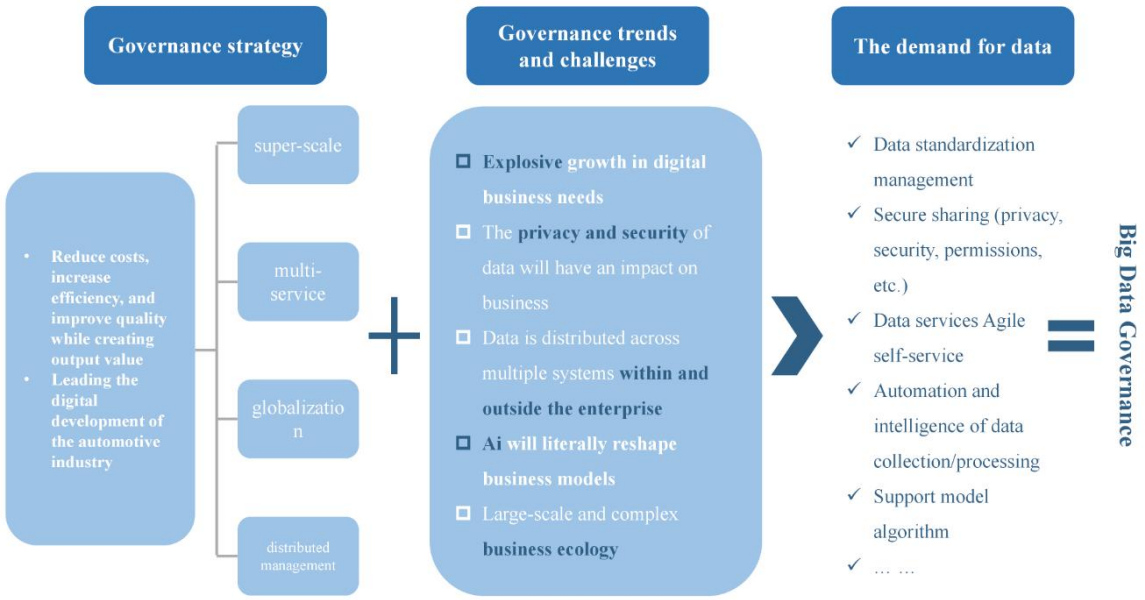



**Figure 2. Trends of Automotive Data Governance.**

From the perspective of promoting data governance work in automotive enterprises, they mainly face pain points in three aspects: decentralized construction of business data, multi head management of data resources, and incomplete management of the entire data lifecycle, which leads to universal challenges such as data fragmentation and disorder, poor sharing, low conversion rate, and resource waste. Among them, in terms of decentralized construction of business data, due to business departments taking their respective positions in building, using, and managing data, the distribution of data is relatively dispersed, resulting in a lack of unified and reliable data standards, data norms, and data sources at the enterprise level, resulting in problems such as inconsistent data and inability to share data; In terms of multi head management of data resources, data construction and management functions are dispersed among various departments, resulting in dispersed data management responsibilities and unclear rights and responsibilities, leading to a lack of a global perspective on data management at the enterprise level, resulting in the inability to achieve unified data management regulations, standards, etc., making it difficult to implement a global data management system and ensuring the effective implementation of data management systems; In terms of incomplete data lifecycle management, there is a lack of comprehensive management norms and standards for the processes of data collection, access, transmission, use, backup, and scrapping. At the same time, there is no big data platform or other information tools to support data status query, which reduces the effective utilization rate of metadata management.

As the first national standard in the field of big data management, DCMM evaluates the eight major process areas of data strategy, governance, and security, providing evidence for automotive big data governance, effectively promoting the use, flow, and sharing of data, breaking through data barriers, unleashing the potential value of data, and supporting the digital transformation and upgrading of the automotive industry (Figure 3). Based on the national standard DCMM model, automotive companies can evaluate their data management capabilities and identify pain points for business development. On this basis, how to use big data governance to form a framework for automotive big data

governance has become an urgent problem for the automotive industry. This requires sorting and interpreting key elements from multiple levels such as core ideas, top-level design, and implementation plans, focusing on data full connectivity, data agile services In terms of data co construction, sharing, and governance (Figure 4), we aim to form replicable and promotable advanced experiences and unified methodologies in big data governance, better build a big data governance system for the automotive industry, and accumulate solutions for big data governance in automobiles.

