

The Practical Challenges and Legal Approaches to Data Regulation in the Low-Altitude Economy

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Abstract

As a strategic emerging industry, the low-altitude economy is an important bridge between the digital economy and the real economy. The data in this field plays a key role in supporting both industrial development and safety supervision. However, research on low-altitude economic data regulation in China is still quite weak right now. We especially lack systematic studies that combine data elements with safety supervision. In practice, there are several obvious problems. For example, data standards are often fragmented, different regulatory departments don't coordinate well enough, and there is no systematic guarantee for data security and privacy protection. Traditional regulatory methods just can't adapt to the unique features of low-altitude data, it is three-dimensional, highly dynamic, and very sensitive. Because of this, the actual effect of supervision is seriously limited. To solve these problems, we can improve the system from three main aspects. First, we need to rely on data platforms to build a consensus on unified standards. Second, the government should take the lead to build a collaborative supervision mechanism involving multiple departments. Third, it is necessary to set up a national-level data security classification system, along with a flexible privacy protection mechanism based on different scenarios. By doing these things, we can further improve the data supervision system and provide a solid legal guarantee for the high-quality development of the low-altitude economy.

Keywords

Low-altitude economy, data regulation, data security.

1. Introduction

The low-altitude economy uses low-altitude airspace as its foundation. It is mainly driven by the flight activities of various manned and unmanned aircraft, which helps promote the integrated development of related industries[1]. This economy covers many fields, such as low-altitude aviation, aerial tourism, low-altitude logistics, and drone operations. At the same time, it deeply integrates with cutting-edge technologies like artificial intelligence, the Internet of Things, blockchain, and smart manufacturing. This creates a new area where the digital economy and the real economy come together. Data is the foundation for the development of all low-altitude business models. It helps drive industrial innovation and structural optimization[2]. It also improves public services and makes the safety supervision system better. However, as a new business model, the low-altitude economy still faces many practical challenges, and theoretical research is not enough yet. Current legal research is quite limited. Most studies focus on explaining concepts, planning application scenarios, building industry regulations, and discussing government governance. Very few researchers look at this issue from the perspective of data elements, or combine it with the safety supervision system to discuss data regulation. Low-altitude economic data is highly sensitive. It is closely related to national security, public safety, and personal privacy. Data regulation plays a key role in preventing data leaks and misuse, ensuring flight safety, and unlocking the value of data.

Therefore, improving the data regulation system and filling the gaps in current research is extremely important for the healthy and sustainable development of the low-altitude economy.

2. Practical Challenges in Low-Altitude Economy Data Regulation

2.1. Fragmentation of Low-Altitude Economy Data Standards

In the current low-altitude economic industry, although all kinds of aircraft and supporting technologies have been available, the problem of fragmentation of data standards is becoming more and more obvious because of the long-term lack of unified technical specifications, market access standards and industry competition rules. Once the standard system is missing, there is no unified guidance for the supervision work, and it is difficult for everyone to form a joint force, which seriously restricts the standardization and effectiveness of supervision [3]. We know that low-altitude flight activities often have to be carried out across administrative regions, in particular the need for collaborative linkages. However, the fragmentation of data standards directly amplifies the difficulty of supervision and hinders the real implementation of cross-regional collaboration. If each region formulates its own exclusive flight specification and data management layout, and uses different technical processes to identify, store and control flight data, it will inevitably lead to specification confusion and data flow block, and ultimately lead to data unable to achieve inter-regional flow and mutual recognition. It is difficult for regulatory authorities to uniformly verify and track cross-regional flight data in real time, unable to accurately grasp the dynamics of aircraft, and difficult to identify potential data security risks. This has greatly increased the probability of regulatory loopholes and laid a hidden danger to low-altitude flight safety and data security. In practice, local governments often develop their own management standards and data standards to adapt to local needs based on their own data management level, economic status, usage habits and digital capabilities. This decentralized formulation model further aggravates the fragmentation of standards and forms multiple constraints on data supervision. As the differences in data identification standards, processes and management measures in different regions continue to expand, the inter-regional data storage system gap is also deepening [4]. In the end, inter-regional data cannot be exchanged and recognized, which leads to a series of regulatory problems, the regulatory authorities cannot detect data leakage, tampering and other security risks in time, which seriously restricts the orderly development of data supervision, and also makes it difficult for supervision to adapt to the high-quality development of low-altitude economy.

2.2. Insufficient Coordination Among Low-Altitude Economy Data Regulatory Bodies

The regulation of low-altitude economic data is inherently complex, spanning several areas and particularly dependent on technology. However, at this stage, the cooperation between the various regulatory bodies is not tacit enough, which has obviously dragged down the effectiveness of supervision. Specifically, there are two main pain points. Supervision authority is too scattered, we lack an effective coordination mechanism. You see, civil aviation, public security, network information, industrial and information departments, in fact, are in charge of the low-altitude economic data supervision of this piece. But now everyone is in charge of their own, according to their own responsibilities, has not yet established a unified and efficient cross-sectoral coordination mechanism. The direct result of the decentralization of authority is that the regulatory standards are not uniform, and the scale of law enforcement is also inconsistent. This not only greatly reduces the efficiency of law enforcement, but also weakens the credibility and unity of supervision. It is indeed difficult to achieve effective control of the whole process and all-round of low-altitude economic data[5]. The existence of data barriers limits the effectiveness of collaborative governance. The data of low-altitude economy has a distinctive feature, that is, cross-regional circulation, cross-industry association, and real-time

requirements are particularly high. However, because the technical standards between the various regulatory bodies are not uniform, and the division of authority is not clear, a deep data barrier has been formed between the departments, and each has become an independent 'information island'. Once this barrier exists, various types of information such as low-altitude flight data, equipment operation data, and regulatory approval data cannot be circulated in real time and efficiently integrated. As a result, it is difficult for various regulatory authorities to fully grasp the overall situation of low-altitude economic data, which not only affects the scientific nature of regulatory decisions, but also slows down the emergency response in case of emergencies, which seriously affects the overall effect of collaborative supervision.

2.3. Lack of Systematic Safeguards for Low-Altitude Economy Data Security and Privacy

2.3.1. Illegal Data Acquisition Threatens National Security

The data application of low-altitude economy is closely linked to national security. If these data are illegally obtained, it is easy to endanger national security, which brings a very serious challenge to our low-altitude economic data supervision. The current supervision of low-altitude areas shows a clear trend of military-civilian integration[6]. Such core links as airspace resource use, flight trajectory tracking, and drone control may involve sensitive information about national security. Objectively speaking, the wide application of low-altitude aircraft such as drones also provides a convenient carrier for criminals to obtain data illegally. In the event that they are used for espionage or military reconnaissance, sensitive data once leaked, it will directly threaten the country's airspace security, information security and even military secrets. This has forced the supervision of low-altitude economic data to assume additional responsibilities for national security prevention and control, and the scope and difficulty of supervision have increased significantly. More importantly, our existing airspace management and related laws and regulations still have obvious shortcomings, which further enlarges the above dilemma. At present, the construction of low-altitude economic data security protection system is not perfect enough, especially in the dynamic sensitive data and static geographic coordinate norms related to national security, there are still some omissions, resulting in a blank in security control. At the same time, the data of low-altitude economy needs to be shared among civil aviation management departments, logistics enterprises, tourism enterprises and other multi-subjects, but the access rights of military data are extremely strict. Due to the lack of a sound data security guarantee mechanism, it is difficult for the regulatory authorities to ensure that military sensitive information will not be leaked during the sharing process. This leads to the high risk of illegal acquisition, which seriously affects the safety and effectiveness of low-altitude economic data supervision.

2.3.2. Lack of Systematic Protection for User Privacy Data

With the rapid development of low-altitude economy, the problem of user privacy data protection has become more and more prominent. Our country still lacks systematic design in privacy protection in this field, and the relevant regulations also have shortcomings. This not only threatens the personal and property safety of the people, but also seriously restricts the effectiveness of low-altitude economic data supervision, which has become a major bottleneck for the orderly advancement of the industry. For civil drones, the current management norms mainly focus on technical standards, monitoring certification and flight safety, and do not involve the regulation and relief mechanism of privacy infringement. This regulatory gap directly leads to loopholes in the control of privacy data. Nowadays, intelligent drones can easily capture privacy information such as citizens' homes, property and daily life. These unregulated data, due to the lack of systematic protection and regulatory guidance, have been in a state of disorderly collection, storage and use, which greatly increases the difficulty of supervision. In reality, frequent cases of privacy infringement by drones not only illustrate the

urgency of protection, but also directly impact the existing data supervision work. At the same time, the privacy data in various scenarios of low-altitude economy also lacks targeted protection, which further aggravates the regulatory dilemma. The current regulations only clarify the scope of drone flight and driver management, but do not regulate their information shooting, collection behavior and privacy protection mechanism, resulting in a lack of clear basis for regulatory authorities to deal with the collection, transmission and use of privacy data. For example, low-altitude tourism, drone aerial photography is easy to capture the privacy of residents, but the regulatory authorities are difficult to effectively intervene because of the lack of systematic regulation. In addition, in the digital environment, data dissemination is fast and wide, and the effect of ex post relief is very limited due to unintentional privacy leakage[7]. There is no clear regulation on this in the current regulation, which leads to the passive supervision in the prevention and control of privacy risks, and it is difficult to cover the whole process.