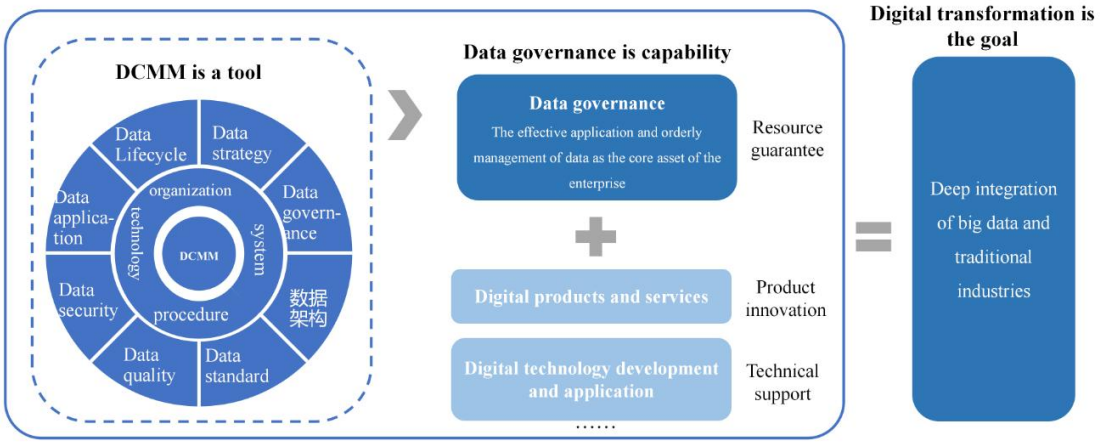



**Figure 3. The Relationship between DCMM and Automotive Data Governance.**

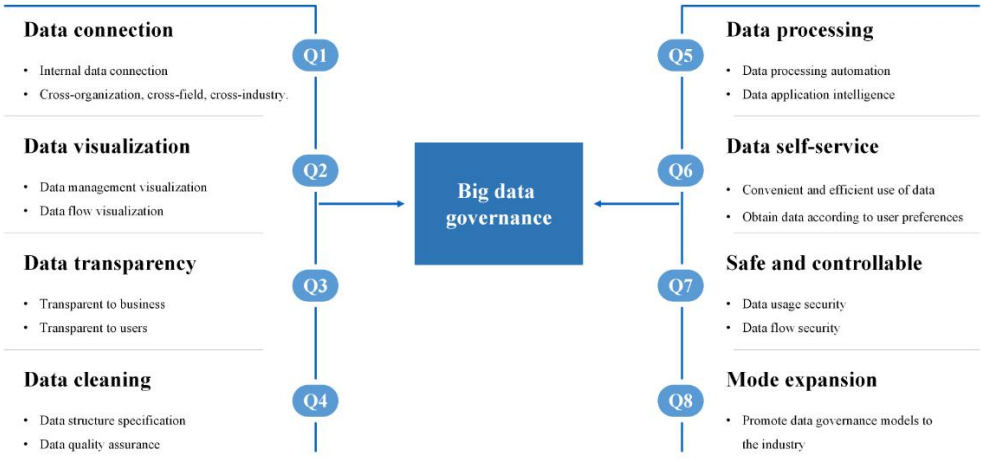



**Figure 4. Goals of Automotive Data Governance.**

### 3.1 Core Ideas of Automotive Big Data Governance

The key content of automotive big data governance lies in the comprehensive governance of data, algorithms, applications, and services. At the level of data asset management, by constructing a "comprehensive", "unified", and "universal" comprehensive big data system, we standardize the management of automotive big data and form a unified data external service mechanism; At the level of intelligent

algorithm development, by constructing a "comprehensive", "unified", and "specialized" intelligent algorithm model system, a mechanism for maximizing the value of algorithm model precipitation and reuse is formed. On this basis, by building application encapsulation and platform services for automotive big data, a big data governance system for the automotive industry characterized by "integration, collaboration, intelligence, security, and openness" is formed, achieving intelligent storage, simplified management, and maximum value of automotive big data.

Overall, the core idea of automotive big data governance is to form a service mechanism of "One Service" by constructing a "One Data" big data system, a reuse mechanism of "Multi Use" by constructing a "One Model" algorithm system, and ultimately a "four modernizations" closed-loop application system by constructing a full chain of "data knowledge, knowledge software, software platform, and platform data", Enable the top-level design and implementation plan of automotive big data governance to be carried out under the guidance of unified principles, forming strong norms to ensure efficiency and quality.

### 3.2 Top Level Design of Automotive Big Data Governance

Focusing on big data governance, with core ideas as the main thread, focusing on multiple aspects such as data connectivity, data visualization, data transparency, data processing, data self-service, security and controllability, and pattern expansion, through data classification management, data lifecycle processing, and data standard research, from the four major systems of organizational system, management system, technical system, and execution system, Accelerate the top-level design and implementation of automotive big data governance, support efficient management of the entire data lifecycle from collection, storage, calculation, management, and use, create a data security guarantee system in all fields, build an open and shared big data industry ecosystem, and unleash the potential value of data. On the one hand, around the entire lifecycle of data in the automotive industry, we comprehensively standardize and standardize data management, promote the use, flow, and sharing of data, transform data resources into data assets, and unleash the potential value of data; On the other hand, ensuring the information security during data circulation and use, ensuring that data is easy to use, controllable, convenient, and secure, and centered on data, serving the data and maximizing its value.

### 3.3 Implementation Plan for Automotive Big Data Governance

The implementation plan for automotive big data governance is based on top-level design. By establishing and improving the four major systems of organization, management, technology, and execution, it effectively reduces costs, improves data reuse capabilities, improves business efficiency, and mines the derivative value of integrated data, further realizing the precipitation of knowledge and assets.

In terms of organizational system construction, a three-layer framework of data governance management committee, data governance committee, and data governance execution group is established to form a data governance organization, and the structure, roles, and responsibilities of the data governance organization are clarified. Among them, the Data Governance Management Committee is the decision-maker, the Data Governance Committee is the overall manager, and the Data Governance Execution Group is the data producer, data user, data owner, and data manager. At the same time, it clearly defines the role boundaries and respective responsibilities within the organizational structure, promoting innovation and development of the organizational system through data.

In terms of management system construction, starting from the core business and focusing on key capabilities and data value, by formulating data standards, management mechanisms, application rules, and data models, a full value flow rule is formed for data generation, data integration, data analysis, and data application. Among them, the data generation process requires the construction of data classification and design standards, as well as data quality management standards; The data integration process requires the establishment of data asset construction processes and standards, as well as data asset coding standards; The data analysis process requires the construction of a

data analysis technical guide and data analysis process; The data application process needs to establish a data service management process and data sharing and security management regulations.

In terms of technical system construction, based on metadata management, with data standards as the key point, master data management as the core, and improving data quality as the goal, work is carried out around four major directions: data quality, master data management, data standards, and metadata management. Among them, metadata is "data about data", which refers to the descriptive information of data. Different types of metadata are formed by describing different aspects of data, mainly including four aspects: business, technology, operation, and management. Data standards are benchmark data that provide a standardized and standardized basis for the data of various businesses. Master data management refers to the management of core data through the application of relevant processes, technologies, and solutions, involving all business processes. It is necessary to maintain the consistency, integrity, relevance, and correctness of core data. Establish a data quality management system, clarify data quality management objectives, control objects and indicators, define data quality inspection rules, and continuously improve data quality.

In terms of execution system construction, promoting data quality management through performance, linking data producers, owners, managers, and users to form a sustainable and effective execution system, ensuring continuous high-quality data supply, and promoting the optimization and improvement of data governance system. By sorting out core business and data flows, establishing data control objectives, conducting quality exploration, processing, and analysis of data according to standards, integrating high-quality data and forming a data pool, monitoring and warning data flows according to rules, and ultimately ensuring the continuous and effective operation of data control mechanisms in the form of performance, achieving data lifecycle management.

## 4. Conclusion

Driven by the trend of "new four modernizations" in automobiles in the future, the application demand and development potential of automotive big data governance are enormous. Focusing on the construction of big data governance capabilities in the automotive industry, it is urgent to carry out key tasks such as improving governance capabilities, building service capabilities, developing industry standards, and promoting industry promotion. Targeting different clients such as industry regulatory authorities, automotive manufacturing enterprises, and industry application developers, with a focus on research consulting, evaluation and certification, we aim to form a comprehensive and comprehensive solution for data governance in the automotive industry, and build a service capability for big data governance in the automotive industry. Build a big data governance system for the automotive industry characterized by "integration, collaboration, intelligence, security, and openness", form a big data governance solution suitable for the automotive industry that includes data, algorithms, and applications, and enhance the automotive industry's big data governance capabilities. At the same time, we will focus on developing key common standards for automotive big data, a big data market trading standard system, and a big data statistical monitoring indicator system, in order to improve the development of big data standards for the automotive industry.

In short, in the context of the digital economy, the automotive industry should seize opportunities and deepen the path of digital upgrading in response to new demand side requirements for high-quality development and explosive supply side technologies. The research and practice of automobile big data governance based on DCMM is the cornerstone of modern economic system and the trend of deep integration with traditional industries.

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