3. The Legal Approach to Low-Altitude Economy Data Regulation

3.1. Utilizing Low-Altitude Economy Data Platforms to Establish Consensus on Data Standards

In order to do a good job in the data supervision of the low-altitude economy, the big premise is that everyone must first reach a consensus and come up with a unified set of data standards. This is not only the key to make products more standardized, but also the only way to build a complete regulatory system. I think we can lay the foundation from two aspects ,one is to integrate the existing good practices in various places and set up a unified rule .The second is to collect, organize, cross-check and share data in an orderly manner through the open platform of public data now everywhere. In this way, there are both institutional support and technical paths, and the foundation is solid. In this process, the low-altitude economic data platform is actually a good communication hub . We can use this platform to solicit opinions, to deal with complaints and objections. On the one hand, it can bring together the data resources in the hands of all parties, and on the other hand, it can also clarify everyone 's consensus on data quality. For example, whether the data is good or not, whether it can be used, whether it is reliable, and not related to the business, etc., these core indicators are clearly defined, and there will be a basis for later management. On this basis, we must also find a way to improve the quality of data. In this regard, we can learn from the experience of the EU 's General Data Protection Regulation , and make a double verification mechanism of data subject and data processor , so that we can check together to ensure that the data is accurate and new[8]. At the same time, it is also necessary to give full play to the practical functions of this platform. In addition to routine verification, it can also encourage applicants to take the initiative to correct, correct and feedback problems. In this way, we can not only ensure that the data is true and effective, but also let everyone really do things according to the standard. In general, making good use of this platform to communicate information and coordinate linkage can not only set up a technical shelf, but also unify everyone 's ideas. This not only respects the rights of all parties, but also draws the boundary of supervision. In order to truly improve the effectiveness of supervision, the most important thing is to promote data opening through everyone 's cooperation.

3.2. Establishing a Government-Led Collaborative Regulatory Mechanism

It is simply unrealistic to rely on a single department to fight alone and want to manage the data of the low-altitude economy in an all-round and whole process. Therefore, the key is to establish a government-led collaborative supervision mechanism. This can not only solve the problem of low cooperation, but also improve the efficiency of data supervision, and lay a good foundation for the orderly advancement of our entire industry. In order to establish this mechanism, we

must first clarify the government 's dominant position in it and clarify the responsibility boundaries of governments at all levels and relevant departments. Specifically, there are several levels .First is the top-level design. In the future, if the law of " civil aviation law " is revised, the power and responsibility should be clearly divided from the source. Such as data authorities, civil aviation, industrial and information technology, network information, public security departments. There must be a clear statement, do not cross the responsibility or play ball with each other, otherwise it is easy to leave a regulatory vacuum. The second is coordination. This piece still has to adhere to the management system led by the central air traffic control commission[9]. Led by them, the various relevant departments to pull together, co-ordinate the national planning, policy and cross-sectoral collaboration to ensure that the whole country a game of chess, pace. Further down is the place to implement. The local government should also establish a local government-led model, pulling the public security, industry and information, network information and other departments to cooperate together. Local governments have to pick up the beams, responsible for the implementation of the above policies, organize the daily work of various departments. After clarifying the responsibilities of these subjects, we must really break the wall between departments. The old way of managing a stall in the past not only has high cost and poor effect, but also makes enterprises feel that there are too many rules and it is too difficult to understand. Coupled with the lack of information between departments, it is even worse. Therefore, the government must take the lead to create a system, so that everyone has a clear division of labor and efficient cooperation. Joint law enforcement is a good move. Led by the government, a special joint group is set up between departments and regions, or a regular meeting is held to bring everyone 's strength to one place and completely bid farewell to their own ways. Finally, synergy between regions is also important. You can refer to the practice of the joint meeting, led by the provincial government to carry out a low-altitude economic data supervision joint meeting [10]. On the one hand, coordinate the work of various regions to ensure that policy implementation is not discounted .On the other hand, it is also necessary to ensure that local actions are consistent with the country 's top-level strategy and truly pull up the synergy between regions.

3.3. Establishing Systemic Safeguards for Data Security and Privacy Protection

3.3.1. Establish a Tiered Protection System for National Data Security

Now drones, remote sensing, these high-tech in the low-altitude economy with too much, but our existing legal rules obviously a little behind. Especially in the national data security and how to manage these data, the short board is quite obvious. Therefore, from the perspective of the overall national security concept, with the foundation of the data security law and the network security law, we must work together from the three aspects of technology, classification control and cross-border supervision, so as to ensure security and make supervision work. Technically, protection must be solid. On the one hand, if various departments and localities want to share low-altitude data, they must set the rules to death : who can see, how much can see, and what to do with it must be clear. Moreover, the data must go through a special internal channel circulation, which can not only ensure the security of transmission, but also leave traces throughout the process and prevent the leakage of state secrets on halfway. On the other hand, it is also necessary to force those operating companies to shoulder their safety responsibilities. Whether it is collecting, storing or destroying data, it cannot be taken lightly. For example, when storing data, the permissions are tightened, and the desensitization must be desensitized to minimize the risk from the source. Data can not be a one-size-fits-all management, have to engage in scientific classification. Simply put, it is to divide the data of national security, public, enterprises and individuals into three or six or nine. In particular, it involves sensitive data such as military facilities and critical infrastructure, which must not be out of the way. There must be controllable places in the country, and anti-

hackers must be encrypted. When the national sharing platform processes these data, the level of security protection must also be pulled to the highest level. As for those general data, management can be a little loose, under the premise of ensuring safety let everybody use more convenient, don't waste regulatory resources in unnecessary places. The cross-border flow has to be watched. At present, many low-altitude economies are transnational businesses or Sino-foreign joint ventures. It is inevitable that data will go abroad, which will easily leave security risks. In order to prevent foreign forces from stealing our sensitive information, we must build a whole-process supervision mechanism from beginning to end. Prior to the filing review, sensitive data to go abroad, must first pass the strict safety assessment of this level. The matter has to rely on the platform for real-time monitoring, so that enterprises regularly submit reports, as soon as there is a wind blowing grass can be found. After the fall, the accounts will be counted[11]. Whoever dares to violate the rules and disorderly transmit sensitive data should not only be punished, but also be rectified within a time limit. Only by using this hard means to force them to abide by the rules, can our data supervision truly form a closed loop.

3.3.2. Establish a Context-Specific Dynamic Balance Mechanism for Privacy

The development of low-altitude economy will inevitably encounter the privacy information of the people. If these data are used indiscriminately, it will not only infringe on personal privacy, but also add great trouble to our current data supervision. The single management method that used to be completed by ' user point consent ' has long been unable to adapt to various complex flight scenarios. So change the idea : take the ' personal information protection law ' as the core, establish a new mechanism that looks at the scene and dynamically balances. It is necessary to protect privacy and not to jam the industrial development. In order to establish this new mechanism, the first step is to lay a good foundation for the system. Through the ' Personal Information Protection Law ', we can introduce some more detailed special provisions for the low-altitude economy. Whether it is to collect, store data or use them for sharing, there must be a clear statement of why it is legal, whether it only takes the least necessary information, how to protect the rights of users, and how to fine-tune these rules. The generation gap between the law and the actual operation has also been filled. It is not enough to have the law alone, but also to make the illegal people feel pain. It is necessary to straighten out the way of accountability. Whether it is administrative punishment, civil compensation or criminal responsibility, it must be arranged to greatly increase the cost of violation. At the same time, industry associations also have to play a role, take the lead in formulating norms, and guide enterprises to check themselves. In addition, it is necessary to do more popular science education for the public, so that everyone has the awareness of protecting personal information. Only by laying down the two cornerstones of the system and social consensus, can our dynamic balance mechanism of privacy be truly implemented.

4. Conclusion

Low-altitude economy has become an important breakthrough for China to cultivate new productivity and promote the high-quality development of digital economy. In the three-dimensional dynamic, multi-domain intertwined and highly sensitive scene of low altitude, data supervision is not a simple maintenance of order, but a systematic project related to national security, social public interests and individual rights. It directly determines whether the low-altitude economy can go on healthily and sustainably. In order to truly build a regulatory system that conforms to the law of low-altitude economic operation, we must do several things : first, unify data standards, second, establish a collaborative regulatory mechanism, and finally, build a barrier to data security and privacy protection. Looking forward to the future, with the deepening of airspace reform and the iterative upgrading of digital technology, the data supervision of low-altitude economy will surely move towards a more standardized and

efficient new stage. As long as we improve the data supervision system, we can make the data elements better enable the whole industry, help the low-altitude economy become an important engine to serve the national strategy and improve the governance ability, and also provide a solid legal guarantee for its stability.

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